



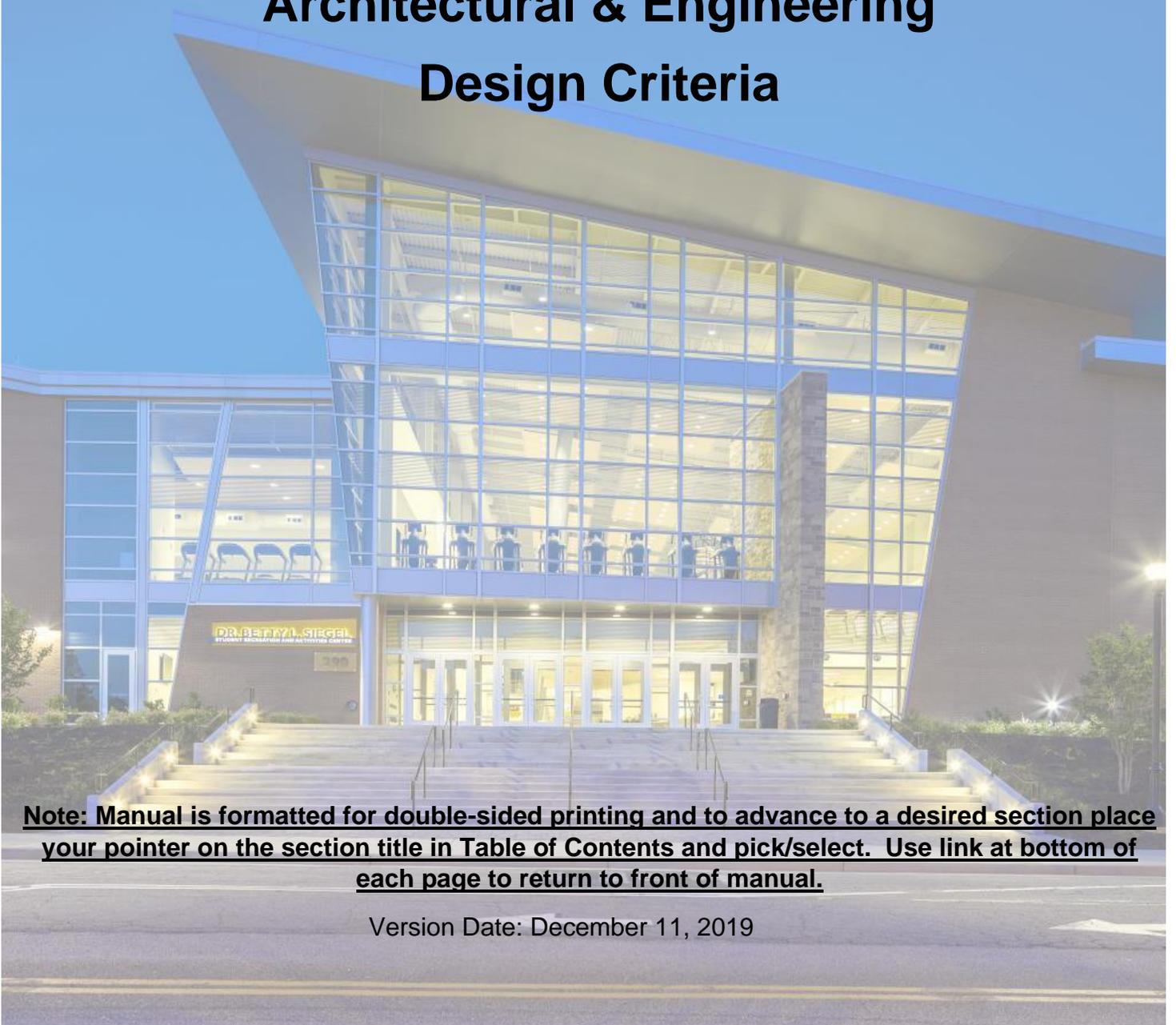
**KENNESAW STATE**  
UNIVERSITY

**Facilities Service**

**Planning, Design & Construction Services**

**Architectural & Engineering**

**Design Criteria**



**Note: Manual is formatted for double-sided printing and to advance to a desired section place your pointer on the section title in Table of Contents and pick/select. Use link at bottom of each page to return to front of manual.**

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## DIVISION 01 – GENERAL REQUIREMENTS

### SECTION 01 0000 – GENERAL REQUIREMENTS

#### A. GENERAL

1. Refer to [Georgia's Department of Community Affairs for Applicable Codes](#).
2. General overall layout of rooms, corridors and facilities shall be functional and logical, and meet current codes. [Board of Regents Guidelines and Procedures](#) must be satisfied.
3. The intent of these standards is “not” to specify proprietary products or systems. The Design Professional shall assure that competitive bidding exists unless otherwise approved in writing by the Owner.
4. All work shall comply with current published criteria of ADAAG (Americans with Disabilities Act Accessibility Guidelines) and all applicable codes.
5. Design Professional (and later, the Contractor[s]) should include adequate (but not excessive) time and focus in the project schedule for flushing out the gasses from the new space construction and/or material. Confirmation of acceptability of air quality by testing air samples (either internally performed or an independent agency, submitting to KSU directly, depending on project needs) prior to acceptance/turn-over/move-in. This can probably be concurrent with time for “burn-in” of the facility by KSU personnel. All timing needs to be carefully coordinated with the end users (alignment with semester start dates and pre-requisite activities such as furniture, move-in, etc.). The contract documents that the Design Professional prepares, should carry these responsibilities into the contractor[s] scope-of-work. Refer to Appendix - IEQ Guidelines prepared by KSU's EHS&RM Department.
6. For larger projects, Owner will procure separate Commissioning Agency for roof, exterior envelope, design reviews, water testing of roof & walls.

#### B. ARCHITECTURAL DESIGN

1. Since feature areas (such as stairs and/or landings in a lobby, atrium, etc.) tend to be areas where concentrated groups of people gather for photo opportunities, choral & other types of special performances etc., consider the assembly loads necessary for safe, concentrated assembly of people on these elements. Design Professional to show a prominent note on all Design & Construction Documents that shows the designed allowable floor load for these types of features.
2. In new construction, provide a dedicated service entrance, one service elevator, one service office and one storage room by the service office and the service elevator.
3. Room numbering on all design/construction documents shall be coordinated with and approved by University. Establish space numbering prior to preliminary design review.
4. Stair identification will NOT be by numerals (1, 2, 3, 4, etc.) due to confusion with floor

numbering. Therefore, stair identification will be by letters (A, B, C, D, etc.) or, if the KSU Project Manager approves, compass direction (North Stair, South Stair, etc.). This will be applicable to all new buildings. Remodel projects will be at the discretion of the KSU Project Manager.

5. Acoustical Performance to be determined by the following standards:

- a. Ceiling Attenuation Class (CAC) – a measure of reduction in sound transmission via plenum path between two adjacent rooms, determined in accordance with ASTM e 1414, and plotting decibel reduction (transmission loss) obtained at 16 frequencies against a standard reference curve, in accordance with ASTM e 413. **A ceiling with a high rating of 35 is preferred.**
- b. Noise Reduction Coefficient (NRC) – a measure of sound absorbed by a material. The single number designation represents the average of the sound absorption coefficients of a material at 250 Hz, 500 Hz, 1000 Hz, and 2000 Hz rounded to the nearest 0.05 when tested in accordance with ASTM C 423. **A minimum NRC is considered to be 0.65.**
- c. Articulation Class (AC) – rates a ceiling's suitability for achieving normal speech privacy in open office spaces as a function of noise absorption and reflection into adjacent cubicles. AC is the primary measure of acoustic performance in open plan offices and is covered in ASTM E1110 and E1111. **A ceiling with an AC above 170 is preferred.**
- d. Sound Transmission Class (STC) – a single-number rating of a material's or assembly's sound barrier effect. Higher STC values are more efficient for reducing sound transmission. For example, loud speech can be understood fairly well through an STC 30 wall or ceiling, but should not be audible through an STC 60 wall. The rating assesses the airborne sound transmission performance at a range of frequencies from 125 Hertz to 4000 Hertz. This range is consistent with the frequency range of speech. The STC rating does not assess low frequency sound transfer. Special consideration must be given to spaces where the noise transfer concern is other than from speech, such as mechanical equipment or music. Even with a high STC rating, any penetration, air-gap, or "flanking" path can seriously degrade the isolation quality of a wall. Flanking paths are the means for sound to transfer from one space to another other than through the wall. Sound can flank over, under, or around a wall. Sound can also travel through common ductwork, plumbing or corridors.
  - **STC-45** if the adjacent space is a corridor, staircase, office or conference room,
  - **STC-50** if the adjacent space is another core learning space, speech clinic, health care room or outdoors,
  - **STC-53** if the adjacent space is a restroom,
  - **STC-60** if the adjacent space is a music room, mechanical equipment room, cafeteria, gymnasium or indoor swimming pool.
  - Classroom doors should be rated as **STC-30** or more, and music room doors as **STC-40** or more. Entry doors across a corridor should be staggered to minimize noise transmission.
- e. Impact Insulation Class (IIC) – tests the ability to block impact sound by measuring the resistance to transmission of impact noise or structure-borne noise (simulating footfalls, objects dropped on the floor, etc.).
  - IIC ratings for floor-ceiling assemblies above core learning spaces should be at least **IIC-45** and preferably **IIC-50** (measured without carpeting on the floor).

- In new construction, gymnasias, dance studios or other high floor impact activities shall not be located above core learning spaces.
  - In existing facilities, **IIC-65-70** (depending on the volume of the space below) is recommended if gymnasias, dance studios or other high floor impact activities are located above core learning spaces.
6. Provide access to building for maintenance vehicles. Provide shielded exterior areas with wash down capability for refuse containers. If too close to Cooling Towers, refuse will be pulled into tower(s).
  7. Provide adequate storage areas for custodial materials as well as maintenance equipment, preferably one or more per floor. Custodial materials and maintenance equipment not to be in same areas.
  8. Provide (where possible) an outside door to mechanical rooms, particularly boiler rooms (which require mechanics to carry chemicals for equipment services). No carpet in chiller – boiler equipment rooms.
  9. Mechanical rooms should not be located next to sound-sensitive spaces. Locate high voltage transformers as far as practical from office/classroom space and equipment. Mechanical noise should not be noticeable in classrooms and meeting rooms.
  10. Design space layouts so that all major equipment may be removed and replaced without removal of building elements.
  11. Provide safe rooftop access for large, heavy loads.
  12. Avoid inaccessible ceiling systems where maintenance is required for above ceiling equipment
  13. Provide a minimum of one janitor closet per floor.
  14. To the fullest practical extent possible, capture roof and condensate water in a storage area so the water can be used for irrigation purposes.
  15. Water features are strongly discouraged.

### **C. BIDDING, CONTRACT DOCUMENTS AND CONSTRUCTION**

1. Refer to [BOR Building Projects Procedures Manual](#) for deliverables per design phase.
2. Provide north arrows on all floor plans. Provide key plans where needed for orientation. Confirm exact name and number of projects with Kennesaw State University. Include special conditions and requirements after discussing with the Owner.
3. For new and remodeled buildings, after approval of construction documents, Project Architect is to submit an Excel spreadsheet with the final room names, all room numbers per floor, room type, and square footage for our use. All interior spaces should be accounted for, and the total net and gross areas should be documented along with this information. A diagram showing the exterior dimensions and area of each floor should also be included. This information will

be used by KSU for the campus Facilities Inventory Report.

4. Refer also to Appendix for Section F – Supplementary General Conditions
5. All PDF copies of drawing sets issued to the owner should be bookmarked. Individual PDF files shall also be provided for individual sheets. The file shall be numbered per sheet number and drawing title.
6. Contractors and vendors are responsible for arranging their own network connections to the internet, etc. KSU can possibly accommodate them with a network connection if the job trailer is within 200-300 ft. of a building and there is sufficient capacity at that location. Also, AT&T does not provide DSL on campus and Comcast (or other providers) do not have a presence on campus, so that will not be an option for them. If any contractors have a need for any type of network connectivity and KSU cannot readily provide it, they will have to plan on a wireless network card from a cell service provider such as AT&T, Sprint or Verizon.
7. Contractor to provide a safety plan that identifies temporary barriers, egress, site/building access & staging plan, construction entrance, etc.

#### **D. PROJECT CLOSEOUT**

1. Provide two (2) sets of Owner's Manuals (bookmarked) containing trade, company/vendor contact information, selection and submittal data, warranties, guarantees and affidavits, etc. to the KSU Project Manager at the Acceptance/Turn-over of the project.
2. Design Professional to provide CADD drawings to Owner on a jumpdrive. Provision of the BIM model may be required.
3. Design Professional is responsible to provide framed evacuation plan for all new and/or remodeled areas. It is acceptable to put this requirement in the project documents for the Contractor's responsibility.

**SECTION 01 3546 – INDOOR AIR QUALITY PROCEDURES**

See Appendix.

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**SECTION 01 7419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

See Appendix

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**SECTION 01 7800 – CLOSEOUT SUBMITTAL REQUIREMENTS**

**A. DELIVERABLES – DESIGN PROFESSIONAL**

1. Naming Structure - use correct terminology. Name files per sheet numbers (i.e. A101 First Floor Plan).
2. Delivery Type - Autocad file of floor plans, 2D format, with xrefs embedded into the file. Revit file is not necessary. Provide complete set of PDF including all disciplines. Also provide individual sheets, named per sheet number and title. Specs to be provided as a single compiled file in PDF format.

<b>A/E DELIVERABLES</b>			
<b>Note: BOR or GSFIC projects shall follow respective Guidelines for deliverables.</b>			
<b><u>PHASE</u></b>	<b><u>DRAWINGS</u></b>	<b><u>SPECS</u></b>	<b><u>OTHER</u></b>
<b>SD</b>	<b>2 half size sets; electronic pdf set</b>	N/A	3d Rendering (if within Contract)
	<i>Site Plan; Floor Plans; Building Elevations; Building Sections</i>	<i>Narrative</i>	
<b>DD</b>	<b>1 full size sets; 2 half size sets; electronic pdf set</b>	<b>1 set; electronic pdf</b>	<ul style="list-style-type: none"> <li>Cutsheets (lighting and plumbing fixtures [labeled to match schedule], HVAC equipment &amp; door hardware)</li> <li>Finish Material Board (20"x30" min.) (if within Contract) – pdf &amp; samples</li> <li>Updated 3d Rendering</li> </ul>
	<i>Site Plan; Life Safety Plan; Floor Plans; Roof Plan; Building Elevations; Building Sections; Typical Wall Sections; RCPs; Structural Diagrammatic Framing Plan</i>	<i>MEP Narratives; Outline Specifications</i>	
<b>50% CD</b>	<b>1 full size sets; 2 half size sets; electronic pdf set</b>	<b>1 set; electronic pdf</b>	
	<i>Civil Site Plans &amp; Details; Life Safety Plans; Floor Plans; Roof Plan; building Elevations; building Sections; Wall Sections; RCPs; Interior elevations; Details; Schedules; Structural Plans and Details; MEP plans, schedules and details</i>	<i>Specifications</i>	
<b>80% CD</b>	<b>1 full size sets; 2 half size sets; electronic pdf set</b>	<b>1 set; electronic pdf</b>	Final Finish Material Board (20"x30" min.) (if within Contract) – pdf & samples
	<i>Civil Site Plans &amp; Details; Life Safety Plans; Floor Plans; Roof Plan; building Elevations; building Sections; Wall Sections; RCPs; Interior elevations; Details; Schedules; Structural Plans and</i>	<i>Project Manual</i>	

	<i>Details; MEP plans, schedules and details</i>		
<b>100% CD</b>	<b>2 full size sets; electronic pdf set</b>	<b>2 sets; electronic pdf</b>	
	<i>Civil Site Plans &amp; Details; Life Safety Plans; Floor Plans; Roof Plan; building Elevations; building Sections; Wall Sections; RCPs; Interior elevations; Details; Schedules; Structural Plans and Details; MEP plans, schedules and details</i>	<i>Project Manual</i>	
<b>CLOSEOUT</b>	<b>Record pdf set Updated Master Campus Plan</b>	<b>Record pdf set</b>	Updates shall be made to: building footprint; utilities, roads, parking, and other hardscape.

**B. DELIVERABLES - CONTRACTOR**

1. As-Builts - The purpose of the Final Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed without lengthy and expensive site measurement, investigation and examination. If record set kept on the job site is clean and legible in the opinion of the Architect, it may be submitted for the permanent record Final Record Documents. If not, all data on the soiled set shall be transferred to the clean Final Record Documents.
2. O&M Manuals – Provide 2 copies of each manuals for each system as required in the project specifications.
3. Naming Structure for digital files– name files by product type, sheet number and name, at a minimum. Include Project Name/Number on the cover.
4. Delivery Type – 3-ring Binder and electronic pdf format on a jumpdrive.

**SECTION 01 8113 – SUSTAINABLE DESIGN REQUIREMENTS****A. GENERAL**

1. The Design Professional shall incorporate the requirements of the Energy Efficiency & Sustainable Construction Act (SB 130) (O.C.G.A. 50-8-18). The project will be the first at Georgia Tech to adhere to ASHRAE Standard 189.1-2014, Standard for the Design of High-Performance Green Buildings. The Design Professional and Construction Manager will work collaboratively with Georgia Tech Staff, and any third-party consultants retained by Georgia Tech, to create design strategies in compliance with this standard, and identify any requirements that may not be able to be achieved within the reasonable scope of this project.

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## SECTION 01 9100 – GENERAL COMMISSIONING REQUIREMENTS

### A. GENERAL

1. The commissioning process will measure the building's systems against the criteria from this document, the BOD, and design documents. The systems that shall be commissioned include all applicable building systems listed in the GSFIC Commissioning Checklist. Refer to <https://gsfic.georgia.gov/commissioning> to download the current checklist from GSFIC.

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**DIVISION 02 – EXISTING CONDITIONS****SECTION 02 0000 – EXISTING CONDITIONS****A. GENERAL**

1. Contractor shall restore existing trees, shrubs, grass, sprinklers, sidewalks, etc. to their original condition if disturbed.
2. Owner will be responsible for removing any items/systems that they want to be salvaged or reused.

**B. DEMOLITION**

1. Contractor should NOT use KSU's waste management equipment. Contractor shall provide a waste management plan that identifies construction dumpster locations, staging and access routes.

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## SECTION 02 2100 – SURVEYS

### A. GENERAL

1. Soil conditions should be tested by a licensed professional geotechnical engineer. Foundations shall be designed in accordance with engineer's recommendations. Copy of soils report shall be delivered to University for project file.

### B. DRAWING GUIDELINES

1. Deliverable drawings shall follow Industry Standards, as required for the project size and scope.
  - a. Drawing shall be provided in PDF and DWG file formats. Refer also to [Section 01 7800- Closeout Submittal Requirements](#).

### C. SERVICES

1. Civil Engineer shall update the Master Campus Plan for projects for new buildings and/or additions to existing buildings. KSU will provide the Master Campus Plan Autocad file for revision.
2. Updates shall be made to: building footprint; utilities, roads, parking, and other hardscape.

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**DIVISION 03 – CONCRETE****SECTION 03 0000 – CONCRETE****A. GENERAL**

1. It is recommended for any new exposed concrete to match existing exposed concrete at adjacent buildings.
  - a. Smooth-formed Finish (“Green-rubbed”): Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes.
  - b. Chamfer exterior corners and edges of cast-in-place architectural concrete.

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**DIVISION 04 – MASONRY****SECTION 04 0000 – MASONRY****A. GENERAL**

1. It is recommended for any new brick masonry to match adjacent buildings. Complementary colors are subject to approval by KSU.
  - a. For reference purposes, the typical brick on the Kennesaw, North Campus is: Cherokee Brick – Velour Cherokee Rose #53-05-206.
2. All stone for site or building shall match existing and/or be approved by KSU.

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## **DIVISION 05 – METALS**

### **SECTION 05 4000 – COLD-FORMED METAL FRAMING**

#### **A. GENERAL**

1. Design Team to provide proposed design for KSU to review.

#### **B. BLOCKING** - Refer to [Section 06 0000-General Wood Requirements.](#)

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## **SECTION 05 5000 – METAL FABRICATIONS**

### **A. RAILINGS**

1. Exterior railings shall be Stainless Steel or Factory-finished.
2. Interior Handrails shall be Stainless Steel.
3. Interior Guardrails shall be Stainless Steel or Factory-finished.

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## **DIVISION 06 – WOOD, PLASTICS & COMPOSITES**

### **SECTION 06 0000 – GENERAL WOOD REQUIREMENTS**

#### **A. GENERAL**

1. Use “Green Building” standards that give certification credits equally to forest products grown, manufactured, and certified under the Sustainable Forestry Initiative, the American Tree Farm System, and the Forest Stewardship Council per The State of Georgia Executive Order, dated August 10, 2012.

#### **B. BLOCKING**

1. Blocking is to be provided at all wall hung and wall attached equipment, including but not limited to the following locations:
  - a. Casework / Millwork
  - b. Grab bars
  - c. Wall mounted toilet accessories
  - d. Toilet Partitions
  - e. Railings
  - f. Sectional Door tracks
  - g. Visual Displays
  - h. Wall door bumpers
  - i. Owner-Provided Digital Screens
2. Specify fire-retardant wood as required by Code.

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**SECTION 06 4000 – ARCHITECTURAL WOODWORK****A. COUNTERTOPS**

1. Breakroom/Lactation Room counters – Provide post-formed plastic laminate countertop with integral backsplash and “Futura” edge profile.
2. Restroom/Unisex Toilet counters – Provide solid surface countertop with 4” high backsplash. **No Plastic Laminate Counters.**
3. Food Services/Dining Hall/Commercial Kitchen counters – Provide either solid surface or quartz countertops with 4” high backsplash. **No Plastic Laminate Counters.**

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**DIVISION 07 – THERMAL & MOISTURE PROTECTION****SECTION 07 1000 – DAMPPROOFING & WATERPROOFING****A. MOISTURE CONTROL**

1. Prevent moisture problems (underground). Provide sheet membrane waterproofing and positive slope foundation perimeter drains to grade. Use protection board over all membranes.

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**SECTION 07 2400 – EXTERIOR INSULATION & FINISH SYSTEMS****A. GENERAL**

1. EIFS and uncoated concrete masonry systems are not acceptable for permanent buildings.
2. EIFS is only approved as an exception based on budgetary concerns. It is not preferred at grade level. Specify hardcoat type, height of high impact system, and drainable system.

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**SECTION 07 5000 – MEMBRANE ROOFING, ACCESSORIES & FLASHING****A. GENERAL**

1. Exterior envelope systems shall be selected with low maintenance longevity as the primary consideration.
2. All exposed metal shall be factory finished.

**B. FLASHING**

1. Prevent moisture problems (underground). Provide sheet membrane waterproofing and positive slope foundation perimeter drains to grade. Use protection board over all membranes.
2. Prevent moisture problems (above ground). Provide metal window and door head flashing, through wall flashing, and counter flashing with 50-year min. expected life. Slope all ledges and horizontal surfaces 1/4"/ft. minimum.

**C. ROOFING**

1. Roofing types: (unless otherwise approved by University)
  - a. Low Slopes: (flat to 1/4" per foot slope) - 3-ply SBS modified bitumen, cold adhesive, torch applied base and cap sheet.
  - b. Med. Slopes: (1/4" to 3" per foot slope) - 3-ply SBS modified bitumen, cold adhesive, torch applied base and cap sheet
  - c. High Slopes: (3" per foot and steeper) - standing seam metal panels or heavy weight fiberglass-based asphalt shingles.
2. Roofing material specifications shall require the use of "non-asbestos containing material". Roofing repair or replacement on roofs suspected of containing asbestos shall comply with regulations and codes.
3. Insulation Board: Mechanically attached polyisocyanurate insulation minimum 3" thickness. Provide cover board fully-adhered.
4. Use roofing materials with a solar reflectance index (SRI) equal to or greater than 78 for roofs with a slope less than or equal to 2:12 and 29 for roofs with a slope greater than 2:12 for 75% of the roof.
5. Provide minimum 30" wide protected walkway path from roof access to rooftop equipment with walk pads compatible with roofing system. Rooftop equipment should have a walkway path on all four sides for maintenance.

6. Provide an additional membrane “sacrificial” sheet under all rooftop equipment.

#### **D. WARRANTY**

1. Specify that the Manufacturer must provide a twenty (20) year, no dollar limit guarantee for the installed roofing system.

#### **E. ROOF SYSTEM COORDINATION**

1. Specify manufactured equipment curbs (Pate or Thycurb) for all roof mounted equipment. Don't allow equipment to be mounted on pressure treated wood. Roof maintained equipment should comply with recommended details of the National Roofing Contractors Association “*Handbook of Accepted Roofing Knowledge*”.
2. Fume hood fans, motor starters and other roof mounted equipment should be installed on fully flashed raised curbs without the use of pitch pans. When roof mounted equipment cannot be set on curbs, allow 18 inches clearance minimum to facilitate repairs and reroofing.
3. Provide a roof hatch if there is equipment on the roof. Roof hatch should be a minimum 36” x 30” and should include extendable post and fall protection guardrail. The hatch shall be lockable if not within an enclosed space. Provide a light fixture at point of entry if the hatch is in an enclosed space.
4. Piped overflow drains are preferred in lieu of parapet scuppers.

## DIVISION 08 – OPENINGS

### SECTION 08 1000 – DOORS & FRAMES

#### A. DOORS

1. Standard door sizes: 3' x 7' x 1.75"
2. Standard interior doors:
  - a. Material - Solid core wood, flush style, 20 minute "C" label fire rated minimum, higher ratings as required by design and fire ratings.
  - b. Finish: Rotary cut Birch Veneer, clear seal finish.
    - i. Match existing finish in existing buildings, new construction either stained or clear coated with a urethane varnish satin.
3. Standard Exterior Doors:
  - a. Material: 16 gauge Hollow Metal insulated, flush style
  - b. Finish: shop-primed painted finish.

#### B. FRAMES

1. Standard door frames:
  - a. Interior: 1½ pair heavy duty standard hinge placement pattern, reinforced for door closers where required, 16 gauge minimum knockdown style cold-rolled steel, throat thickness to match wall design thicknesses. Provide standard Mortise Lockset strike with plaster guards, to match campus lock standards, door silencers.
  - b. Exterior: 1½ pair Heavy duty standard hinge placement pattern, reinforced for door closers or other attached hardware where required, 14 gauge (.053-inch) minimum Welded cold-rolled galvaneal steel, throat thickness to match design standards. Continuous security hinges may be required in lieu of the standard 1½ pair hinge pattern.
  - c. Shop Prime paint all steel material.
2. Sustainable (LEED Certified) finishes and material selections contrary to the campus design standards briefly described herein shall be submitted to the KSU FPDS offices for approval.

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**SECTION 08 3100 – ACCESS DOORS & PANELS****A. GENERAL**

1. Access Panels - Provide appropriately sized flush access panels in gypsum board assemblies in order to service clean-outs, valves and any other devices concealed by drywall.
  - a. Where possible, locate serviceable equipment above accessible ceilings.
2. Type:
  - a. Not key locked, only tool operated.
  - b. Minimum size 18"x18".

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**SECTION 08 4113 – ENTRANCES****A. GENERAL**

1. Refer to Appendix for door hardware specifications.

**B. STOREFRONT ENTRANCES**

1. Storefront doors:
  - a. Wide style doors only, no narrow or medium.
  - b. All should have continuous geared hinge.

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## DIVISION 09 – FINISHES

### SECTION 09 2000 – GYPSUM BOARD ASSEMBLIES

#### A. GENERAL

1. The typical (non-fire rated) interior partition construction shall be of the following minimum standards:
  - a. Metal studs – 3-5/8" 24 gauge minimum, 16" O.C. to underside of acoustic grid ceiling, or 6" above ceiling.
  - b. Gypsum Wall Board – 5/8" minimum thickness, staggered joints, 8" O.C. screws on edge, 12" on field.
2. Partition Heights
  - a. Office to Office – to underside of ceiling or 6" above ceiling.
  - b. Office to Corridor – from floor to underside of structure/deck above.
  - c. Conference Rooms – from floor to underside of structure/deck above for entire perimeter of room.
  - d. Auditoriums / Classrooms / Music Rooms – from floor to underside of structure/deck above for entire perimeter of room.
  - e. Restrooms / Janitor Closet / Mech. & Elec. Rooms / MDF & IDF Rooms – from floor to underside of structure/deck above for entire perimeter of room.
3. Acoustics
  - a. Minimum STC rating: **STC-38**
  - b. Restrooms, Offices, & Conference Rooms: **Min. STC-45** with sound attenuating batts.
  - c. Restrooms: **Min. STC-53** with sound attenuating batts.
  - d. Auditoriums & Classrooms: **Min. STC-50** with sound attenuating batts.
  - e. Music Rooms, Mech. Equipment Rooms, & Gymnasiums: **Min. STC-60** with sound attenuating batts.
  - f. Acoustic wall assemblies shall continue up to bottom of deck above unless noted otherwise in "Partition Heights" above.
4. Finish
  - a. Match existing design conditions where possible on renovations, Level 4 finish standard.

- b. Level 5 drywall finish is required in all areas where gloss, semi-gloss enamel or non-textured flat paints are specified, except in building service areas that receive semi-gloss paint but will not need the Level 5 drywall finish.

**SECTION 09 3000 – TILING****A. GENERAL**

1. Porcelain Tile – Large format tiles preferred, min. 18” x 18”. Design Professional to select tile that is readily available in USA and does not have a long lead time for delivery.
2. Natural Stone – Natural materials that have voids that may fracture under floor loads are not acceptable.
3. Grout – Stain resistant epoxy grout.
4. Restrooms & Janitor Closets – Tile flooring to be installed over a waterproof coating that extends up partitions a min. of 6” high.
5. Restrooms Wet Walls – Tile to extend up partition min. 6'-0” AFF.

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**SECTION 09 5100 – ACOUSTICAL CEILINGS****A. GENERAL**

1. Typical suspended ceiling grid to be 24" x 24" – 15/16" white exposed tee grid. Alternate ceiling types or designs may be submitted for approval by the University.
2. Campus Standard Ceiling Tile –
  - a. Armstrong "Cortega" 770, 24" x 24" x 5/8", square edge, NRC – 0.55, CAC – 33.
3. Campus Ceiling Tile Acceptable Upgrades –
  - a. Armstrong "Cirrus High NRC" 563, 24" x 24" x 7/8", square edge, NRC – 0.75, CAC – 35, AC – 170 (Typical for open office areas).
  - b. Armstrong "Cirrus" 574, 24" x 24" x 3/4", square edge, NRC – 0.70, CAC – 33.
  - c. Armstrong "Cirrus High NRC" 556, tegular edge, 24" x 24" x 7/8", NRC – 0.75, CAC – 35, AC – 170 (Typical for open office areas).
  - d. Armstrong "Cirrus" 584, 24" x 24" x 3/4", tegular edge, NRC – 0.70, CAC – 35.
  - e. Armstrong "Mesa" 680, 24" x 24" x 3/4", square edge, NRC – 0.60, CAC – 33.
  - f. Armstrong "Mesa" 681, 24" x 24" x 3/4", tegular edge, NRC – 0.60, CAC – 35.

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**SECTION 09 6000 – FLOORING****A. GENERAL**

1. Design Professional to verify with KSU Project Manager existing building finishes when renovating existing buildings.

**B. CARPET**

1. Carpet Tile/Plank – Modular carpet preferred over broadloom. Installation to be pressure-sensitive adhesive. Campus Standards are as follows, but not limited to:
  - a. Interface Flor, Style: “The Standard” 1467302500, Color: 9361 Mangrove.
  - b. Interface Flor, Style: “Cubic” 1380102500, Color: 6395 Construction.
  - c. Patcraft, Style: “Conundrum” I0218, Color: Maze 18152.
  - d. Patcraft, Style: “Big Splash” I0166, Color: High Score 00120.
  - e. Shaw, Style: “Diffuse” 59575, Color: Voyage 75715.
  - f. Shaw, Style: “Captivate” 59554, Color: Hammock 54740.
2. Walk-off Mat – Modular carpet tile. Installation to be pressure-sensitive adhesive. Campus Standards are as follows, but not limited to:
  - a. Patcraft, Style: “Walk Right In” I0115, Color: Charcoal 00119.

**C. RESILIENT FLOORING**

1. Luxury Vinyl Tile (LVT) – Large format tiles preferred, min. 18” x 18”. Campus Standards are as follows, but not limited to:
  - a. Centiva, Style: “Contour Stone”, Color: Santorini Tandem CS-0553-C, Surface: PH, Edge: SE or SB.
  - b. Centiva, Style: “Contour Stone”, Color: Valleta CS-0610-C, Surface: QU, Edge: SE or SB.
  - c. Centiva, Style: “Contour Plank”, Color: Foxwood CP-3623-C, Surface: TK, Edge: SE or SB.
  - d. Centiva, Style: “Event Classic Plank”, Color: European Cherry ECK-3307, Surface: NG, Edge: SE or SB.
2. Vinyl Composite Tile (VCT) – NOT acceptable.
3. Rolled/sheet goods- (Marmoleum), NOT acceptable. Tiled products are acceptable. Cannot be used in heavily wheeled traffic areas (i.e. Dining Hall).

4. Rubber Base – Rolled goods only, sections not acceptable. Campus Standards are as follows, but not limited to:
  - a. Roppe, Pinnacle Rubber Base, 4” high, Standard Toe, Color: 193 Black Brown.

#### **D. OTHER**

1. Poured/rolled flooring – mechanical rooms (epoxy rolled on with aggregate), kitchen facilities, dishrooms, (industrial grade), and Janitor closets.
  - a. Minimum slip resistance coefficient shall follow the requirements set forth by the IBC and ADA codes, for the intended use.
2. Polished/Stained Concrete – Refer to American Society of Concrete Contractors’ Concrete Polishing Council (ASCC-CPC), Finishing: Class A or B, Gloss Level: 2 Satin (Honed) or 3 Polished.
3. Terrazzo – NOT acceptable.
4. Wood Base – NOT acceptable.

## **SECTION 09 7200 – WALLCOVERINGS**

### **A. GENERAL**

1. Vinyl, fabric, or paper wallcoverings are NOT acceptable, unless specifically approved by KSU. Never use this product at exterior walls.

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**SECTION 09 9000 – PAINTING****A. GENERAL**

1. Interior paints and primers to be water-based complying with VOC requirements established by Green Seal Standard 11.
2. Paint Finishes:
  - a. Offices, Classrooms, Conf. Rooms, etc. – Latex eggshell finish.
  - b. Corridors, High Traffic Areas, etc. – Latex satin finish.
  - c. Restrooms, Janitor Closets, Wet Areas, etc. – Epoxy semi-gloss finish.
  - d. Metal Doors, Door Frames – Latex semi-gloss finish.
  - e. Wood Doors – Match existing finish in existing buildings, new construction either stained or clear coated with a urethane varnish satin.
  - f. Interior Railings (Public areas) – Factory or shop applied powder coat semi-gloss finish.
  - g. Interior Railings (Back of house or egress stairs) – Latex semi-gloss finish.
3. Paint Colors Campus Standards, but not limited to:
  - a. Sherwin Williams SW7517 “China Doll” (Typical wall color).
  - b. Duron 8220W “Hayseed” (Typical wall color).
  - c. Sherwin Williams SW6904 “Gusto Gold” (KSU Gold accent color).
  - d. Sherwin Williams SW7040 “Smokehouse” (Accent color).
  - e. Sherwin Williams SW7020 “Black Fox” (Door frames, railings).
  - f. Sherwin Williams SW7039 “Virtual Taupe” (Doors, if painted)
4. Design Professional to verify with KSU Project Manager existing building finishes when renovating existing buildings.

**B. INTERIOR DESIGN**

1. All proposed finish and furniture selections will be submitted to and approved by the KSU Project Manager and Interior Designer.
  - a. Submittal shall be in form of a "color board", 8½" x 11" min. size, with actual paint colors, material samples, fabric swatches, and furniture pictures.

5. Color standards for existing campus building are on file in the Kennesaw State University Facility Planning and Design office.
6. Finishes - All finishes shall be selected for easy maintainability and durability. In high abuse areas, these are the essential characteristics to consider in material selections.

## **DIVISION 10 – SPECIALTIES**

### **SECTION 10 1116 – MARKERBOARDS**

#### **A. GENERAL**

1. Markerboards shall be provided in all auditoriums, classrooms, conference rooms, and student group study rooms. Size and location to be determined based on room size, function, and audio-visual requirements. Sizes to be manufacturer standards, custom sizes not acceptable.
2. Whiteboards – Provide porcelain enamel steel magnetic boards with aluminum perimeter frame with or without bottom tray. If bottom tray is omitted provide magnetic accessory pack with holder for markers, eraser, and cleaner.
3. Frameless Whiteboards – Provide porcelain enamel steel magnetic boards without bottom tray and magnetic accessory pack with holder for markers, eraser, and cleaner.
4. Glass Wall Boards – May be provided in limited quantities for President’s or Dean’s conference rooms. Provide wall mounted accessory pack with holder for markers, eraser, and cleaner.

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## SECTION 10 1400 – SIGNAGE

### A. GENERAL

1. Provide room number/identity signs for all project spaces which do not have existing signs meeting University standard or same numbering as approved for project by University. Signs shall comply with University standard designs or match existing signs. Refer to Appendix.
2. The Design Professional should locate and design all interior and exterior signage for new building and renovation projects, (per KSU signage standards). The signage should be included in the construction project and should be fully designed even if the University decides to provide signs under a separate contract. Signage should be designed so that people are easily able to find destinations in the new building or area, and the designer shall work with the user representatives to make sure exact wordings are correct and all key components are identified.
3. The Design Professional should design and specify in plans a place to install egress plans according to Code. Design Professional shall be responsible for providing proper egress plans based on their digital floor plans. Digital files shall be to the contractor, so that permanent emergency egress plans are installed in accordance with applicable codes, as part of the project.

### B. SIGNAGE TYPES

1. Building Directories – Provide a directory located on each floor at the elevator lobby and/or main building entry lobby listing the main spaces in the building, i.e. – auditorium, departments, colleges, dean's office, etc.
2. Wayfinding Maps – Provide an 18" x 25" print format color graphic wayfinding map mounted in a 22" x 30" acrylic frame with 1" dia.-1" standoffs for each floor located at the elevator lobby and/or main building entry lobby showing the main spaces in the building, i.e. – auditorium, departments, colleges, dean's office, etc. Graphic plan to also show egress routes, severe weather refuge areas, fire extinguishers, emergency exits, fire alarm pull stations, and automated external defibrillators.
3. Interior Signage – All interior spaces are to be identified with a room sign mounted on the latch side of the door complying with ADA requirements. Provide directional signage showing where the restrooms and elevators are located on each floor.
4. Department Signage – Providing signage for a department or a Dean's suite to be determined on a case-by-case basis due to the expense of changing signage when a department name changes or is relocated.
5. Building Monument Sign – Provide one monument sign located along main street or walkway adjacent to main building entrance.

6. Building Number Sign(s) – Provide building number sign(s) on the exterior of the building in prominent location(s) adjacent to the building entrance(s) visible from a distance.
  
7. See Appendix – KSU Standards Signage Program for signage examples.

**SECTION 10 2100 – TOILET & SHOWER / DRESSING COMPARTMENTS****A. GENERAL**

1. Provide floor anchored overhead braced toilet compartments. Ceiling hung compartments are NOT acceptable.

**B. MATERIAL**

1. Preferred panel construction may be either black core solid phenolic or stainless steel with “Diamond” embossed texture. Solid plastic (HPDE) panels may be used due to project budget limitations. Painted metal panels are NOT acceptable.

**C. HARDWARE**

1. Provide either continuous heavy duty anodized extruded aluminum or continuous heavy-duty stainless-steel wall brackets.
2. Provide continuous stainless-steel hinge at compartment doors.

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**SECTION 10 2200 – PORTABLE / MOVABLE PARTITIONS****A. GENERAL**

1. Operable partitions, where required for subdividing multi-use spaces, may be either manual or motorized operation depending on the specific function or use. Operation shall be simple enough for one person to operate.
2. Provide either horizontal single panel, horizontal double panel or vertical folding panels depending on project budget. Accordion partitions are NOT acceptable.
3. Design Professional to specify operable partition enclosures that meet or exceed a STC-50 rating and design enclosures to eliminate flanking paths for sound transmission, which shall be field verified by an independent testing agent.

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## SECTION 10 2600 – WALL PROTECTION

### A. GENERAL

1. Corridors, public spaces, and high traffic areas enclosed with drywall partitions shall have corner protection at each corner. Areas that have movable furniture against drywall partitions shall have wall protection to prevent damage from tables and/or chairs sliding along or leaning against partitions.
2. Basis of Design (or prior approved equal):
  - a. Corner guards – Construction Specialties, SM-20N Acrovyn 4000 corner guards, min. 48” high, color coordinated with wall color.
  - b. Rubstrips – Construction Specialties, RS-40N Acrovyn 4000 rubstrips, min. 6” high mounted to coordinate with table/chair heights, color coordinated with wall color.

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**SECTION 10 2800 – TOILET ACCESSORIES**

**A. GENERAL**

1. Refer to “Toilet Accessories Table” below and Appendix for Toilet Accessory cut sheets.
2. Restrooms to have exhaust fan with back flow damper.
3. Waste receptacles shall be located under the lavatory counters with a stainless-steel waste chute or opening in counter. Provide one waste receptacle per pair of lavatories located between lavatories so they are accessible from both.
4. Install one soap dispenser per pair of lavatories located between lavatories so they are accessible from both.
5. Provide both paper towel dispensers and hand dryers in each restroom, with the exception of unisex toilets and lactation rooms. Unisex toilets and lactation rooms shall only have a paper towel dispenser.
  - a. Paper towel dispensers and hand dryers installed on drywall partitions shall have a water-resistant finish, i.e. – tile, stainless steel, solid surface, etc.
  - b. Never install paper towel dispensers or hand dryers on a painted drywall surface.
  - c. Locate units together preferably on wall opposite lavatories so as not to impede access to lavatories while drying hands.

<b>TOILET ACCESSORIES TABLE</b>						
<b>Description</b>	<b>Contractor Provided</b>	<b>Contractor Installed</b>	<b>Owner Provided</b>	<b>Owner Installed</b>	<b>Manuf.</b>	<b>Model Number</b>
<b>Hand Dryer</b>	X	X			Excel Dyson (ALT.)	Xlerator XL-SB Airblade V HU02 Sprayed Nickel (ALT.)
<b>Seat Cover Dispenser</b>	X	X			Bobrick	B-221
<b>Toilet Tissue Dispenser</b>	X	X			Bobrick	B-2892
<b>Soap Dispenser</b>		X	X		GOJO	LTX-12
<b>Paper Towel Dispenser</b>		X	X		Wausau Paper	Optiserv Hybrid

<b>Janitor's Closet Utility Shelf</b>	X	X			Bobrick	B-239
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## **SECTION 10 4100 – EMERGENCY ACCESS**

### **A. GENERAL**

1. Design Professional to coordinate emergency access required with the Authority Having Jurisdiction.
2. Provide a Fire Department Knox Box for new construction and major renovations per Cobb County Fire Department specifications.

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**SECTION 10 4313 – DEFIBRILLATOR CABINETS****A. GENERAL**

1. Automated External Defibrillator (AED) cabinets to be provided, located and installed by KSU Public Safety. Each floor to have a min. of one AED unit, two depending on the floor area and layout, located adjacent to the elevator lobby and main circulation paths.
2. Design Professional to provide location and/or recess to comply with ADA requirements for protruding objects in circulation path.
  - a. AED cabinet is 18" x 18" x 7" deep mounted at 42" AFF to the bottom.
  - b. Design professional to request current manufacturer's cut sheet from KSU.

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**SECTION 10 4400 – FIRE EXTINGUISHER CABINETS****A. GENERAL**

1. Fire extinguisher cabinets shall be semi-recessed and should fit in a 3 5/8" metal stud partition.
2. Locations required per state building codes to be reviewed by KSU Fire Safety Manager to determine if additional locations are required.
3. Provide fire extinguisher cabinet adjacent to the MDF/IDF rooms, not within the room.
4. Provide Type A-B-C fire extinguisher, typical.

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## SECTION 10 8000 – INTERIOR WASTE RECEPTACLES

### A. GENERAL

1. The University contracts with a waste management vendor, who provides a single stream recycling service so only one general recycling waste receptacle needs to be provided in lieu of separate receptacles for paper, plastic, glass, etc.
2. Interior waste receptacles shall be included in the Contractor's scope of work for new construction and major renovations. See Appendix.

### B. RECEPTACLES

1. Public Areas, Entry/Elevator Lobbies & Corridors
  - a. General Waste – Rubbermaid FGSC22ERBSM, 50 gal., color: "Stardust Silver Metallic".
  - b. Recycled Waste – Rubbermaid FGDCR24TSM, 29 gal., color: "Stardust Silver Metallic".
2. Auditoriums, Classrooms, Conference Rooms, Group Study Rooms & Breakrooms
  - a. General Waste – Rubbermaid "Slim Jim" FG354060BLA, 23 gal., color: "Black".
3. Offices & Workstations
  - a. General Waste – Rubbermaid FG295600BLA, 28 qt., color: "Black".
  - b. Recycled Waste – Rubbermaid FG295673BLUE, 28 qt., color: "Blue".
4. Restrooms
  - a. General Waste – Rubbermaid "Slim Jim" FG354060BLA, 23 gal., color: "Black".

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## **DIVISION 11 – EQUIPMENT**

### **SECTION 11 1300 – LOADING DOCK EQUIPMENT**

#### **A. GENERAL**

1. Min. requirements for a service dock to be 48” high concrete dock with projected dock bumpers sized based on slope of the loading area to the dock to prevent the top of the truck from hitting the loading dock door and/or building wall.
2. Recessed pit style mechanical leveler preferred, if project budget allows.
  - a. Mechanical Edge-of-Dock leveler acceptable as alternate to recessed pit mechanical leveler.

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**SECTION 11 3000 – BREAKROOM EQUIPMENT****A. GENERAL**

1. Refrigerators:
  - a. To be specified by Design Professional and to be included in the Contractor's scope of work.
  - b. Provided with an icemaker
  - c. One per Breakroom
  - d. Finish to be stainless steel
  
2. Microwaves:
  - a. To be specified by Design Professional and to be included in the Contractor's scope of work.
  - b. One per breakroom
  - c. Locate unit either on countertop or on shelf below counter to provide ADA accessibility.

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## SECTION 11 5200 – AUDIO-VISUAL EQUIPMENT

### A. GENERAL

1. Audio-visual systems for auditoriums, classrooms, student group study rooms, conference rooms, etc. shall be designed and specified by KSU IT. Audio-visual design and equipment specifications will be provided by KSU IT to Design Professional to coordinate power, data and structural support requirements.
2. Auditoriums or classrooms with exterior windows that require black-out shades for audio-visual system shall be integrated with audio-visual system for operational control.
3. See Appendix for basic audio-visual system requirements.

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**SECTION 11 8200 – FACILITY SOLID WASTE HANDLING EQUIPMENT****A. GENERAL**

1. The University contracts with a waste management vendor, who provides a self-contained compactor. Design Professional to verify the equipment specifications with the current waste management vendor. See Appendix.
2. Provide two self-contained compactors, min. 34 CY/each, per building typical: One for recycling and one for regular trash.
3. Provide reinforced concrete pad sized per the current waste management vendor equipment specifications.

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## DIVISION 12 – FURNISHINGS

### SECTION 12 2000 – WINDOW TREATMENTS

#### A. GENERAL

1. All exterior windows shall have window shades in each auditorium, classroom, office, conference room, etc., except for large public spaces, i.e. – entry lobbies. Public spaces and/or corridors with seating/lounge furniture with exterior windows may have window shades to be determined on a case-by-case basis.
2. Use of draperies, vertical blinds and/or 1” wide aluminum horizontal mini-blinds is discouraged in University facilities and may be used only with specific approval of the University.
3. Manual roller fabric shades are the preferred window treatment. Fabric shades shall be max. 1% open fabric. Provide manufacturer’s standard aluminum fascia to conceal mechanisms with finish to match window framing.
4. Auditoriums and large (80 seat) classrooms with exterior windows shall have a dual motor-operated roller fabric shade connected to audio-visual system. Exterior fabric to be max. 1% open and interior fabric to be black-out shade with side channels.

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**SECTION 12 4813 – ENTRANCE FLOOR MATS****A. GENERAL**

1. All entrance vestibules shall have a walk-off area to cover the entire vestibule. Provide walk-off carpet tiles per [Section 09 6000 – Flooring](#).
2. Recessed aluminum grate or grille type floor mats are NOT acceptable.

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## SECTION 12 5000 – FURNITURE

### A. GENERAL

1. The University will contract with a furniture vendor to design, layout, specify, procure, and install furniture for new construction and major renovations. Design Professional will participate in the furniture selections and finishes to coordinate with the design of the building.
2. Typical office layouts have been developed to provide office standards. Refer to Appendix for typical office furniture layouts.
3. Fixed seating for tiered auditoriums and/or large tiered classrooms shall be specified by the Design Professional to be included in the Contractor's scope of work. Fixed seating shall be 20" wide minimum. Provide adequate spacing to allow for the physically challenged and provide space for ADA accessibility seating areas.
4. The University has final approval on all furniture selections with the input from the University Building Committee and the Design Professional.
5. For all lounge furniture do NOT provide tablet arms.

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## DIVISION 14 – CONVEYING SYSTEMS

### SECTION 14 2000 – ELEVATORS

#### A. GENERAL

1. The service elevator or at least one (1) elevator needs to be on the emergency generator.
2. Provide three complete sets of final wiring diagrams, operating and maintenance manuals, parts manuals and troubleshooting guides. Provide all user and service codes for all diagnostic equipment with instructions.
3. Provide all special diagnostic equipment, meters or monitors manuals needed to trouble shoot or repair elevators. Proprietary equipment, components, computer hardware and software, shall not be used.
4. Parts or troubleshooting equipment needed to repair or maintain elevator equipment should be easily obtainable and generic.
5. Provide 2 copies of "design certificates" to University.
6. To keep University elevator equipment in peak running environment, all new and renovated elevators shall have air conditioning and humidity controls in the control cabinets or equipment rooms. Shaft ways exposed to exterior environment (i.e. parking garages) shall be provided with humidity control to prevent water condensation on rails and operating mechanisms.
7. The entire elevator installation shall be in accordance with ASME A17, the most current edition.

#### B. MANUFACTURERS

1. Approved manufacturers:
  - a. KONE Elevators
  - b. Thyssen Krupp
  - c. Otis Elevator Company

#### C. ELEVATOR DESIGN

1. For passenger elevators, the elevator speed shall be no less than 150 FPM. For freight elevators, the speed is to be determined according to project needs.
2. Provide one dedicated service/freight elevator, listed at 5000#'s, for all new construction for facilities 4 stories or greater. And, provide one storage room adjacent to the service elevator.
3. Provide one elevator to access the roof for equipment replacement and other repairs. If there are two elevators in the building, this elevator will be the freight, rated at 5000 lbs.
4. For hydraulic elevators, provide safety sleeve for jack.

**D. CAB DESIGN**

1. Elevator cab lighting - provide LED lamps or as approved by the University.
2. Provide key locks for independent service, fire service inspection, emergency stop, and fan. (Four [4] keys for each lock.)
3. Provide ADA-hand free communication with direct dial telephone line to KSU Public safety monitoring facility; one button push. Coordinate with KSU.
4. Provide wall panels in all elevator cabs with hangers for safety pads.
5. Provide safety pads in all elevator cabs (contractor must protect cabs during construction).
6. Provide hard, smooth, non-slip surface flooring (no carpet).
7. Provide Braille and tactile numbers and labels and meet all ADA requirements.
8. Provide instructions for fire service etched into panel.
9. Provide directional indicator lantern lights in hoist way opening jamb at each floor and car position indicator at main entry levels.
10. All interior cab finishes & call button plates should be stainless steel.

**E. MACHINE ROOM**

1. Upon power failure one elevator must continue to operate off the emergency generator.
2. Provide one laptop computer and elevator software with remote capability in the elevator machine room.
3. Provide one spill control kit for each elevator machine room in accordance with KSU Spill Prevention Control and Countermeasures (SPCC).

**F. MAINTENANCE**

1. Starting at the date of Material Completion, provide a complete systematic inspection and maintenance of each elevator for a period of 24 months after Material Completion.
  - a. Furnish trained experts and equipment to check, adjust, lubricate, and otherwise maintain the elevators in operation without defects of deterioration.
  - b. Replace and repair materials and parts which become defective or deteriorated for any reason except through abuse or misuse by the Owner or occupants of the building.
  - c. Return to the Project, within 18 hours of time the Owner reports defective operation and

proceed with repair and maintenance work to restore operation promptly.

- d. Provide inclusive maintenance, call-back service, and emergency repair on each elevator after it is completed and placed in operating order for a period indicated above with no overtime charges during warranty period.

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## **DIVISION 21 – FIRE SUPPRESSION SYSTEMS**

### **SECTION 21 0510 – GENERAL FIRE-SUPPRESSION REQUIREMENTS**

#### **A. OWNER’S DESIGN CRITERIA**

1. International Fire Code, 2018 Edition with Georgia Amendments.
2. International Building Code, 2018 Edition with Georgia Amendments.
3. National Electric Code, 2017 Edition.
4. International Energy Conservation Code, 2015 Edition with Georgia Amendments.
5. NFPA 13 - Standard for the Installation of Sprinkler Systems, 2013 Edition.
6. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems, 2013 Edition.
7. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection, 2013 Edition.
8. Rules and Regulations of the Safety Fire Commissioner 120-3-3, Dated January 1, 2020.

#### **B. GENERAL**

1. Provide fire sprinkler system in accordance with NFPA 13 for all new buildings unless directed otherwise by University project manager. Provide sprinkler system in renovation/repair projects wherever necessary to meet applicable codes or where requested by University project manager.
2. All fire sprinkler system design drawings must be sealed by a Georgia registered professional engineer and must be approved by the State Fire Marshal's Office.
3. Contract documents shall require the fire protection contractor to submit sprinkler shop drawings and hydraulic calculations directly to the State Fire Marshal for approval.
4. Perform a fire flow test at the beginning of the fire sprinkler system design to determine available water pressure and flowrate. The sprinkler contractor shall perform an additional fire flow test within 6 months of submitting shop drawings to the State Fire Marshal's Office.
5. Close Out Document Requirements:
  - a. As-Built Drawings, Warranties, and Guarantees.
  - b. Operation and Maintenance Manuals.

- c. Equipment Log with Model and Serial Numbers.
  - d. Extra Equipment and Materials for Owner Stock.
  - e. MEP Orientation for Plant Service. Provide video copy.
6. Operating and Maintenance Manuals
- a. Digital delivery of Operating and Maintenance Manuals:
    - i. Take steps to reduce submittal file size.
    - ii. Do not scan in color or high resolution unless required for clarity.
    - iii. Ensure any reproductions are legible.
    - iv. Identify the manuals in the email subject line using the official project title, specification section and submitted item.
    - v. Table of Contents (Index) sheets shall be included in the order listed with identifications typed in capital letters.
    - vi. The O&M Pdf should contain bookmarks to each section of the manual, and bookmarks to each product.
7. Physical delivery of Operating and Maintenance Manuals:
- a. Three (3) bound and indexed Operating and Maintenance Manuals shall be provided.
  - b. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
  - c. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
  - d. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
  - e. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
  - f. Table of Contents (Index) sheets shall be provided in the order listed with identifications typed in capital letters.
8. Provide Pipe Sleeves in Slabs and Partitions:

- a. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
  - b. Rated Drywall Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
9. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable.
10. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.
11. Piping Pressure Testing
- a. General:
    1. Complete tests prior to installing ceiling. Leaks shall be repaired, defective materials replaced, and system shall be retested. Strike all joints in copper and steel piping under a pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system.
    2. No water pressure test shall be conducted in freezing weather where subject to freezing.
    3. Test shall be maintained at conditions specified until approved but, in no event, for less than two (2) hours minimum duration, unless otherwise noted.
    4. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.
    5. Test pressures shall be read from a gauge located at the low elevation point of the system being tested.
  - b. Existing Sprinkler System Piping:
    1. Test as specified where isolation is possible.
    2. Where fewer than 20 sprinklers are modified pressure testing is not required.
    3. Where isolation is not possible, pressure testing is not required.
  - c. Wet Sprinkler System:
    1. Hydrostatic Test; 200 PSIG

2. Portions of the system normally subjected to working pressures in excess of 150 PSIG shall be tested at 50 PSIG higher than the normal working pressure of the system.
- d. Dry Pipe Sprinkler Systems:
    1. Hydrostatic Test; 200 PSIG
    2. In addition to Hydrostatic Test, an Air Pressure Leakage Test at 40 PSIG shall be conducted for 24 hours. Any leakage that results in a drop of 1.5 PSIG for 24 hours shall be corrected.
    3. Where systems are installed in spaces subject to temperatures below 32 degrees F, the Air Pressure Leakage Test shall be conducted at the lowest nominal temperature of the space.
  - e. Water Service to Fire Protection System: Hydrostatic test, 200 PSIG.

### **C. DEMONSTRATION, TRAINING AND INSTRUCTIONS**

1. A minimum of 40 total hours of training shall be provided for plumbing systems. Training shall occur in 3 hour sessions in the afternoon.
2. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment). The contractor shall have training sessions recorded (audio and video) by a third party.
3. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.
4. An Owner Training Video shall be made separate from training sessions and professionally recorded. The video shall cover all equipment and systems addressed in the owner training sessions.
5. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

**SECTION 21 1100 – FIRE-SUPPRESSION PIPING****A. GENERAL**

1. Wet System Piping: Black Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 795 Schedule 40.
2. Dry System Piping: Black Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 795 Schedule 40.
3. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
4. No flexible braided drops are allowed. All sprinkler drops will be hard piped.
5. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
6. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
7. Gate Valves:
  - a. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, 200 PSIG working pressure.
8. Butterfly Valves:
  - a. Gear operated, cast iron body, wafer design type body, U.L. Listed - F.M. approved, with resilient seat, 175 pound W.O.G.
9. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
10. Provide drain valves at main shut-off valves, low points of piping and apparatus. Route drains to interior mop basins or exterior of building.
11. Backflow Preventer: (If installed inside building)
  - a. Double Check Detector Valve Assemblies:
    1. ASSE 1048, FM approved; two independently operating check valves within a single housing, sleeve access port, 4 test cocks and two OS&Y valves. Bypass assembly shall consist of a meter, a double check backflow device and test cocks.

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**SECTION 21 1200 – FIRE-SUPPRESSION STANDPIPES****A. GENERAL**

1. Install Wet and Dry Standpipe Systems in accordance with NFPA 14.
2. Locate standpipe valves on floor level of every egress stair.
3. Locate standpipe valves at no more than 60 inches above finished floor.
4. Where static pressure exceeds 175 psi but is less than 350 psi at any fire valve cabinet, provide pressure reducing valve on hose connection valve to prevent pressure from exceeding 175 psi.

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**SECTION 21 1300 – FIRE-SUPPRESSION SPRINKLERS****A. GENERAL**

1. Sprinkler Heads
  - a. All sprinklers installed shall be by the same manufacturer.
  - b. Contractor shall select temperature ratings in accordance with NFPA 13. Provide Intermediate Rated (175°F-225°F) Sprinkler Heads in MDF and IDF Rooms.
  - c. Provide quick response sprinkler heads throughout buildings.
  - d. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
  - e. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
2. Dry Sprinkler Systems shall utilize Nitrogen Generators to pressure system, in lieu of Air Compressor.
  - a. Nitrogen Generator: Provide 98% purity nitrogen to the dry fire sprinkler system. System shall include filtration to remove water and hydrocarbons. Control Panel to monitor air compressor runtimes, nitrogen generator pressure, and operational mode locally and over the internet. Leak detection system capable of determining sprinkler system leak rates and give alerts if leaks develop within the piping system, nitrogen system, or compressed air system. The shall automatically switch between air bypass mode and nitrogen generating mode based on demands from the dry sprinkler system. System shall be FM Approved.

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**SECTION 21 2200 – CLEAN-AGENT FIRE EXTINGUISHING SYSTEM****A. GENERAL**

1. Clean Agent Fire Suppression Systems should be considered for use to protect main server rooms and large data centers. Consult with the University project manager for each space that may utilize a clean agent system.
2. Install Clean Agent Fire Suppression Systems in accordance with NFPA 2001.
3. Interlock clean agent system with HVAC motorized dampers and building fire alarm system.

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**SECTION 21 3000 – FIRE PUMPS****A. GENERAL**

1. Fire Pumps and Jockey Pumps shall be installed in accordance with NFPA 20. Fire pumps should only be provided where required to meet NFPA 13 or NFPA 14 pressure requirements.
2. Provide access space around pumps for service; no less than minimum as recommended by manufacturer. Provide clearance in accordance with NEC for Controllers.
3. Fire Pump Rooms shall be conditioned to maintain maximum 75°F and minimum 50°F temperatures.
4. Fire Pumps:
  - b. Horizontal base-mounted type; UL 448 and FM approved; horizontal shaft, single stage, double suction, direct connected, horizontally split casing, for 250 psi minimum working pressure.
  - c. Vertical in-line type; UL 448 and FM approved; single stage, close coupled, radially split casing, for in-line mounting, for a minimum 250 psi working pressure.
  - d. All pumps to have mechanical seals.
5. Fire Pump Controller:
  - e. Digital solid state starter with soft start and soft stop, in NEMA 2 enclosure, and shall include an automatic transfer switch to allow connection to an emergency generator.
  - f. Circuit Breaker: Comply with NFPA 20; minimum 100,000 amperes interrupting capacity.
    2. The controller shall be capable of interrupting a short circuit current at least equal to the available short circuit current in the controller supply circuit.
    3. This fire pump controller installation requires an withstand rating of not less than 100,000 amps RMS symmetrical at an operating voltage of 480 Volts.

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## **DIVISION 22 – PLUMBING**

### **A. OWNER'S DESIGN CRITERIA:**

1. International Plumbing Code, 2018 Edition with Georgia Amendments.
2. International Fire Code, 2018 Edition with Georgia Amendments.
3. International Fuel Gas Code, 2018 Edition with Georgia Amendments.
4. International Building Code, 2018 Edition with Georgia Amendments.
5. National Electric Code, 2017 Edition.
6. International Energy Conservation Code, 2015 Edition with Georgia Amendments.
7. Americans with Disabilities Act, 2010 Edition.
8. Rules and Regulations of the Safety Fire Commissioner 120-3-3, Dated January 1, 2020.

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**SECTION 22 0510 – GENERAL PLUMBING REQUIREMENTS****A. GENERAL**

1. The design team is responsible for designing all systems for adequate clearances and access to all systems. The General Contractor, and its subcontractors, shall coordinate and schedule the installation of all work above the ceiling in accordance with manufacturer's installation instructions for all equipment. All trades shall participate and be required to attend special project meetings for the purpose of ceiling space coordination. Such coordination shall include, but is not limited to, the following work:
  - a. Ceiling grid and Ceiling Tile Installation.
  - b. Access Door Sizes, and Locations.
  - c. Plumbing Piping and Valves.
  - d. All Equipment.
2. All equipment and accessories requiring service or adjustment, shall be easily accessible to within 3 feet of the finished ceiling. Equipment access may require the installation of service platforms.
3. The contractor shall be solely responsible for determining, verifying, and complying with inspection requirements relative to the scope of work and with the authority having jurisdiction. All in-floor, in-wall, above ceiling, and pressure tests shall be inspected by the architect/engineer prior to cover-up. All inspection reports shall be in writing and supported by digital pictures where deficiencies are found. Once the deficiency is corrected a follow-up inspection shall be made to verify compliance with the contract documents.
4. Close Out Document Requirements:
  - a. As-Built Drawings, Warranties, and Guarantees.
  - b. Operation and Maintenance Manuals.
  - c. Equipment Log with Model and Serial Numbers.
  - d. Extra Equipment and Materials for Owner Stock.
  - e. MEP Orientation for Plant Service. Provide video copy.
  - f. Valve Tag lists and Diagrams.
  - g. Piping Integrity Testing Videos.
5. Operating and Maintenance Manuals
  - a. Digital delivery of Operating and Maintenance Manuals:
    - i. Take steps to reduce submittal file size.

- ii. Do not scan in color or high resolution unless required for clarity.
  - iii. Ensure any reproductions are legible.
  - iv. Identify the manuals in the email subject line using the official project title, specification section and submitted item.
  - v. Table of Contents (Index) sheets shall be included in the order listed with identifications typed in capital letters.
  - vi. The O&M Pdf should contain bookmarks to each section of the manual, and bookmarks to each product.
- b. Physical delivery of Operating and Maintenance Manuals:
- i. Three (3) bound and indexed Operating and Maintenance Manuals shall be provided.
  - ii. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.
  - iii. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
  - iv. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
  - v. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
  - vi. Table of Contents (Index) sheets shall be provided in the order listed with identifications typed in capital letters.
6. Contractor(s) to record and photograph the data plate information along with the location in the building and the name of the equipment(as designated on the blueprints) into an excel spreadsheet, on a CD, and to be submitted when the building is turned over to KSU, as part of the close-out documents.
7. All equipment, piping, conduit, etc. within a renovated space which is abandoned shall be removed. If it cannot be removed it shall be properly capped plugged using the same type and gauge material as the existing system.
8. Provide Pipe Sleeves in Slabs and Partitions:

- a. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab. Provide 4" high concrete curb around piping penetrating mechanical penthouse floor slabs.
  - b. Rated Drywall Partitions: Schedule 40 black steel pipe. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
9. Pipe sleeves in footings and foundation walls:
- a. Schedule 40 black steel pipe.
  - b. Water pipe, distribution piping, soil or waste pipe or building drain passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
10. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable.
11. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.
12. Piping Pressure Tests
- a. General:
    - i. Complete tests prior to insulating.
    - ii. Leaks shall be repaired, defective materials replaced, and system shall be retested.
    - iii. Strike all joints in copper and steel piping under a pressure test.
    - iv. Conduct tests prior to connecting to equipment or isolate equipment from system.
    - v. No water pressure test shall be conducted in freezing weather where subject to freezing.
    - vi. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.
    - vii. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.
  - b. Domestic Water System: Hydrostatic test; 150 PSIG.

- c. Soil, Waste and Vent System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.
  - d. Storm Drain System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.
  - e. Multistory Buildings: Test tees shall be provided in soil, waste and storm drain piping to eliminate pressure testing of more than two floors at a time.
  - f. Natural Gas System: Pressure test; 50 PSIG air or inert gas; 3 hours minimum duration. Oxygen shall not be used.
  - g. Force Main Piping: Hydrostatic Test; 100 PSIG.
  - h. Piping Integrity Testing:
    - i. At the completion of construction, the contractor shall have a full video inspection of the new underslab sanitary and storm piping systems to the cleanout located 5 feet outside the building to verify integrity of piping.
    - ii. Any damage to the piping system shall be repaired prior to material completion. Provide an additional video inspection of the repaired areas.
    - iii. Record inspection and provide a digital copy of the video with the O&M Manual.
13. Equipment Bases and Housekeeping Pads:
- a. Provide housekeeping and equipment bases for all equipment.
  - b. Bases/Pads shall be 4" High with a 4" overhang on all sides of the equipment.
  - c. Provide a concrete pad at all pipe penetrations of floors in mechanical rooms above grade.
14. Mechanical Rooms shall have epoxy floors extending to wall and 4-inches vertical on wall seamlessly. All floors shall slope at 2% to floor drains.
15. Penthouses shall have epoxy floors extending to wall and 4-inches vertical on wall seamlessly. All floors shall slope at 2% to floor drains.

## **B. DEMONSTRATION, TRAINING AND INSTRUCTIONS**

1. A minimum of 40 total hours of training shall be provided for plumbing systems. Training shall occur in 3 hour sessions in the afternoon.
2. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment). The contractor shall have training sessions recorded (audio and video) by a third party.
3. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.
4. An Owner Training Video shall be made separate from training sessions and professionally recorded. The video shall cover all equipment and systems addressed in the owner training sessions.
5. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

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**SECTION 22 0519 – METERS AND GAUGES FOR PLUMBING PIPING****A. GENERAL**

1. All metering shall adhere to the KSU Utility Metering Standard dated March 1, 2016, Located in Appendix 12.
2. Provide pressure gauge on incoming side of backflow preventer and pressure regulating assemblies. Provide one pressure gauge downstream from each backflow preventer or pressure reducing valve.
3. Provide thermometers on water heating systems. Locate thermometer leaving thermostatic mixing and water heater.
4. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

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**SECTION 22 0553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****A. GENERAL**

1. Identify equipment such as pumps, water heaters, tanks, compressors and enclosed motor controllers with plastic nameplates.
2. Where equipment is located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.
3. Identify control panels and major control components outside panels with plastic nameplates.
4. Install Pipe Markers on all piping systems at the following Locations:
  - a. Mechanical Equipment Rooms:
    - i. Within 18 inches of each valve.
    - ii. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.
    - iii. At not over 20 feet intervals along all exposed piping.
  - b. Above Suspended Ceilings:
    - i. Within 18 inches of each valve or valve assembly.
    - ii. At tees, identify both main and branch within 36 inches of tee.
    - iii. Within 36 inches of each 90 elbow.
    - iv. At not over 15 feet intervals along all concealed piping.
  - c. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
    - i. Omit identification on piping, 1 inch exterior diameter or smaller (insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
    - ii. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

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**SECTION 22 0719 – PLUMBING PIPING INSULATION****A. GENERAL**

1. Domestic Water:
  - a. Domestic Hot, Tempered, and Circulating Piping: 1.5-inch thick rigid glass fiber with factory ASJ jacket.
  - b. Domestic Cold Piping: 1-inch thick rigid glass fiber with factory ASJ jacket.
2. Roof Drain Bodies: Flexible glass fiber; 1-1/2 inch thick.
3. Roof Drainage Piping: Flexible fiberglass blanket type, ½-inch minimum thick.
4. Waste Piping Handling HVAC Condensate: 1 inch thick phenolic foam with Saran vapor jacket. Insulate fittings with pipe insulation mitered to fit.
5. Insulation exposed to the exterior or unconditioned spaces shall be wrapped with Aluminum Jacket.

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**SECTION 22 1005 – PLUMBING PIPING****A. GENERAL**

1. A. Sanitary Sewer and Storm Drainage:
  - a. All piping shall be cast iron pipe above and below slab on grade.
  - b. Cleanouts shall be provided at the end of all restroom batteries, and they shall be readily accessible and located in the Men's restrooms where possible.
  - c. Cleanouts shall be provided within the system run at intervals not to exceed 75 feet maximum to the first manhole.
  - d. In renovation projects, Camera all below slab sanitary and storm drainage piping that will be re-used to determine condition of piping and suitability for the new plumbing design.
2. Water Piping:
  - a. All piping shall be copper pipe with solder or press fit joints and copper fittings.
  - b. Provide ball valves at all branch taps for isolation. Use globe valves for throttling.
  - c. Isolation valves shall be provided for each floor of a multistory building, to isolate the floor from the main building water supplies.
  - d. Isolation valves shall be provided for all banks of restrooms to isolate the restroom from the main water supplies for that floor.
3. Pressure Reducing Valves: Zurn 500XL or equivalent. Sizes 2" and larger shall be flanged and equipped with regulated low flow bypass.
4. Provide ample access for maintenance, service, and adjustment to all equipment, plumbing piping, and isolation valves.
5. All exposed exterior gas piping shall be primed, painted(yellow), and labeled. All equipment supports shall be primed and painted.
6. Provide unions in piping to all equipment and specialties to permit removal for service; unions 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.
7. Piping Integrity Testing:
  - a. At the completion of construction, the contractor shall have a full video inspection of the new underslab sanitary and storm piping systems to the cleanout located 5 feet outside the building to verify integrity of piping.
  - b. Any damage to the piping system shall be repaired prior to material completion. Provide an additional video inspection of the repaired areas.

- c. Record inspection and provide a digital copy of the video with the O&M Manual.

**SECTION 22 1006 – PLUMBING PIPING SPECIALTIES****A. GENERAL**

1. Floor Drains:
  - a. Provide square floor drains in tile floors.
  - b. Install floor drains at low points in floor.
  - c. Install trap primer connections to all floor drains.
  - d. Locate floor drains in all janitor's closets, mechanical rooms, and restrooms.
2. Trap Primer Valves:
  - a. Install unions on both sides of trap primer and distribution unit to ease maintenance and replacement.
3. Cleanouts:
  - a. Provide cleanouts at the end of each restroom battery. Try to locate in Men's Restrooms.
  - b. Cleanouts to be readily accessible in the floor if possible.
4. Hose Bibbs:
  - a. Locate hose bibs under the lavatories for each gang restroom, and in strategic locations around the mechanical rooms, boiler rooms, chiller rooms, air handler rooms, and mechanical penthouses.
  - b. A 1" domestic water line with hose bibb or non-freeze yard hydrant will be installed within 25 feet of air-cooled chillers. Any piping exposed to the exterior or unconditioned spaces shall have heat tracing installed to prevent freezing.
  - c. A 2" Utility Hydrant should be installed at all Cooling Towers.
  - d. Non- Freeze Wall Hydrants should be installed around the perimeter of the building spaced approximately 80'-100' apart.
  - e. An isolation valve shall be provided for all Utility and Non-Freeze Wall and Yard Hydrants. The isolation valve shall be located at the closest readily accessible location of the supply piping.
5. Grease Traps:
  - a. All grease traps are to be installed outside the building as near as possible to the fixtures being served.
  - b. Coordinate size requirements with The Cobb County Health Department.

6. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to all fixtures and toilet batteries. Size and install in accordance with the (Plumbing and Drainage Institute Standard) PDI WH-201.

**SECTION 22 3000 – PLUMBING EQUIPMENT****A. GENERAL**

## 1. Domestic Water Heaters:

- a. Install water heater on concrete housekeeping base, sized minimum 4 inches larger than heater base. Refer to Section 22 0510.
- b. Pipe relief valves to floor.
- c. Pipe drains to nearest floor drain.
- d. Water Heaters shall be electric or gas fired and shall be determined on a case by case basis for each project.
- e. Provide thermostatic mixing valves to control water temperature delivery to building.

## 2. Pumps:

- a. Domestic Water Circulation Pumps shall be by Bell and Gossett, Grundfos, or Taco.
- b. Sump Pumps shall have oil alarm systems or shall be connected to oil separators to prevent hydraulic oil from discharging to the sanitary system.

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**SECTION 22 4010 – PLUMBING FIXTURES****A. FLUSH VALVE WATER CLOSETS**

## 1. FIXTURE 'WC1'; WATER CLOSET (WH, FV (1.1/1.6 gpf), STD)

## a. Bowl:

## i. Manufacturers:

1. American Standard Inc.; Model 2856.128
2. Kohler Company; Model K-4325
3. Sloan; Model ST-2459
4. Toto; Model CT708U(G)
5. Zurn; Model Z5615 - BWL

- ii. ASME 112.19.2M; 1.1gpf to 1.6 gpf operation range, wall hung vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, chromium plated nuts and washers, china bolt caps; standard accessible.

## 2. FIXTURE 'WC2'; WATER CLOSET (WH, FV (1.1/1.6 gpf), ADA)

## a. Bowl:

## i. Manufacturers:

1. American Standard; Model 2856.128
2. Kohler; Model K-4325
3. Sloan; Model ST-2459
4. Toto; Model CT708U(G)
5. Zurn; Model Z-5615-BWL

- b. ASME A112.19.2M; 1.1gfp to 1.6 gpf operation range, wall hung vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, chromium plated nuts and washers, china bolt caps; disabled access.

## 3. FIXTURE 'WC3'; WATER CLOSET (FM, FV (1.1/1.6 gpf), STD)

## a. Bowl:

## i. Manufacturers:

1. American Standard; Model 2234.001

2. Kohler; Model K-96053
  3. Sloan; Model ST-2009
  4. Toto; Model CT705UN (G)
  5. Zurn; Model Z-5655- BWL1
- ii. ASME A112.19.2M; 1.1 gpf to 1.6 gpf operation range, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, chromium plated nuts and washers, china bolt caps; standard accessible.
4. FIXTURE 'WC4'; WATER CLOSET (FM, FV (1.1/1.6 gpf), ADA)
- a. Bowl:
    - i. Manufacturers:
      1. American Standard; Model 3043.001
      2. Kohler; Model K-96057
      3. Sloan; Model ST-2029
      4. Toto; Model CT705ULN (G)
      5. Zurn; Model Z-5665-BWL1
    - ii. ASME A112.19.2M; 1.1 gpf to 1.6 gpf operation range, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, chromium plated nuts and washers, china bolt caps; disabled accessible.

## B. URINALS

1. FIXTURE 'UR1'; URINAL (WH, FV (0.125 gpf), STD)
  - a. Urinal:
    - i. Manufacturers:
      1. American Standard; Model 6590.001
      2. Kohler; Model K-4991-ET-0
      3. Sloan; Model SU-1009
      4. Toto; Model UT445U(V)
      5. Zurn; Model Z5758-U

- ii. ASME A112.19.2M; 0.125 gpf, vitreous china, wall hung wash-out urinal fixture with integral trap, battery powered touchless electronic flush valve, and floor mounted carrier.

2. FIXTURE 'UR2'; URINAL (WH, FV (0.125 gpf), ADA)

a. Urinal:

i. Manufacturers:

1. American Standard; Model 6590.001
2. Kohler; Model K-4991-ET-0
3. Sloan; Model SU-1009
4. Toto; Model UT445U(V)
5. Zurn; Model Z5758-U

- ii. ASME A112.19.2M; 0.125 gpf, vitreous china, wall hung wash-out urinal fixture with integral trap, battery powered touchless electronic flush valve, floor mounted carrier, disabled accessible.

### C. WALL HUNG LAVATORIES

1. FIXTURE 'LV1'; LAVATORY (WH, VC, ADA)

a. Lavatory Basin:

i. Manufacturers:

1. American Standard; Model 0356.421
2. Kohler; Model K-2007
3. Sloan; Model SS-3103
4. Toto; Model LT307
5. Zurn; Model Z5341

- ii. ASME A112.19.2M; vitreous china, wall hung, 21" x 18" fixture with single hole drilling, front overflow, soap depression, drilled for floor mounted concealed arm carrier, disabled accessible.

### D. COUNTER MOUNTED LAVATORIES

1. FIXTURE 'LV2'; LAVATORY (CT, VC, ADA)

a. Lavatory Basin:

- i. Manufacturers:
    1. American Standard; Model 0475.047
    2. Kohler; Model K-2196-1
    3. Sloan; Model SS-3102
    4. Toto; Model LT501
    5. Zurn; Model Z5111
  - ii. ASME A112.19.2M; counter mounted, vitreous china, 20" x 17" oval with single hole drilling, front overflow, soap depression; disabled accessible.
2. FIXTURE 'LV3'; LAVATORY (CT, VC, ADA)
- a. Lavatory Basin:
    - i. Manufacturers:
      1. American Standard; Model 0497.221
      2. Kohler; Model K-2211
      3. Sloan; Model SS-3001
      4. Toto; Model LT569
      5. Zurn; Model Z5220
    - ii. ASME A112.19.2M; undercounter mounted, vitreous china, 17"x14"x5.5", front overflow, disabled accessible.

## **E. COUNTER MOUNTED SINKS**

1. FIXTURE 'SK1'; SINK (SS, CT, 22" x 19" SC, ADA)
  - a. Sink:
    - i. Manufacturers:
      1. Elkay; Model LRAD-22196
      2. Just; Model SL-ADA-2219-A-GR
    - ii. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment 22 x 19 x 6 -inches overall with 3 -hole drilling for faucet, 3-inch drain opening; ADA accessible.

## **F. SPECIALTY SINKS**

1. FIXTURE 'SK2'; SINK (SS, UC, 22" x 19" SC)
  - a. Sink: Undermount Stainless Steel Sink
    - i. Manufacturers:
      1. Elkay; Model ELUHAD211555
      2. Just; Model USF-ADA-1824-16
    - ii. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment 21 x 15.75 x 5.375 -inches overall, 3-inch drain opening.
2. FIXTURE 'SK3'; SINK (SS, SM, 19" x 17" SC)
  - a. Sink: Surface Mounted Stainless Steel Sink
    - i. Manufacturers:
      1. Elkay; Model PSLVR1917
      2. Just; Model SL-ADA-17519-16-GR
    - ii. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment 16 x 11.5 x 6.125 -inches overall, 3-inch drain opening, disabled accessible.

## **G. MOP BASINS**

1. FIXTURE 'MB1'; MOP BASIN (TERRI, FM 24" x 24" x 12")
  - a. Mop Basin:
    - i. Manufacturers:
      1. Acorn; Model TNC-24
      2. Fiat; Model TSBC-1610
      3. Stern-Williams; Model SBC-1700
    - ii. ASME A112.19.1M terrazzo stone, one piece basin, neo-corner, 24 x 24 x 12-inches overall with integral stainless steel grate with quick connect drain. Wall hung faucet, with hose and bracket.

## **H. MISCELLANEOUS FIXTURES**

1. FIXTURE 'WMB1'; WASHING MACHINE BOX
  - a. Washing Machine Box Assembly
    - i. Manufacturers:

1. Guy-Gray; Model FB200
  2. Acorn; Model 8185
  - ii. 20-gauge white powder-coated metal box, pre-punched, sloped to drain, 2-inch connection, 1/2"-inch FIP hose angle valves; with 18-gauge white powder-coated metal face frame/flange.
2. FIXTURE 'IMB1'; ICEMAKER SUPPLY BOX
- a. Icemaker Box Assembly
    - i. Manufacturers:
      1. Guy-Gray; Model BIM 875
      2. Oatey; Model 38687/38689
    - ii. 20-gauge steel with powder-coated white finish; 1/2"-inch FIP inlet by 1/4"-inch outlet compression angle valve with 1/2"-inch MPT connection.

## **I. EMERGENCY SHOWERS AND EYE WASHES**

1. FIXTURE 'ES/EW1'; EMERGENCY SHOWER AND EYE WASH (Free Standing)
  - a. Manufacturers:
    - i. Haws; 8309WC
    - ii. Speakman; Model SE-1200
    - iii. Guardian; Model GBF1994
    - iv. Water Saver; Model SSBF994
    - v. ANSI Z358.1 and ANSI 117.1; ADA shower and eye wash assembly with galvanized steel stanchion, ABS shower head with pull rod & stay-open shower valve; thermostatic mixing valve assembly for providing 'tepid water'.
2. FIXTURE 'ES/EW2'; EMERGENCY SHOWER/EYEWASH (Recessed)
  - a. Manufacturers:
    - i. Haws; Model 8356WCC
    - ii. Water Saver; Model SSBF2150
    - iii. Guardian; Model GBF2150
    - iv. ANSI Z358.1 and ANSI 117.1; ADA Recessed wall mounted combination shower/eyewash assembly; below ceiling chrome plated shower head

with pull down lever activation. Pull down eyewash mounted in recessed cabinet; thermostatic mixing valve assembly for providing 'tepid water'.

## **J. ELECTRIC WATER COOLERS**

### **1. FIXTURE 'EWC1'; ELECTRIC WATER COOLER (HI-LO w/Bottle Filling Station)**

#### **a. Water Cooler**

##### **i. Manufacturers:**

1. Elkay; Model LZSTL8WSLK
2. Oasis; Model PG8EBFSL
3. Halsey Taylor; Model HTHB-HACG8BLSS-WF

- ii. ARI-1010; Bi-level, with ADA unit on the right, wall mounted electric water cooler assembly with stainless steel water surfaces, heavy duty galvanized steel wall mounting frame, 'sandstone' paint or vinyl finish cabinet, elevated anti-squirt bubblers with stream guard, automatic stream regulators; front and side push button actuators; high efficiency cooling tank and air cooled coil delivering 8.0 gph 50-degree water at 90-degree ambient air temperature; with ADA compliant bottle filling station. Bottle filling station to have no touch sensor activation with 30 second shut-off timer, filter, and 1.1 gpm flow rate.

### **2. FIXTURE 'EWC2'; ELECTRIC WATER COOLER (HI-LO MODULAR with Bottle Filling Station)**

#### **a. Water Cooler**

##### **i. Manufacturers:**

1. Elkay; Model LZWS-LRPBM28K
2. Oasis; Model M8WREBF
3. Halsey Taylor; Model HTHBWF-OVLSER-I

- b. ARI-1010; Bi-level, ADA unit on right, stainless steel modular type electric water cooler assembly with round or oval bowls, integral heavy duty galvanized steel mounting frame, elevated anti squirt bubblers with stream guard, automatic stream regulators; front actuator buttons; recessed cooling unit consisting of high efficiency cooling tank and air cooled coil delivering 8.0 gph 50-degree water at 90-degree ambient air temperature; with ADA compliant bottle filling station. Bottle filling station to have no touch sensor activation with 30 second shut-off timer, filter, and 1.1 gpm flow rate.

## **K. FIXTURE ACCESSORIES**

### **1. FLUSH VALVES – Campus Standard**

- a. Water Closet Flush Valve (Dual Flush Electronic Water Closet Valve)
    - i. Manufacturers:
      - 1. Sloan Model; ECOS 111
      - 2. American Standard; Model 606B.761 w/PK00.HAC
      - 3. Zurn; Model ZR6000AV-WS1-DF-HW
    - ii. ASME A112.18.1; Exposed chrome plated diaphragm type with hardwired infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 1 1/2 inch top spud, 11 1/2-inches high; 1 solid-ring supports; 1.1/1.6 gpf dual flush.
  - b. Urinal Flush Valve (Electronic Urinal Valve)
    - i. Manufacturers:
      - 1. Sloan; Model ECOS 186
      - 2. Zurn; Model ZEMS6003PL-ULF
      - 3. American Standard; Model 606B.013 w/PK00.HAC
    - ii. ASME A112.18.1; Exposed chrome plated diaphragm type hardwired infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 3/4 inch top spud, 11 1/2-inches high; 1 solid-ring support; 0.125 gpf maximum flush.
2. FLUSH VALVES – Budget Reduction Option Only
- a. Water Closet Flush Valve (Dual Flush Water Closet Valve)
    - i. Manufacturers:
      - 1. Sloan “Upper Cut”; Model WES-111-YK
      - 2. Zurn “Aqua Vantage”; Model Z6000AV-WS1-DF-YK
    - ii. ASME A112.18.1; Exposed chrome plated diaphragm type with battery powered sensor operated flush valve, non-hold open, heavy duty escutcheon with set screw, integral screwdriver stop, vacuum breaker; 1 1/2 inch top spud, 11 1/2-inches high; 1 solid-ring supports; 1.1/1.6 gpf dual flush.
  - b. Urinal Flush Valve (Urinal Valve)
    - i. Manufacturers:
      - 1. Sloan; Regal Optima 186-0.125-YK

2. Zurn; Aqua-Vantage Z6003AV-ULF-YK
3. American Standard; Model 6145013.002

- ii. ASME A112.18.1; Exposed chrome plated diaphragm type with side oscillating handle, non-hold open, heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 3/4 inch top spud, 1 1/2-inches high; 1 solid-ring support; 0.125 gpf maximum flush.

### 3. SEATS

- a. Water Closet Seat (Elongated, open front, less lid, white)

- i. Manufacturers:

1. Bemis; Model 1655SSC
2. Beneke; Model 527SS
3. Kohler; Model K-4666-S-C
4. Church; Model 9500SSC
5. Centoco; Model 1500 series
6. Zurn; Model Z-5955-SS-LL

- ii. Extra heavy weight, injection molded solid plastic, open-front, less lid, molded bumpers, external check hinges and stainless steel posts.

### 4. FAUCETS

- a. Lavatory Faucet (Electronic with standard spout) – Campus Standard

- i. Manufacturers:

1. American Standard; Model 605B.105 w/PK00.PAC and 605TMV1070
2. Chicago; Model 116.102 AB 1 w/240.630.00.1 and 131-ABNF
3. Sloan; Model EAF-100-P w/MIX-135-A
4. Zurn; Model Z6913-XL-TMV-1-ACA-FS

- ii. ASME A112.18.1M; Chrome plated brass electronic supply fitting with below counter ASSE 1070 thermostatic mixing valve, Plug in transformer with 6' cord, infrared sensor, water proof electronics with 60 second wash cycle, a 2 second maximum run-on time, aerator, 0.5 gpm; less grid drain.

- b. Lavatory Faucet (Single lever) – Budget Reduction Option Only

- i. Manufacturers
    - 1. American Standard; Model 6114.110.002
    - 2. Chicago; Model 420-E2805ABP
    - 3. Moen; Model 8422F05
    - 4. Zurn; Model Z81000-XL-3M
  - ii. ASME A112.18.1M; Chrome plated brass combination supply fitting with standard chrome plated brass handles, ADA, standard spout, aerator, 0.5 gpm; less drain.
- c. Counter Mounted Sink Faucets (8-inch spread w/ gooseneck spout - Lavatories or Sinks)
- i. Manufacturers:
    - 1. Chicago; Model 201-A-3GN8A-E3VP
    - 2. T&S Brass; Model B-2688-78-79A
    - 3. Zurn; Model Z-831-C4-2F-ICT
  - ii. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread gooseneck lavatory combination supply fitting rigid hi-arc gooseneck spout, aerator; 4-inch wrist handles, 1.5gpm; less drain.
- d. Mop Basin Faucet (w/ integral check stops and vacuum breaker)
- i. Manufacturers:
    - 1. Chicago; Model 897-RCF
    - 2. Speakman; Model SC-5811-RCP-CK
    - 3. T&S Brass; Model B-0667-RGH
  - ii. ASME A112.18.1M; Rough Chrome plated brass exposed yoke wall-mount utility faucet assembly with integral stops and vacuum breaker, bucket hook, and threaded hose end, rough chrome finish.
- e. Mop Basin Accessories:
- i. Mop Basin Hose and Bracket
    - 1. Manufacturers:
      - a. Florestone MR-370
      - b. Fiat 832-AA

- c. Stern-Williams T-35
  - 2. .625" outside diameter x 36" long, heavy duty hose with .75" coupling and wall-mounted stainless steel bracket with spring loaded rubber grip.
  - 3. Mop Hanger
    - a. Manufacturers:
      - i. Florestone MR-377
      - ii. Fiat 889-CC
      - iii. Stern-Williams T-40
    - b. 24" long stainless steel with 3 spring loaded rubber mop handle grips.
  - 4. Mop Basin Wall Guards
    - a. Manufacturers:
      - i. Florestone
      - ii. Fiat MSG-2424
      - iii. Stern-Williams BP
    - b. Two 24" long polished 20 gauge, type 304 stainless steel panels.
5. DRAINS
- a. Lavatory Drains (Flat grid off-set drain)
    - i. Manufacturers:
      - 1. Dearborn; Model 760W
      - 2. EBC; Model SG7WC
      - 3. Kohler; Model K-13885
      - 4. McGuire; Model 155-WC
      - 5. Sanitary-Dash; Model R7308
      - 6. Zurn; Model Z-8746
    - ii. ASME A112.18.1M; 1 1/4" inch diameter chrome plated brass flat grid type drain with offset 17-gauge tailpiece.

b. Counter Mounted Sink Drains (Flat off-set 3 1/2-inch grid)

i. Manufacturers:

1. EBC; Model SF8WC
2. Elkay; Model LKAD18
3. Just; Model J-ADA-35-FS
4. McGuire; Model 1149WC
5. Zurn; Model Z-8750

- ii. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass grid type strainer/drain assembly with offset 20-gauge off-set tailpiece.

6. SUPPLY STOPS

a. Lavatory, Counter Mounted Sink, and Electric Water Cooler Supply Stops (3/8"-inch, 1/4 turn; Loose Key)

i. Manufacturers:

1. Brasscraft; Model SR1512AC-LK
2. Dearborn; Model SR1512-LK
3. EBC; Model LA10-K
4. McGuire; Model 165LK
5. Zurn; Model Z-8820-LR-LK

- ii. ASME A112.18.1M; Chrome plated brass angle heavy duty stop with nonmetal-to-metal seat and removable actuator key; supply tubing and escutcheon plate.

7. TRAPS

a. Lavatory Traps (1 1/4"-inch Adj. 'P')

i. Manufacturers:

1. EBC; Model TA-125-CF
2. Dearborn; Model 707 DFBN
3. Kohler; Model K-9000
4. McGuire; Model 8872

5. Zurn; Model Z-8700
  - ii. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.
- b. Counter Mounted Sink Traps (1 1/2"-inch Adj. 'P')
  - i. Manufacturers:
    1. EBC; Model TA-150-CF
    2. Dearborn; Model 710 GDFBN
    3. Kohler; Model K-9000
    4. McGuire; Model 8912
    5. Zurn; Model Z-8702
  - ii. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.

## 8. CARRIERS

- a. Water Closets: Commercial Type with a 500 pound support weight capacity, adjustable vertically and horizontally from the faceplate, with base support, adjustable coupling, gasket, and chromium plated through bolts, and acron nuts.
- b. Urinals: Commercial Type, floor mounted, with hanger plates.
- c. Lavatories: Commercial type, floor mounted, with concealed arm supports.
- d. Electric Water Coolers: Commercial Type, floor mounted, with hanger plates.
- e. Carrier Manufacturers: Josam, Wade, Watts, J.R.Smith, and Zurn

## 9. ADA FIXTURE INSULATION

- a. Manufacturers:
  - i. EBC; Model 1K Series
  - ii. McGuire; Model 'Pro-Wrap' Series
  - iii. Plumberex; Model Pro-2000 Series
  - iv. True-Bro; Model 'Lav Guard' Series
  - v. Zurn; Model 'Trap Wrap' Series
- b. Insulation assembly shall be for supply stops & tubing; drains (including off-sets) and P-traps under all ADA lavatories and counter sinks.

- c. ANSI A117.1, ADA4.19.4; Fully molded, anti-bacterial flexible vinyl insulation assembly, minimum 1/8"-inch wall thickness, white in color, self-extinguishing meeting ASTM D635, and have a K-value of 1.17.

**DIVISION 23 – HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)****A. OWNER'S DESIGN CRITERIA**

1. Kennesaw State University Metering Standard.
2. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.
3. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.
4. Permits and Codes: Refer to the General Conditions.
5. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments, for all work involving cutting and welding.
6. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code, International Mechanical Code, 2018 Edition with all Georgia State Amendments.
7. Energy: Conform to the Georgia State Energy Code for Buildings, International Energy Conservation Code, 2015 Edition with all Georgia State Amendments.
8. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1, 2020", and ADA.
9. Electrical: Refer to Division 26. Conform to the National Electrical Code, 2017 Edition, NFPA 70.
10. Building Code: Conform to the Georgia State Minimum Standard Building Code, International Building Code, 2018 Edition with all Georgia State Amendments.

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## SECTION 23 0510 – GENERAL MECHANICAL REQUIREMENTS

### A. DEFINITIONS

1. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.
2. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.
3. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.
4. Provide: Furnish and install.
5. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.
6. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.
7. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.
8. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling through an access point by maintenance staff safely standing on a ladder no taller than the ceiling.
9. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.
10. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.
11. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.
12. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be

inferred that the Design Professional shall be the instructor or shall be notified, as the case exists.

13. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.
14. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

## **B. OPERATING AND MAINTENANCE MANUALS**

1. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of two months prior to the request for Material Completion.
2. Digital delivery of Operating and Maintenance Manuals:
  - a. Operating and Maintenance Manuals may be delivered digitally.
  - b. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
  - c. Do not scan in color or high resolution unless required for clarity.
  - d. Ensure any reproductions are legible.
  - e. Table of Contents (Index) sheets shall be included in the order listed with identifications typed in capital letters.
  - f. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
3. Each Manual shall contain the following information, data and drawings:
  - a. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.
  - b. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
  - c. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
  - d. Control diagrams, electrical interlock diagrams, and control valve lists.

- e. Copies of as-built shop drawings showing layouts and construction details.
- f. Copies of Test and Balance Reports including list of instruments and description of methods employed.

### **C. PRODUCT DELIVERY, STORAGE, AND PROTECTION**

1. Accept all products on site in factory-fabricated protective containers. Inspect for damage.
2. Store products in a clean dry place and protect from weather and construction traffic.
3. Handle products carefully to avoid damage to components, enclosures, and finish.
4. After placement, protect products from damage during construction, by all trade contractors.
5. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

### **D. WARRANTY**

1. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.
2. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.
3. Correct any defective Work within a one year period after Date of Material Completion. Provide HVAC Installer's warranty letter dated the date of the Material Completion
4. Where warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start on the same date as the Contractor's warranty.

### **E. DESIGN CRITERIA**

1. Redundancy is desired in HVAC equipment:
  - a. Air handling systems (manifold AHU's).
  - b. Air handling unit fans (fan array).
  - c. Secondary chilled and heating water pumps (100% redundancy).
  - d. Chillers (minimum 120% of connected load).
  - e. Boilers (minimum 120% of connected load).
  - f. Computer room air conditioners (100% redundancy).

2. All buildings shall include chilled and heating water stub-outs (U.G.) for future connection to district energy plants. Stub-outs shall extend minimum 5 foot beyond building exterior wall.
3. Use of roof mounted HVAC equipment is strongly discouraged.
4. Where possible, fans should be direct drive type.
5. In general KSU prefers non-condensing firetube boiler hot water plants, optionally a hybrid (high-mass condensing & non-condensing boilers) hot water boiler plant would be acceptable; if either is not feasible, high mass condensing boilers are mandatory versus a low-mass type condensing boiler.
6. Chiller preferences:
  - a. Water-cooled systems (preferred chilled water system type): magnetic bearing centrifugal type chillers with VFD.
  - b. Manufacturers: Daikin, JCI, or Trane.
  - c. All chiller and cooling towers shall include sound attenuation packages. Specify noise criteria for equipment components. Noise criteria shall be provided for the full operating range of the chiller.
7. In general A/V closets shall be ventilated by dedicated air terminal unit or ventilation fan.
8. In general data and A/V rooms shall be conditioned by dedicated ductless split system with cooling capability down to 0F degrees.
9. Design documents shall include projects anticipated energy use intensity (EUI) estimates based on Energy Star median. [www.energystar.gov/](http://www.energystar.gov/)
10. In general the use of grooved hydronic pipe is acceptable where readily accessible.

## **F. MECHANICAL SLEEVE SEALS**

1. Manufacturers: Link-Seal series 300M as manufactured by Thunderline Corporation, Metraseal by Metraflex or Advance Products and Systems Innerlynx.
2. Synthetic rubber elements linked together to form a watertight seal between pipe and opening for penetrations.
3. Openings in new construction shall be provided with schedule 40 pipe sleeves having 10 gauge leak plate, 4-inch larger than sleeve O.D., welded thereto and poured in place.

## **G. MANUFACTURED CURBS, EQUIPMENT RAILS AND OTHER ROOF ASSEMBLIES**

1. Manufactured Curbs:

- a. The Pate CompanyPC-\*: [www.patecurbs.com](http://www.patecurbs.com)
  - b. ThyCurb TC-\*: [www.thybar.com](http://www.thybar.com)
2. Manufactured Equipment Rails:
    - a. The Pate CompanyES-\*: [www.patecurbs.com](http://www.patecurbs.com)
    - b. ThyCurb TEMS-\*: [www.thybar.com](http://www.thybar.com)
  3. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
  4. Equipment Rails: Two-sided curbs in straight lengths, with top of rail horizontal for equipment mounting.
  5. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.

## **H. PREFABRICATED PIPE CURB**

1. Manufacturers: Pate, ThyCurb.

## **I. INSTALLATION**

1. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.
2. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.
3. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.
4. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.
5. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.
6. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
  - a. Provide sleeves in all slabs and walls/partitions unless otherwise noted.

- b. Omit sleeves on cast iron pipe through slabs on grade.
  - c. Provide sleeve seals where pipe passes thru building wall to a below grade location.
  - d. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
  - e. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
  - f. Omit sleeves in openings core drilled in masonry partitions.
  - g. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
  - h. Non-Rated Drywall Partitions: Omit sleeves.
7. Pipe sleeves in footings and foundation walls:
- a. Schedule 40 black steel pipe.
  - b. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
  - c. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.
8. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400
9. Seal sleeves and openings in exterior walls vaportight or watertight as applicable. Refer to Section 07 9000.
10. Install roof equipment support rails spanning roof joists.

## **J. SPACE CONDITIONING DURING CONSTRUCTION**

- 1. Coordinate with the Contractor regarding the limits of space conditions specified or requested by other trade sections.

2. Assist the Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.
3. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.
4. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.
5. Filters during construction:
  - a. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.
  - b. Provide and maintain filters on all return air grilles once ceilings are installed when air handling equipment or terminal units are used for space conditioning during construction.
  - c. Provide filters with a minimum MERV rating of 8.
6. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

#### **K. PIPING PRESSURE TESTS**

1. General:
  - a. Provide 48 hours notification to the Design Professional and commissioning agent in advance of any test.
  - b. Complete tests prior to insulating.
  - c. Leaks shall be repaired, defective materials replaced, and system shall be retested.
  - d. Strike all joints in copper and steel piping under a pressure test.
  - e. Conduct tests prior to connecting to equipment or isolate equipment from system.
  - f. No water pressure test shall be conducted in freezing weather where subject to freezing.
  - g. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.
  - h. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

#### **L. EQUIPMENT BASES AND HOUSEKEEPING PADS**

1. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.
2. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.
3. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

#### **M. EQUIPMENT BACKBOARDS**

1. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.
2. Type: 3/4-inch thick grade 1 fire retardant treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.
3. Finish: Frame and board with two coats light gray enamel paint.

#### **N. STARTING EQUIPMENT AND SYSTEMS**

1. Adjust equipment for proper operation within manufacturers' published tolerances.
2. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

#### **O. DEMONSTRATION, TRAINING AND INSTRUCTIONS**

1. A minimum of 40 total hours of training shall be provided for mechanical, electrical, plumbing, and fire protection systems. Training shall occur in 3 hour sessions in the afternoon.
2. Training shall include a minimum of 24 hours of training dedicated to building controls; of which at least 4 hours shall be field training and at least 20 hours for classroom instruction.
3. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

4. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.
5. An Owner Training Video shall be made by the contractor(s) separate from training sessions and professionally recorded. The video shall cover all equipment and systems addressed in the owner training sessions.
6. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

## **P. CLEANING AND PROTECTION**

1. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.
2. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.
3. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.
4. All air handling equipment shall be cleaned internally prior to Material Completion. Clean unit casing externally and internally. Seal/replace all damaged duct liner.
5. Chipped or scraped paint shall be retouched to match original finish.
6. Clean and polish all equipment nameplates. All nameplate information shall be legible.
7. All dents and sags in ductwork and equipment casings shall be straightened.
8. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.
9. Additional cleaning due to contractor use of building systems during construction:
  - a. Contractor shall have all associated duct work, coils, heat exchangers, and piping professionally cleaned prior to turn over of the building to the owner.

## **Q. FINISHING EQUIPMENT AND MATERIAL**

1. Use paint systems specified in Division 9 for the substrates to be finished.
2. Paint shop-primed equipment.

3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
4. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
5. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
6. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish and exposed to outside conditions or in mechanical rooms shall be painted to prevent rust.
7. Paint all exposed un-insulated ferrous metals, flat black.
8. Paint miscellaneous ferrous metals such as nipples and fittings on chilled water piping at drains, vents and instrument tapings before insulation.
9. Paint all exterior un-insulated ferrous metals at cooling tower and tower piping with aluminum paint.
10. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
11. Concrete Equipment pads: Clean concrete and paint pad safety yellow.

**SECTION 23 0513 – MOTORS FOR HVAC EQUIPMENT****A. MANUFACTURERS**

1. Baldor
2. Century
3. GE
4. Lincoln
5. Marathon
6. Magnetec
7. Toshiba

**B. GENERAL CONSTRUCTION AND REQUIREMENTS**

1. Electrical Service:
  - a. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
  - b. Motors over 1/2 HP: three phase 60 Hz.
    - i. 460 volt motors on 480 volt systems.
  - c. Refer to Electrical drawings for voltage and phase required.
2. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.
3. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code.
4. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.
5. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
6. Motors serviced by Variable Frequency Controllers:
  - a. Motors shall be Definite Purpose Inverter-Fed Motors complying with NEMA MG1-Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise.

- b. Motors shall be equipped with factory installed grounding rings to electrically ground the motor shaft to prevent eddy current damage to bearings, AEGIS-SCR.

7. Wiring Terminations:

- a. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
- b. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

**SECTION 23 0514 – VARIABLE FREQUENCY CONTROLLERS****A. MANUFACTURERS**

1. ABB ACH550
2. Danfoss
3. VLT HVAC
4. Eaton IS-5000+

**B. DESCRIPTION**

1. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
  - a. Employ microprocessor-based inverter logic isolated from power circuits.
  - b. Employ pulse-width-modulated inverter system providing a carrier frequency adjustable from 4,000Hz to 8,000Hz.
  - c. Design for ability to operate controller with motor disconnected from output.
  - d. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

**C. COMPONENTS**

1. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.
2. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.
3. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control. Omit on fans with automatic isolation dampers.
4. Include undervoltage release.
5. Control Power Source: Integral control transformer.
6. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

7. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.
8. Control Interlocks:
  - a. Furnish terminals for remote contact to allow starting in automatic mode.
  - b. Furnish factory installed BACNET communication device(s) to interface VFD with the BAS. Information communicated between the BAS and the unit controller shall allow unit monitoring, control, and alarm notification.
  - c. Provide auxiliary outputs to comply with the sequence of operation specified in Section 23 0994. Furnish programmable analog outputs(two minimum) and programmable digital outputs(three minimum).
9. Manual Bypass: Manual bypass is not required, optional. Bypass shall be integral to the variable speed drive and manufactured by same firm that manufactures drive. Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. By-pass shall be two contactor type (does not allow maintenance on inverter while motor is operating).
10. Emergency Stop: Use dynamic brakes for emergency stop function.
11. Jogging: On drives serving motors of supply, return, or exhaust fans ducted into one single header duct, provide capability to bring motor up to preset, adjustable, low speed, prior to fan isolation damper opening, signal fan isolation damper to open, then continue to ramp motor up to controlled speed.
12. Disconnecting Means: Include integral circuit breaker on the line side of each controller.
13. Wiring Terminations: Match conductor materials and sizes indicated.

**SECTION 23 0515 – ENCLOSED MOTOR CONTROLLERS****A. MANUFACTURERS**

1. Allen Bradley
2. Cutler Hammer
3. Furnas
4. General Electric
5. Square-D

**B. AUTOMATIC CONTROLLERS**

1. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
2. Starters shall be NEMA type starters. IEC type starters are not allowed.
3. Coil Operating Voltage: 120 volts, 60 Hertz.
4. Overload Relays: NEMA ICS 2; bimetal.
5. Enclosures:
  - a. Enclosures: NEMA ICS 6, Type 1 indoors.
  - b. Enclosures: NEMA ICS 6, Type 3R outdoors.

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## SECTION 23 0519 - METERS AND GAGES FOR HVAC PIPING

### A. REFER TO KSU METERING STANDARDS FOR:

1. Electrical Meters/Metering
2. Natural Gas Meters/Metering
3. Domestic Water Meters/Metering
4. Makeup Water Meters/Metering
5. Chilled Water Meters/Metering
6. Heating Water Meters/Metering

### B. LIQUID FLOW METERS

1. Annular element flow stations (FM):
  - a. Manufacturers: Ellison Annubar, Barco, Mid-West, Preso.
  - b. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
  - c. Pressure rating: 275 psi.
  - d. Maximum temperature: 400 degrees F.
  - e. Accuracy: Plus 0.55 percent to minus 2.30 percent.

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**SECTION 23 0548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT****A. PERFORMANCE REQUIREMENTS**

## 1. General:

- a. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
- b. Steel springs to function without undue stress or overloading.

**B. EQUIPMENT SUPPORT BASES**

## 1. Concrete Inertia Bases:

- a. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
- b. Size: 6 inches minimum depth and sized to accommodate elbow supports.
- c. Mass: Minimum of 1.5 times weight of isolated equipment.
- d. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
- e. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.

**C. INSTALLATION - GENERAL**

## 1. Install in accordance with manufacturer's instructions.

## 2. Bases:

- a. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators and restraints.
- b. Isolators shall be installed after all equipment is installed without changing equipment elevations.
- c. Adjust equipment level.
- d. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolators or the isolation system.

## 3. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:

- a. Pipes within ground floor mechanical rooms shall be vibration isolated from the building's floor above. Minimum first three points of support from base mounted pumps.
  - b. Up to 4 Inches Pipe Size: First three points of support.
  - c. 5 to 8 Inches Pipe Size: First four points of support.
  - d. 10 inches Pipe Size and Over: First six points of support.
  - e. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.
4. Vibration isolation hangers shall be positioned as close as possible to the structure without coming in contact with any object (including the structure).
    - a. Hanger rods shall not contact any object which would short circuit the isolator.

#### **D. SCHEDULE**

1. Equipment Isolation Schedule.
  - a. Base Mounted HVAC Pumps on Grade.
    - i. Base: Concrete pad.
    - ii. Base Thickness: 8 inches.
    - iii. Isolator Type: None
  - b. Base Mounted HVAC Pumps above Grade.
    - i. Housekeeping Pad: 4 inches thick.
    - ii. Base: Concrete inertia base.
    - iii. Base Thickness: 6 inches.
    - iv. Isolator Type: Open spring isolators.
    - v. Isolator Deflection: 2.0 inches.
  - c. Base Mounted Fans.
    - i. Housekeeping Pad: 4 inches thick.
    - ii. Base: Structural steel base.
    - iii. Isolator Type: Open Spring Isolators

- iv. Isolator Deflection: 1.5 inches.
- d. Roof Mounted utility and fume Fans.
  - i. Base: Structural steel base.
  - ii. Isolator Type: Restrained Closed Spring Isolators
  - iii. Isolator Deflection: 0.75 inches.
- e. Suspended fans:
  - i. Isolator Type: Spring Isolator.
  - ii. Isolator Deflection: .75 inches.
- f. Air Handling Units mounted on floor slabs on grade: Fan is factory spring isolated.
  - i. Base: Housekeeping pad.
  - ii. Housekeeping Pad Thickness: 6 inches. minimum, unless noted otherwise on Drawings. Increase pad height for unit furnished to provide space for condensate drain trap, refer to trap detail on drawings.
  - iii. Isolator Type: Neoprene Pads.
  - iv. Isolator Deflection: 0.25 inches.
- g. Air Handling Units mounted on floor slabs above grade: Fan is factory spring isolated. Isolate unit casing from housekeeping pad to reduce vibration from casing.
  - i. Base: Housekeeping pad.
  - ii. Housekeeping Pad Thickness: 4 inches. minimum, unless noted otherwise on Drawings. Increase pad height for unit furnished using galvanized steel base rails to provide space for condensate drain trap, refer to trap detail on drawings.
  - iii. Isolator Type: Neoprene Pad.
  - iv. Isolator Deflection: .25 inches.
- h. Air Cooled Condensing Units, 7-1/2 tons capacity and less. Refer to Detail on Drawings.
  - i. Base: Exterior concrete pad.
  - ii. Isolator Type: Rubber Mount.
- i. Air Cooled Water Chiller:

- i. Base: Exterior concrete base.
  - ii. Base Thickness: 6 inches.
  - iii. Isolator Type: Neoprene Pad Isolators
  - iv. Isolator Deflection: 0.10 inches.
- j. Centrifugal Water Chillers.
  - i. Base: Concrete Pad.
  - ii. Base Thickness: 6 inches.
  - iii. Isolator Type: Neoprene pad isolators.
  - iv. Isolator Deflection: 0.10 inches.
- k. Induced Draft Cooling Tower.
  - i. Base: Concrete Sump.

## SECTION 23 0553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### A. IDENTIFICATION APPLICATIONS

1. Air Handling Units: Nameplates.
2. Air Terminal Units: Nameplates.
3. Automatic Controls: Tags. Key to control schematic.
4. Control Panels: Nameplates.
5. Dampers: Ceiling tacks, where located above lay-in ceiling.
6. Heat Transfer Equipment: Nameplates.
7. Instrumentation: Tags.
8. Major Control Components: Nameplates.
9. Piping: Pipe markers.
10. Pumps: Nameplates.
11. Tanks: Nameplates.
12. Valves: Tags and ceiling tacks where located above lay-in ceiling.
13. Water Treatment Devices: Nameplates.

### B. MANUFACTURERS

1. Brimar.
2. Kolbi.
3. Seton.

### C. NAMEPLATES

1. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.
2. Size: 1/2 inch high letters unless otherwise noted.

3. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted. Background color to match ceiling grid.

#### **D. TAGS**

1. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
2. Tag Chart: Typewritten letter size list in anodized aluminum frame.

#### **E. PIPE MARKERS**

1. Manufacturers: Brimar, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services Inc., Seton Identification Products - Setmark.
2. Color: Conform to ASME A13.1.
3. Pipe Markers for Indoor Use: Media indicator with direction-of-flow arrows on calendared vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.
4. Pipe Markers for Outdoor Use: Media indicator and detachable direction-of-flow arrows on weather-resistant pressure-sensitive vinyl sheet; service temperature -40 to 175 degrees F.

#### **F. VALVE TAGS**

1. Brass; Media and identification number imprinted on tag.
2. Securing Devices: Number 6 brass bead chain; provide one securing device for each tag in accepted schedule.
3. Valve Chart Frame: Aluminum frame, plastic window; sized to accommodate included chart, minimum 8-1/2 by 11 inches.

#### **G. INSTALLATION**

1. Install tags with corrosion resistant chain.
2. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

3. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
4. Where equipment is located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.
5. Where manual air vents are located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.
6. Identify control panels and major control components outside panels with plastic nameplates.
7. Identify air terminal units with plastic nameplates.
8. Tag automatic controls, instruments, and relays. Key to control schematic.
9. Install Pipe Markers on all piping systems at the following Locations:
  - a. Mechanical Equipment Rooms:
    - i. Within 18 inches of each valve.
    - ii. Within 36 inches of each 90° elbow, tee, connection to equipment or vessel and point where pipe exits room.
    - iii. At not over 20 feet intervals along all exposed piping.
  - b. Above Suspended Ceilings:
    - i. Within 18 inches of each valve or valve assembly.
    - ii. At tees, identify both main and branch within 36 inches of tee.
    - iii. Within 36 inches of each 90° elbow.
    - iv. At not over 30 feet intervals along all concealed piping.
  - c. Concealed Piping in Chases or Shafts: Identify each pipe visible through access door panel.
  - d. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
    - i. Omit identification on piping, 1 inch exterior diameter or smaller (insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.
    - ii. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

#### 10. Valve Tags:

1. Valve Chart: List all tagged valves indicating system, valve identification number, location and purpose or special information. Mount to wall in mechanical room.

## SECTION 23 0593 – TESTING, ADJUSTING AND BALANCING FOR HVAC

### A. SECTION INCLUDES

1. Duct leakage testing of 4 inch WG pressure class or higher ducts.
2. Leakage testing of building return air chase.
3. Initial testing, adjustment, and balancing of air systems.
4. Winter and Summer Seasonal testing, adjustment, and balancing of air systems.
5. Initial testing, adjustment, and balancing of hydronic systems.
6. Winter and Summer Seasonal Testing, adjustment, and balancing of HVAC systems.
7. Measurement of final operating condition of HVAC systems.
8. Testing of control sensors, controllers and safeties.
9. Commissioning activities.

### B. SUBMITTALS

1. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.
2. Field Logs: Submit at least once a week to the Commissioning Authority.
3. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
4. Initial Review: Submit results of testing and balancing agency's examination of documents and systems within 30 days after Notice to Proceed.
5. Initial Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - a. Submit two weeks prior to Contractor's Request for Material Completion.
  - b. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
  - c. Submit copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
  - d. Submit an electronic copy of typewritten report in searchable format.

- e. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - f. Reports shall include the manufacturer's performance curves, graphs, and tables with the specified design and actual, measured/as-balanced duty points identified on each. The performance data shall show efficiencies, brake horsepower, speeds, etc. for design and actual operating conditions.
  - g. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - h. Units of Measure: Report data in I-P (inch-pound) units only.
  - i. Test Reports: Indicate data on NEBB forms.
  - j. Include the following on the title page of each report:
    - i. Name of Testing, Adjusting, and Balancing Agency.
    - ii. Address of Testing, Adjusting, and Balancing Agency.
    - iii. Telephone number of Testing, Adjusting, and Balancing Agency.
    - iv. Project name.
    - v. Project location.
    - vi. Project Architect.
    - vii. Project Engineer.
    - viii. Project Contractor.
    - ix. Report date.
6. Seasonal Reports: Submit seasonal report within 14 days of completion of seasonal adjustments. Include test reports for any equipment that could not be tested at the initial report due to season, temperature or other conditions.
- a. Submit an electronic copy of typewritten report in searchable format.
  - b. List of deficiencies noted, adjustments made and corrective action taken.
  - c. Temperature of each conditioned space and dry bulb setting of controlling thermostat.
  - d. Temperature at all sensors in equipment, space duct or pipe and settings of controllers.
  - e. Date and outdoor DB and WB range during the time of the seasonal test.

### C. GENERAL REQUIREMENTS

1. Perform total system balance in accordance with one of the following:
  - a. AABC MN-1, AABC National Standards for Total System Balance.
  - b. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
2. TAB work shall not commence until building envelope is completed, doors and windows installed, ceilings installed, and HVAC systems and controls to be tested, adjusted, or balanced are operational.
3. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the State Fire Marshal.
4. TAB Agency Qualifications:
  - a. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - b. Having minimum of five years documented experience.
  - c. Certified by one of the following:
    - i. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - ii. NEBB, National Environmental Balancing Bureau: [www.nebb.org/#sle](http://www.nebb.org/#sle).
  - d. Company shall an independent firm with no relationship with any Contractor on this Project.
5. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
6. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the State in which the Project is located.
7. Reports shall be certified by a AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work.

### D. EXAMINATION

1. Review the contract documents and existing conditions for appurtenances and arrangement for balancing prior to the installation of any equipment or material. the Contractor shall notify Architect of any omissions noted within 30 days of the Contractor's notice to proceed.
2. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - a. Systems are started and operating in a safe and normal condition.
  - b. Temperature control systems are installed complete and operable.
  - c. Proper thermal overload protection is in place for electrical equipment.
  - d. All filters are clean and in place. If required, install temporary media in addition to filters.
  - e. Duct systems are clean of debris.
  - f. Fans are rotating correctly.
  - g. Fire and volume dampers are in place, accessible, operable and open. Report observation on test report.
  - h. Smoke dampers are in place, damper and operator are accessible, damper is operable, and open. Report observation on test report.
  - i. All dampers and operators function smoothly from shut-off to full open.
  - j. Air coil fins are cleaned and combed.
  - k. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.
  - l. Air outlets are installed and connected.
  - m. Duct system leakage is minimized.
  - n. Hydronic systems are flushed, filled, and vented.
  - o. Pumps are rotating correctly.
  - p. Proper strainer baskets are clean and in place.
  - q. Service and balance valves are open.

## **E. ADJUSTMENT TOLERANCES**

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
2. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
3. Laboratory Spaces:
  - a. Air Inlets: Adjust total to within plus 0 percent and minus 5 percent of design to space. Adjust inlets in each space to within plus 5 percent or minus 5 percent of design.
  - b. Fume Hoods: Adjust for 100 FPM average face velocity with the sash at 18 inches above the work surface.
  - c. Air Outlets: Adjust total to within plus 5 percent and minus 0 percent of design to space. Adjust outlets in each space to within plus 5 percent or minus 5 percent of design.
  - d. Ensure tolerances result in airflow from the corridors or adjacent non-laboratory spaces into each laboratory.
4. Building Pressure: Ensure that installation tolerances result in each floor of the building being positively pressurized with respect to outside ambient pressure.
5. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

## **F. RECORDING AND ADJUSTING**

1. Ensure recorded data represents actual measured or observed conditions.
2. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
3. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
4. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
5. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
6. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
7. Duct pressure tests shall be reviewed and accepted prior to installing insulation.

## G. FUME HOOD TESTING (ON SITE)

1. General: Test fume hoods as installed to assess airflow velocity, airflow visualization, and level of containment. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.
2. Testing Requirements:
  - a. Perform the following tests, in order:
    - i. Airflow Velocity Test.
    - ii. Airflow Visualization Test.
    - iii. Tracer Gas Containment Test.
  - b. Airflow Velocity Test: Conform to Section 9 of NEBB (FHT) Fume Hood Testing Standard - current edition.
  - c. Airflow Visualization Test: Conform to Section 10 of NEBB (FHT) Fume Hood Testing Standard - current edition.
  - d. Tracer Gas Containment Test:
    - i. Conduct a static mode test of the hood and laboratory configuration. Conduct testing in accordance with ASHRAE Std 110, except as modified herein:
      1. Test hood with simulated scientific apparatus set-up within the hood. Apparatus to consist of: two (2) each 1 gal. round paint cans, one (1) 1' by 1' by 1' cardboard box, and three (3) each 6" by 6" by 12" high cardboard boxes. Position these items from 6 to 10 inches behind the sash, randomly distributed, and supported off of the work surface by 2 inch by 2 inch by 2 inch block of any material.
      2. 6 liters per minute release rate for tracer gas.
      3. Conduct only at the center position for the manikin.
      4. Each tracer gas test duration to be 5 minutes.
      5. Acceptable test results will be 0.05 PPM or better.
      6. At the conclusion of each 5-minute test there will be three rapid walk-by at 1' behind the manikin. Each walk-by to be spaced 30 seconds apart. If a rise in test gas concentration occurs, it cannot exceed 0.10 ppm and must return to 0.05 ppm within 15 seconds.

7. There must be a minimum of three and a maximum of five people in the space in which the fume hood is located during the test procedure.
8. Representatives of the Architect, Engineer, Owner, and Contractor must witness the tests.
9. Test of Alarm: Shut off the fume hood exhaust and verify that the individual fume hood alarm activates.
10. Test individual controls: Test any controls that are provided at the fume hood such as unoccupied cycle override, alarm override, etc.

## H. AIR SYSTEM PROCEDURE

1. Pressure test ducts and building return air chase in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
  - a. Return Air Chase: Class 12.
  - b. 4 inch WG or higher: Class 6 for rectangular ducts and Class 3 for round and oval ducts.
2. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
3. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Close openings after measurement with permanent manufactured plugs.
4. Measure air quantities at air inlets and outlets.
5. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
6. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
7. Vary total system air quantities by adjustment of fan speeds by drive sheave adjustment. Provide drive changes required to place belt in mid-position at final RPM. Vary branch air quantities by damper regulation.
8. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
9. Measure static air pressure conditions on air supply units, including pressure drops at all components including filters and fans, and total pressure across the fan. Make allowances for 50 percent loading of filters.

10. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust operators on outside air dampers to ensure tight seal when shut.
11. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
12. The differential at the time of balance between the outside and return air streams shall be 15 degrees F, minimum, when the outside air quantities are established by temperature differential.
13. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
14. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain positive building pressure near the building entries under all operational sequences.
15. On fan powered VAV boxes, adjust air flow switches for proper operation.
16. Air Handler Wide Open Airflow Test:
  - a. Test system and limit air flow to a 550 FPM chilled water coil air velocity OR loading of motor to 90% of nameplate, whichever occurs first.
  - b. The test shall be performed with all air terminals open to their 100% design airflow (artificially set thermostat setpoints 5 degrees, minimum, below coldest space temperature) and under control.
  - c. The purpose of this test is to determine fixed sheave size that shall be provided for the air handler. Contractor shall provide a new sheave prior upon completion of air flow test and balance work.
  - d. The VFD may be used to temporarily set maximum speed while balancing. Drive shall not be used to provide permanent adjustment.
  - e. The Wide Open maximum speed on the VFD shall be locked on drive to prevent air flow above maximum.
17. Test the apparatus casing(s) downstream of the cooling coils to measure the tightness of assembly by proving that infiltration into this section(s) is less than 3 1/2% of design maximum system air quantity. This infiltration shall be proved by measuring the following:
  - a. Cooling coil L.A.T. (average)
  - b. Fan EAT.
  - c. Duct supply air temperature at discharge of fan.
  - d. Supply air fan motor amperage draw, all legs.

- e. Air delta temperature across apparatus casing shall not be less than 20 F during test with maximum air flow.

## **I. WATER SYSTEM PROCEDURE**

1. Adjust water systems to provide required or design quantities.
2. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
4. Effect system balance with automatic control valves fully open to heat transfer elements.
5. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
6. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

## **J. COMMISSIONING**

1. Perform prerequisites prior to starting commissioning activities.
2. Fill out Prefunctional Checklists for:
  - a. Air side systems.
  - b. Water side systems.
3. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
4. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 50 percent of the air handlers plus a random sample equivalent to 25 percent of the final TAB report data as directed by Commissioning Authority.
  - a. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
  - b. Use the same test instruments as used in the original TAB work.

- c. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
  - d. For purposes of re-check, failure is defined as follows:
    - i. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    - ii. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    - iii. Temperatures: Deviation of more than one degree F.
    - iv. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    - v. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
  - e. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
5. In the presence of the Commissioning Authority, verify that:
- a. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
  - b. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
  - c. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.
  - d. The building pressure control sequences operate as specified through a range of CFMs and maintain the building positive under all conditions.
  - e. Adjust air system economizer operation for stable damper operation and ensure that operation does not open building doors.

## **K. CONTROL SYSTEM PROCEDURE**

1. Low Limit Thermostats, Fire Thermostats, Smoke Detectors and other Safety devices: Test and verify operation. Record setpoint.
2. Sequence of Operation: Operate systems thru specified Sequence and confirm system function.
3. Thermostats, Input/Output sensors and Controls: Measure temperature or flow at device and record measurement and setting of controller.
4. Flow Rate Transducers: Calibrate flow meters. Confirm accuracy of flow meter by testing thru a four point operating range.
5. Humidistats, Humidity Input/Output sensors and Controls: Measure temperature and relative humidity at device and record measurement and setting of controller.

## **L. SMOKE MANAGEMENT SYSTEM TESTING**

1. Upon completion of the project installation, check-out of equipment and systems under Divisions 15 and 16, and following satisfactory completion of the specified test and balance, smoke removal tests shall be performed to demonstrate system performance.
2. The testing shall be in accordance with the State of Georgia Fire Marshal's criteria.
3. Where said criteria is not available, the following shall be performed as a minimum to demonstrate specified performance to the Authority observing the demonstrator
4. Operate all building systems in their normal sequence.
5. Record exterior temperature, humidity, wind speed and direction. Record any change in conditions during testing period.
6. Demonstrate that correct sequences and outputs are obtained in normal mode, automatic smoke control mode, manual over-ride mode and return to normal mode.
7. Tests shall be repeated until each criteria is successfully proven.
8. Demonstration of system performance shall be in the presence of the Fire Marshal (if desired by Fire Marshal) or the Architect's representative. Schedule to conform to schedule desired by Fire Marshal or the Architect, as applicable.
9. Minimum knowledgeable representatives to be present include General Contractor, Mechanical Sub-contractor, Electrical Sub-contractor and representatives of Fire Alarm System, HVAC Controls, and Test & Balance. Other trades necessary for the Contractor to satisfactorily complete the tests shall be scheduled by the Contractor.

10. Reports: Three copies of a certified report of the Smoke Removal system Performance Tests shall be submitted within ten (10) days of the event. Report shall be entitled "Smoke Management System Performance Test(s)" and shall include certification of compliance to criteria by the Contractor.
11. Large Volume space management systems:
  - a. Measure pressure differentials across door openings with systems operating in normal mode.
  - b. Activate the smoke management system and :
    - i. Confirm equipment operation.
    - ii. Measure the force required to open exit doors.
    - iii. Record the pressure differentials across all doors that separate the smoke management system area from adjacent spaces.

#### **M. BALANCE UNDER SEASONAL OPERATING CONDITIONS**

1. After the initial balance has been completed, reviewed and accepted; the contractor shall balance and adjust the system under seasonal operating conditions by performing operational tests over a minimum period of eight hours under both cooling and heating conditions.
2. These tests shall be performed only after each piece of equipment has been individually tested, and is verified to be in correct operating condition, and shall be made at times when outdoor dry bulb temperatures are above 85 F for cooling, or below 50 F for heating.
3. When test is run during the cooling cycle the building must be occupied, and all lights shall be turned on for a minimum of six (6) hours. Doors to all spaces shall be closed and all space thermostats set at its normal setpoint.
4. Purpose: Prove correctness of installation; prove functioning of capacity and safety controls; prove calibration of operating controls; and prove stability of operation under actual loading conditions.

## SECTION 23 0713 – DUCT INSULATION

### A. REGULATORY REQUIREMENTS

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.
2. All duct work shall be insulated in accordance with ASHRAE 90.1.
3. All duct liner shall be preformed flexible closed-cell elastomeric rubber type insulation.
4. All adhesives, sealants, and coating compounds shall be low VOC type.

### B. INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Install in accordance with NAIMA National Insulation Standards.
3. Provide insulation with vapor barrier jackets.
4. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
5. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, duct lined with duct liner, heating coil return bends at terminal units, and expansion joints.
6. Fiber Glass, Flexible:
  - a. Do not pull insulation tight around ducts.
  - b. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.
  - c. Wrap insulation with Tie Wire 18 inches on center, maximum.
  - d. Install mechanical fasteners not more than 18 inches on center on ducts over 24 inches wide.
  - e. Provide 24 inch length, minimum, of rigid glass fiber insulation on bottom of ducts supported from trapeze hangers.
7. Glass Fiber, Rigid:
  - a. Cut to fit between standing seams and stiffeners to provide 1/2 inch, minimum cover.

- b. Secure insulation to ducts with duct insulation adhesive applied to duct to provide 100% coverage and with mechanical fasteners 12 inch on centers, maximum.
  - c. Butt transverse joints.
  - d. Secure metal corner beads to all exterior edges.
  - e. Tape all joints and fastener penetrations with 4 inches wide, minimum, foil scrim kraft tape after pointing clip penetrations with insulating cement.
8. Weld mechanical fasteners to duct. No glue or stick on allowed.
9. Fire Rated Duct Wrap: Install in accordance with manufacturer's installation guide using qualified applicators.
10. Flexible Elastomeric Cellular Insulation: Secure sheet insulation with adhesive. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.
11. Exterior Applications:
- a. Under no circumstances shall insulation applied to exterior ductwork be allowed to get wet prior to final material covering.
12. Duct Accessories, Duct Mounted Meters and Gages Instruments and Duct Mounted Instrumentation and Other Control Devices:
- a. In conditioned spaces devices shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.
  - b. In non-conditioned spaces devices shall be insulated within the insulation vapor barrier jacket with the insulation and jacket arranged to provide access.
  - c. Accessible devices to include:
    - i. Duct mounted Instrumentation,
    - ii. Airflow Measuring Station pressure ports,
    - iii. Input/Output Sensors,
    - iv. Duct access door handles,
    - v. Volume Control damper handles(MVD),
  - d. Damper operators shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.

## SECTION 23 0719 – HVAC PIPING INSULATION

### A. REGULATORY REQUIREMENTS

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.
2. All hydronic piping shall be insulated in accordance with ASHRAE 90.1.
3. All adhesives, sealants, and coating compounds shall be low VOC type.

### B. INSTALLATION

1. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.
2. Insulation jacket shall fit snug to insulation.
3. Valves and fittings:
  - a. Insulate pipe and all valves and fittings including valve bonnets on A.C. condensate drain, chilled water, refrigerant suction, and steam and steam condensate (in return air plenum) piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
  - b. Insulate pipe and all valves and fittings including valve bonnets on Heating Water piping within five feet of terminal unit heating coils. Leave only valve stems, open ends of wells and gauge cocks exposed.
  - c. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.
4. Insulation at Hangers: Hangers for horizontal, A.C. condensate drain, chilled water, refrigerant suction, and trapeze supports shall be outside of insulation with saddles as specified herein.
5. Saddles:
  - a. Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support.
  - b. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping.
  - c. Center saddle on pipe hanger.
6. Flexible elastomeric cellular rubber insulation: Install without splitting and under compression during pipe fabrication. Seal Joints with adhesive. Paint exposed insulation

with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

7. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 15010.
8. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
9. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### C. SCHEDULES

#### 1. Heating Hot Water Systems:

- a. Shall be insulated with glass fiber type insulation.
- b. Heating Water Runouts to Terminal units coils shall be insulated with preformed flexible elastomeric cellular rubber insulation.

#### 2. Steam Systems:

- a. Steam piping shall be insulated with calcium silicate type insulation.
- b. Steam condensate piping shall be insulated with glass fiber type insulation.

#### 3. DX Cooling Systems:

- a. Refrigerant Suction: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

#### 4. Chilled Water systems:

- a. Chilled water piping shall be insulated with cellular glass or phenolic foam type insulation.
- b. Pipe subject to condensation: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

#### 5. Condensate Drains from Cooling Coils: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

#### 6. Outside insulated piping should have metal, venture clad or PVC jacketing.

**SECTION 23 0913 – INSTRUMENTATION AND CONTROL DEVICES FOR HVAC****A. EQUIPMENT - GENERAL**

1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**B. CONTROL VALVES****2. Globe Pattern:**

- a. Up to 2 inches: Bronze body, bronze trim, stainless steel rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
- b. Over 2 inches: Iron body, bronze trim, stainless steel rising stem, plug-type disc, flanged ends, renewable seat and disc.
- c. Hydronic Systems:
  - i. Rate for service pressure of 125 psig at 250 degrees F.
  - ii. Replaceable plugs and seats of stainless steel.
  - iii. Packing: EDPM O-ring.
  - iv. Refer to Valve Coefficients indicated on drawings for size.
  - v. Two-way valves shall have equal percentage characteristics. Size two-way valve operators to close valves against pump shut off head.

**3. Butterfly Pattern:**

- a. Manufacturers: Bray 31, Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 51, Nibco WD-2000-3, Stockham LG551.
- b. Iron body, aluminum bronze disc, resilient replaceable EDPM seat for service to 180 degrees F wafer or lug ends, stainless steel stem, extended neck.
- c. Hydronic Systems:
  - i. Rate for service pressure of 125 psig at 250 degrees F.
  - ii. Size for 1 psig maximum pressure drop at design flow rate.
- d. Electric operator:
  - i. Manufacturers: Bray 70, Grinnell, Johnson.

- ii. Single phase, permanently split-capacitor, reversible motor with Class F insulation or better with self-locking worm gear drive mechanism in enclosure.
- iii. Enclosure: Water-proof die-cast aluminum cover and base, NEMA-4, 4X, IP 65, polyester powder coated, coupling direct to valve. One power and one control conduit NPT entries.
- iv. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
- v. Valve status display: Color coded visual indicator to display valve position through full range of travel.
- vi. SPDT-DB travel limit switches.
- vii. Manual override with aluminum handwheel.
- viii. Stainless steel mechanical travel stops.
- ix. Provide servo control for modulating control sequences.
- x. Provide heater with thermostat prewired to terminal block for operators located in exterior locations.

#### 4. Electric Operators:

- a. Manufacturers: Belimo NF or AF Series, Neptune.
- b. Valves shall spring return(reversible) to normal position as indicated on freeze, fire, or temperature protection.
- c. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
- d. Select operator for full shut off at maximum pump differential pressure.
- e. 24 VAC reversible motor with Class F insulation or better with drive mechanism in enclosure, 10VA maximum.
- f. Enclosure: Water-proof aluminum cover and base, NEMA-2, IP 54, coupling direct to valve.
- g. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
- h. Unit shall be prewired. Provide a conduit fitting and a three foot long appliance cord.
- i. Valve status display: Color coded visual indicator to display valve position through full range of travel.

- j. External built-in travel limit switch to reverse direction.
  - k. Manual override with hex operator.
5. Terminal Unit Control Valves:
- a. Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
  - b. Rate for service pressure of 125 psig at 250 degrees F.
  - c. Size for 3 psig maximum pressure drop at design flow rate.
  - d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
  - e. Operators (Modulating): Self-contained, linear motorized operator with approximately 3/4 inch stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC, 6 watt maximum input.

### **C. CONTROL DAMPERS**

1. Manufacturers: Arrow 395, Johnson VD-1300, Ruskin CD-60, National Controlled Air SCD-LL-HD-57, TAMCO-1000 Greenheck VCD-33.
2. Dampers must have manual operator for positioning dampers.

### **D. DAMPER OPERATORS**

1. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
  - a. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
  - b. Provide one operator for maximum 36 sq. ft. damper section.
2. Electric Operators:
  - a. Manufacturers: Belimo AF24, TFB24, or NF24, Neptune, Johnson Controls.
  - b. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

## E. TOWER BASIN LEVEL CONTROL

1. Displacement Type:
  - a. Manufacturers: Magnetrol Displacer Type B15, Robertshaw Levelac SL-400 SOR 736.
  - b. Top mounting style with flanged connection; polymer coated aluminum NEMA 4X enclosure; stainless steel cable; porcelain displacers; stainless steel clamps; two SPST or SPDT switches. Upper switch for high alarm, middle switches for control, lower switch for low alarm.
  - c. Upper switch breaks on high level; lower switch breaks on low level. 2 inch fixed differential on upper level.
  - d. Enclose displacers in Schedule 40 PVC pipe column to prevent false reading from water turbulence.
  - e. Provide heat tape to protect the basin level controls.

## F. INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.
3. Install control devices in a readily accessible location.
4. Coordinate with Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.
5. Mount outdoor thermostats and outdoor sensors indoors, with sensing elements outdoors on north side of building or in shaded location. Mount with sun shield.
6. Mount outdoor thermostats and outdoor sensors away from building discharge openings or doors where conditioned air from building will effect signal. Do not mount on positive pressurized HVAC devices where conditioned air can leak thru opening effecting signal.
7. Install control valves in a readily accessible location.
8. Install control valves with stems upright or horizontal, not inverted.
9. Provide mixing dampers of opposed blade construction arranged to mix streams.
10. Provide isolation (two position) dampers of parallel blade construction.

11. Install damper operators in accessible locations.
12. Install damper operators on outside of duct in warm areas. Do not install operators in locations at outdoor temperatures.

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**SECTION 23 0923 – DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC****A. GENERAL**

1. DDC system shall be Open Native BacNET

**B. MANUFACTURERS**

1. Andover Controls: [www.andovercontrols.com](http://www.andovercontrols.com); Model Smart Structure.
2. Automated Logic Corporation .

**C. LOAD CONTROL PROGRAMS**

1. Automatic Time Scheduling:
  - a. Self-contained programs for automatic start/stop/scheduling of building loads.
  - b. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
  - c. Special days schedule shall support up to 30 unique date/duration combinations.
  - d. Any number of loads assigned to any time program; each load can have individual time program.
  - e. Each load assigned at least 16 control actions per day with 1 minute resolution.
  - f. Sequence starting of equipment with motors 3 KW or larger with adjustable time delay.
  - g. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
  - h. Create temporary schedules.
2. Start/Stop Time Optimization:
  - a. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
  - b. Adaptive and self-tuning, adjusting to changing conditions unattended.
  - c. For each point under control, establish occupancy period, desired temperature at beginning and end of occupancy period and modify start/stop times, operation of ventilation dampers & toilet exhaust fans.

3. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.
4. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
5. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
6. Trend logging:
  - a. Automatically initiate upload request and then store data on hard disk.
  - b. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
  - c. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

#### **D. UTILITY METERING**

1. Refer to KSU metering standard.

## SECTION 23 2113 – HYDRONIC PIPING

### A. HYDRONIC SYSTEM REQUIREMENTS

1. Comply with ASME B31.9 and applicable federal, state, and local regulations.
2. Piping: Provide piping, fittings, hangers and supports as required as follows:
  - a. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
  - b. Use non-conducting dielectric connections whenever joining dissimilar metals.
  - c. Grooved mechanical joints may be used in accessible locations only.
    - i. Accessible locations include those exposed on interior of building, in mechanical rooms and aboveground outdoors.
    - ii. Grooved mechanical connections and joints comply with AWWA C606.
      1. Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
    - iii. Use rigid joints unless otherwise indicated.
  - d. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
3. Pipe-to-Equipment Connections: Use unions or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
4. Welding Materials and Procedures: Conform to ASME BPVC-IX.

### B. HEATING WATER PIPING, ABOVE GRADE

1. Floor distribution piping 2 inch and smaller and all Runouts to terminal equipment shall be copper tube.
2. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, using one of the following joint types:
  - a. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
  - b. Threaded Joints: ASTM B 16.3, malleable iron fittings.
  - c. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings. Refer to "UNIONS, FLANGES, AND COUPLINGS" for acceptable manufacturers and housing type.

- d. Joints:
  - i. Pipe sizes 2 inch and smaller: Threaded.
  - ii. Pipe sizes 2-1/2 inch & larger and all concealed above non-accessible ceilings: Welded.
  - iii. Pipe sizes 2-1/2 inch & larger in mechanical rooms and other non-concealed locations may be grooved joints at Contractor's option.
- 3. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using the following joints and fittings:
  - a. Fittings: Solder type ASME B16.18 cast/bronze/brass or ASME B16.22 wrought copper fittings, unless otherwise noted.
  - b. Joints:
    - i. Coil connections, and within equipment cabinets:
      - 1. Soldered ASTM B32 lead and antimony free solder, 96 Sn/4 Ag (tin-silver) alloy with zinc fluoride flux.
      - 2. Typical product is Harris Product Group 'Stay -Brite' with 'Staya-Clean' flux.
    - ii. Couplings, Tees and elbows in piping mains and branches:
      - 1. Brazed. AWS A5.8/A5.8M BuCP copper/silver/phosphorous alloy, minimum 1485 degree F liquidus.
      - 2. Solder shall be rated for recommended joint clearance of 0.002" to 0.006".
      - 3. Silver content shall be 5-15%, except 6% silver alloys are not acceptable.
      - 4. Typical products are Harris Product Group 'Stay-Silv 15', 'Stay Silv 5' and 'Dynaflow'.

### **C. CHILLED WATER PIPING, ABOVE GROUND**

- 1. Floor distribution piping 2 inch and smaller and all Runouts to terminal equipment shall be copper tube.
- 2. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black; using one of the following joint types:
  - a. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

- b. Threaded Joints: ASTM B 16.3, malleable iron fittings.
  - c. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings. Refer to "UNIONS, FLANGES, AND COUPLINGS" for acceptable manufacturers and housing type.
  - d. Joints:
    - i. Pipe sizes 2 inch and smaller: Threaded.
    - ii. Pipe sizes 2-1/2 inch & larger and all concealed above non-accessible ceilings: AWS D1.1, welded.
3. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using the following joints and fittings:
- a. Fittings: Solder type ASME B16.18 cast/bronze/brass or ASME B16.22 wrought copper fittings, unless otherwise noted.
  - b. Joints:
    - i. Coil connections, and within equipment cabinets:
      - 1. Soldered ASTM B32 lead and antimony free solder, 96 Sn/4 Ag (tin-silver) alloy with zinc fluoride flux.
      - 2. Typical product is Harris Product Group 'Stay -Brite' with 'Staya-Clean' flux.
    - ii. Couplings, Tees and elbows in piping mains and branches:
      - 1. Brazed. AWS A5.8/A5.8M BuCP copper/silver/phosphorous alloy, minimum 1485 degree F liquidus.
      - 2. Solder shall be rated for recommended joint clearance of 0.002" to 0.006".
      - 3. Silver content shall be 5-15%, except 6% silver alloys are not acceptable.
      - 4. Typical products are Harris Product Group 'Stay-Silv 15', 'Stay Silv 5' and 'Dynaflow'.

#### **D. CHILLED AND HEATING WATER, BURIED**

- 1. Manufacturers:
  - a. Thermacor FERRO-THERM

- b. Thermal Piping Systems
  - c. Perma-Pipe XTRU-Therm
  - d. Rovanco Insul-8
2. Outer conduit shall be a high density polyethylene (HDPE) jacket conforming to ASTM D-1248, Type 3, Class C specifications. The HDPE jacket shall be seamless throughout, minimum thickness throughout, with minimum thickness of 150 mils.
  3. Factory fittings shall be prefabricated, preinsulated to minimize the number of field welds. Fittings shall be provided with one-piece molded HDPE fitting covers. Factory fittings shall be welded by butt fusion or extrusion welding process. Hot air welding or taping shall not be allowed in the factory or field. The manufacturer shall install end seals that provide a permanent water and vapor seal on the ends of each piping section.
  4. Manufacturer closure kits shall be utilized in the field to secure joints. Straight run joints shall be insulated using polyurethane foam to the thickness specified and jacketed with an electro-fusion welded split sleeve. No heat shrink materials will be accepted as the primary sealing method. Each joint shall be pressure tested at 5 psi for 15 minutes. Upon completing the pressure test, the field joint shall be insulated and patch welded over the sleeve opening. All joint closures and insulation shall occur at straight sections of piping.
  5. All underground hydronic system piping shall be insulated with rigid 2-pound density polyurethane foam conforming to ASTM C 591, and coefficient of thermal conductivity (K-factor) not higher than 0.16 at 75°F per ASTM C 518. Insulation thickness shall be per ASHRAE 90.1, minimum.
  6. Foam insulation shall completely fill space between carrier pipe O.D. and jacket I.D.
  7. Sleeves shall be furnished by the manufacturer with insulation kits and installed watertight by the contractor.
  8. Install a copper wire embedded in the foam insulation of each length of pipe to provide a means for leak detecting the piping system.
  9. Terminate outer jackets 4" beyond the inside face of building walls or floors, and provide mastic sealant to protect the end of the factory installed insulation.
  10. Carrier Pipe (Steel):
    - a. ASTM A 53/A 53M, grade B, ERW Schedule 40, black.
    - b. Fittings: ASTM A 234/A 234M, wrought steel welding type.
    - c. Joints: AWS D1.1, welded.
  11. Carrier Pipe (Polypropylene); for alternate field installation of HDPE jacketing and insulation same as described above:
    - a. Carrier Pipe Manufacturers: Aquatherm Blue Pipe, Pestan Mechanical Pipe, Nupi Americas Niron.

- b. Pipe: shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
  - c. Fittings: shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
  - d. Polypropylene Fittings: Butt fusion or fusion outlet fittings shall be used for fusion weld joints between pipe and fittings.
  - e. Mechanical fittings and transition fittings shall be used where transitions are made to other piping materials or to valves and appurtenances.
  - f. Polypropylene pipe shall not be threaded. Threaded transition fittings per ASTM F 2389 shall be used where a threaded connection is required.
12. Bolster Padding: 1-1/2 inch thick, minimum, flexible expansion pads for external expansion compensation of fittings. Pads shall extend to cover the inside and outside radius of the fittings.

#### **E. PIPE ANCHORS**

- 1. Prefabricated steel pipe anchors shall be provided where shown or required by the piping expansion analysis. Anchor plate shall be 1/2-in. thick minimum, welded to the carrier pipe and insulated. Anchor plate shall extend a minimum of 2-1/2-in. beyond the casing diameter on all sides and provided with a high temperature mastic corrosion coating.
- 2. Each anchor assembly shall be poured within a concrete thrust block for firm anchorage into trench sidewalls and bed. Concrete block shall extend a minimum of 12-in. beyond all sides of the anchor plate, and at least 36-in. length. Refer to detail on Drawings.

#### **F. CONDENSER WATER PIPING, BURIED**

- 1. Ductile Iron Pipe:
  - a. Ductile Iron Mechanical Joint Pipe, Flexible Restrained: AWWA C151/A21.51, with working pressure of 350 psi.

- b. Fittings: AWWA C110, ductile iron, standard thickness.
  - c. Perma-Pipe, direct burial pre insulated piping.
2. Pipe Joints:
- a. Flexible restrained joints and jointing materials shall meet the requirements of ANSI/AWWA C111.
  - b. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi.
  - c. Coating: All wedge assemblies shall be phosphate washed and coated with minimum of two coats of thermoset epoxy coating. All casting bodies shall be phosphate washed and coated with polyester based powder.
  - d. Gaskets for all mechanical joints shall be designed to allow the gasket to deflect approximately 30% during assembly of the joint.
  - e. Mechanical joint restraints shall be MEGALUG with EBBA-Seal mechanical joint gaskets, by EBBA Iron Inc.

#### **G. UNDERGROUND WARNING TAPE**

1. Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in minimum 4-inch width rolls, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.
2. Warning tape shall read "CAUTION - BURIED PIPING BELOW" or similar wording at minimum 18-inch intervals.

#### **H. CONDENSER WATER PIPING, ABOVE GRADE**

1. Steel Pipe: ASTM A53/A53M, Schedule 40, black.

#### **I. EQUIPMENT DRAINS AND OVERFLOWS**

1. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

## J. PIPE HANGERS AND SUPPORTS

1. Provide hangers and supports that comply with MSS SP-58.
  - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Manufacturers: B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.
3. Copper Pipe Support: As Specified above, copper plated where tube is not insulated.
4. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
5. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
6. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

## K. UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

1. Unions for Pipe 2 Inches and Less:
  - a. Ferrous Piping: 150 psig malleable iron, threaded.
  - b. Copper Pipe: 400 psig WOG @ 275 degrees F, Brass O-Ring type with EPDM O-Ring , brass nut and tailpiece. Threaded or soldered with reduced size end connection as required by component connection. Apollo UA, FDI UP
  - c. Test Plug tappings may be included on union tailpieces to provide the test plugs specified at piping components.
2. Flanges for Pipe 2 Inches and Greater:
  - a. Ferrous Piping: 150 psig forged steel, slip-on, unless noted otherwise.
  - b. Gaskets: 1/16 inch thick composition sheet type gasket with aramid fiber and NBR binder. Gasket material shall be asbestos-free conforming to ASTM B16.5-2013, selected for the pressure, temperature, and service of the specific joint. Garlock BLUE-GARD 3000, TEADIT NA1001, or similar.
3. Grooved and Shouldered Pipe End Couplings for pipe over 2 inches: Acceptable for use on chilled and condenser water piping exposed in mechanical rooms:

- a. Housing Clamps: ASTM A-47-77 Malleable or ASTM A-536-77 ductile iron to engage and lock, rigid clamshell, bolt-on clamp. Manufacturers: Gruvlok 7000 (Anvil), Grinnell 772, Victaulic 107/W07.
  - b. Gasket: Synthetic rubber conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.
  - c. Basis of Design for rigid couplings/ joints:
    - i. 2-1/2" through 8": Victaulic Style 107H Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be grade "EHP" EPDM compound designed for operating temperatures from -30 deg F to +250 deg F.
    - ii. 10" through 12": Victaulic Style 07 ZeroFlex. Standard rigid coupling. Gasket shall be grade "E" EPDM compound designed for operating temperatures from -30 deg F to +230 deg F.
    - iii. 14" and larger: Victaulic Style W07 Advance Groove System (AGS) rigid coupling. Coupling housings designed with AGS wedge-shaped profile to engage the mating pipe or component wedge-shaped AGS grooves. Housings include lead-in chamfer to accommodate a wide range of initial pipe positions and provide a rigid joint that corresponds with support spacing as defined by ASME B31.1 and B31.9.
  - d. Basis of Design for flexible couplings/ joints:
    - i. 2-1/2" through 8": Victaulic Style 177 Installation ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound designed for operating temperatures from -30 deg F to +250 deg F.
    - ii. 10" through 12": Victaulic Style 77 standard flexible couplings. Gasket shall be Grade "E" EPDM compound designed for operating temperatures from -30 deg F to +230 deg F.
    - iii. 14" and larger: Victaulic Style W77 Advance Groove System (AGS) flexible coupling. Coupling housings designed with AGS wedge-shaped profile to engage the mating pipe or component wedge-shaped AGS grooves. Housings include lead-in chamfer to accommodate a wide range of initial pipe positions and allow for linear and angular movement, vibration attenuation, and stress relief.
4. Dielectric Connections: Dielectric nipple with galvanized or plated steel threaded ends. FDI-DN, Perfection, Pro Hydronic Specialties.

## L. GLOBE OR ANGLE VALVES

- 1. Up To and Including 2 Inches:

- a. Manufacturers: Crane Model 7, Hammond IB413-T, Kitz 09, Milwaukee 590-S, Nibco T235, Stockham B-22 .
- b. 300 psig WOG, bronze body, bronze trim, union bonnet, rising stem and cast or malleable iron handwheel, inside screw , renewable composition disc and bronze seat, threaded ends.

## **M. BALL VALVES**

### 1. Up To and Including 2 Inches:

- a. Two Piece Manufacturers: Apollo Model 70-100, Crane 9301, Flow Design HB/HC, Hammond 8201, Milwaukee BA200, Nibco T580, Stockham T255, Watts B6000.
- b. 400 psig WOG, Bronze two piece body, full port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip with memory stops on balance valves, threaded ends .

## **N. BUTTERFLY VALVES (OVER 2 INCHES)**

1. Manufacturers: Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 66M, Nibco WD-2000-3, Pratt BF, Stockham LG551.
2. Location: Use where specifically shown on Drawings, Detail or Flow Diagram. Refer to Legend for butterfly valve symbol.
3. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
4. Disc: Aluminum bronze.
5. Operator: Infinite position lever handle with memory stop.

## **O. SPRING LOADED CHECK VALVES (OVER 2 INCH)**

1. Manufacturers: Centerline Model CLC, Duo-Check G12HMP, Hammond IR9253, Marlin HZNSF, Metraflex 700, Milwaukee 1400, Muessco 91AP/92AP, Stockham WG970..
2. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

## **P. FLOW INDICATOR-BALANCERS**

1. Manufacturers: B&G Circuit Setter, AAF #6000, Taco ACUF, Illinois #6000, Flow Set -F,HCi Terminator, Florater, Gerand, Armstrong "CBV", Wheatley "GS", Pro Hydronic Specialties "CBV".

## **Q. PREPARATION**

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
3. Remove scale and dirt on inside and outside before assembly.
4. Prepare piping connections to equipment using jointing system specified.
5. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
6. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.
7. Connections to existing systems: Exact location of piping, direction of flow and fluid being handled shall be confirmed by the Contractor prior to installing new piping to assure compatibility of system, fluid being pumped, and pipe sizes

## **R. INSTALLATION**

1. Install in accordance with manufacturer's instructions.
2. Route piping in orderly manner, parallel to building structure, and maintain plumb and level, unless noted otherwise.
3. Maintain 4 inch clearance between pipe and fittings after insulation.
4. Install piping to conserve building space and to avoid interfere with use of space.
5. Group piping at common elevations.
6. Maintain top of piping level with eccentric reducers. Arrange to drain at low points.
7. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
8. Grooved Joints:

- a. Install in accordance with the manufacturer's latest published installation instructions.
  - b. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
9. Install valves with stems upright or horizontal, not inverted.
10. Unions: Provide unions at locations specified and at all locations to permit removal of equipment and ATC control valves for service. Install in correct direction with brass nut upstream. Do not install unions to expedite pipe assembly. Use flanges or grooved coupling for unions for pipes sizes over 2 inch.
11. Dissimilar Metals (Dielectric): Provide dielectric nipples to provide separation between ferrous and nonferrous piping/fittings. Install on ferrous side of connection. Do not install dielectric unions. Dielectric connection shall be comprised of dielectric nipple or thread-to-sweat brass adapter or brass valve. Install unions specified with dielectric nipple where separation is required at a union.
12. Steel Pipe Nipples: All thread (close) nipples are prohibited. Nipples 1-1/2 inch and smaller and attached to larger pipes shall be schedule 80 and attached by the use of threadolet.

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**SECTION 23 2114 – HYDRONIC SPECIALTIES****A. AIR/DIRT SEPARATOR**

1. Manufacturers:
  - a. Armstrong; Model DAS: [www.armstrongpumps.com](http://www.armstrongpumps.com).
  - b. Spirovent: [www.spirotherm.com](http://www.spirotherm.com).
  - c. Thrush; Model Aar-O-Vent: [www.thrustco.com](http://www.thrustco.com).
  - d. Taco; Model 4900: [www.taco-hvac.com](http://www.taco-hvac.com).
2. Coalescing type air and dirt eliminator, fabricated steel rated for 150 psig working pressure. The unit shall include internal bundle to suppress turbulence and provide high efficiency, venting chamber and vent valve mechanism.
3. Air separator shall be capable of removing 100% of free and entrained air, and up to 99.6% of dissolved air in the system fluid.
4. Provide pipe connections for hydronic system inlet and outlet, venting, and drain/blowdown.

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**SECTION 23 2123 – HYDRONIC PUMPS****A. MANUFACTURERS**

1. Aurora:
2. Bell & Gossett, a Xylem Inc. brand:
3. Peerless:
4. Taco:

**B. HVAC PUMPS - GENERAL**

1. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
2. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

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## SECTION 23 2140 - UNDERGROUND HYDRONIC DISTRIBUTION SYSTEMS-STEEL PIPE

### A. SCOPE OF WORK

1. The Contractor shall provide all labor, equipment, materials and incidentals necessary to install the underground chilled water and heating water distribution systems. These systems include but are not limited to: factory fabricated conduit piping, equipment room entry, utility trench construction, thermal insulation, piping supports, fittings, and accessories. These systems shall be installed and tested as shown on the Contract Drawings and as specified herein.

### B. PERFORMANCE REQUIREMENTS

1. Provide a complete prefabricated conduit system for steel piping including jacket, carrier piping, insulation, fittings and installation accessories.
2. The hydronic water system is designed for not less than 125 psig and an operating temperature between 40 and 250 degrees F. System components shall be suitable for maximum working pressure of ANSI Class 150. (150 psig SWP).
3. The hydronic water system is a fully welded system that expands and contracts within the ground as operating temperatures vary.

### C. QUALITY ASSURANCE

1. Country of Fabrication:
  - a. All piping, fittings, and piping accessories not manufactured, fabricated, and/or assembled in the United States of America or Canada must be manufactured, fabricated, and/or assembled by an ISO 9001 registered corporation.
  - b. Submit ISO 9001 registration certificates for all corporations where the piping, fittings, and piping accessories are not manufactured, fabricated, and/or assembled in the United States or Canada.
  - c. For all piping, fittings, and piping accessories not fabricated in the United States or Canada, submit an independent test report for all materials to be provided.
  - d. No piping, fittings, and piping accessories manufactured, fabricated, and/or assembled in China including Taiwan are permitted to be provided in this project Contract.
2. Manufacturer Certification: The prefabricated pipe manufacturer shall provide a certificate stating that the direct buried piping system was installed in accordance with the manufacturer's recommendations.

#### D. DELIVERY, STORAGE, AND PROTECTION

1. Ship the underground chilled water and hot water premanufactured piping and conduit system with plastic pipe end covers secured with tape on the piping prior to shipment from the factory. Bag type covers are not acceptable.
2. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### E. UNDERGROUND HYDRONIC PIPING

1. Manufacturers:
  - a. Thermacor FERRO-THERM
  - b. Thermal Piping Systems
  - c. Perma-Pipe XTRU-Therm
  - d. Rovanco Insul-8
2. Outer conduit shall be a high density polyethylene (HDPE) jacket conforming to ASTM D-1248, Type 3, Class C specifications. The HDPE jacket shall be seamless throughout, minimum thickness throughout, with minimum thickness of 150 mils.
3. Factory fittings shall be prefabricated, preinsulated to minimize the number of field welds. Fittings shall be provided with one piece molded HDPE fitting covers. Factory fittings shall be welded by butt fusion or extrusion welding process. Hot air welding or taping shall not be allowed in the factory or field. The manufacturer shall install end seals that provide a permanent water and vapor seal on the ends of each piping section.
4. Manufacturer closure kits shall be utilized in the field to secure joints. Straight run joints shall be insulated using polyurethane foam to the thickness specified and jacketed with an electro-fusion welded split sleeve. No heat shrink materials will be accepted as the primary sealing method. Each joint shall be pressure tested at 5 psi for 15 minutes. Upon completing the pressure test, the field joint shall be insulated and patch welded over the sleeve opening. All joint closures and insulation shall occur at straight sections of piping.
5. All underground hydronic system piping shall be insulated with rigid 2-pound density polyurethane foam conforming to ASTM C 591, and coefficient of thermal conductivity (K-factor) not higher than 0.16 at 75°F per ASTM C 518. Insulation thickness shall be as listed below:
  6. 4-inch and under pipe outer diameter - 1-1/2 inch thick insulation, minimum.

7. 6-inch pipe outer diameter - 1-1/2 inch thick insulation, minimum.
8. 8-inch pipe outer diameter - 1-1/2 inch thick insulation, minimum.
9. Foam insulation shall completely fill space between carrier pipe O.D. and jacket I.D.
10. Sleeves shall be furnished by the manufacturer with insulation kits and installed watertight by the contractor.
11. Install a copper wire embedded in the foam insulation of each length of pipe to provide a means for leak detecting the piping system.
12. Terminate outer jackets 4" beyond the inside face of building walls or floors, and provide mastic sealant to protect the end of the factory installed insulation.
13. Carrier Pipe:
  - a. ASTM A 53/A 53M, grade B, ERW Schedule 40, black.
  - b. Fittings: ASTM A 234/A 234M, wrought steel welding type.
  - c. Joints: AWS D1.1, welded.
14. Bolster Padding: 1-1/2 inch thick, minimum, flexible expansion pads for external expansion compensation of fittings. Pads shall extend to cover the inside and outside radius of the fittings.

## **F. PIPE ANCHORS**

1. Prefabricated steel pipe anchors shall be provided where shown or required by the piping expansion analysis. Anchor plate shall be 1/2-in. thick minimum, welded to the carrier pipe and insulated. Anchor plate shall extend a minimum of 2-1/2-in. beyond the casing diameter on all sides and provided with a high temperature mastic corrosion coating.
2. Each anchor assembly shall be poured within a concrete thrust block for firm anchorage into trench sidewalls and bed. Concrete block shall extend a minimum of 12-in. beyond all sides of the anchor plate, and at least 36-in. length. Refer to detail on Drawings.

## **G. UNDERGROUND WARNING TAPE**

1. Manufacturers:
  - a. Brady Identoline
  - b. Seton 210

c. Water Works Ind, Inc.

2. Provide detectable aluminum foil plastic-backed tape or detectable magnetic color-coded polyethylene plastic tape for warning and identification of buried piping.
3. Provide tape in minimum 4-inch width rolls, color coded for the utility involved, with warning and identification imprinted in bold black letters
4. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.
5. Warning tape shall read "CAUTION - BURIED PIPING BELOW" or similar wording at minimum 18-inch intervals over the entire tape length..

## H. PIPE SLEEVES

1. Fit all pipes passing through building walls and floors, with shop fabricated pipe sleeves or core drill with mechanical link seals. Extend each sleeve through its respective wall and cut flush on inside and outside surfaces. Provide sleeve size based on recommended link seal size for pipe or conduit being installed. Pipe sleeve shall be fabricated from Schedule 40, galvanized steel pipe conforming to ASTM A-53, Grade B.
2. Attach leak plate around center of pipe sleeve unit prior to delivery. Install a mechanical type interlock seal, Buna-N links shaped to fill the annular area between the sleeve and pipe or conduit. Link type seal shall be installed on interior end of pipe sleeve.

## I. PREPARATION

1. The Contractor shall survey and lay out the new underground utility distribution route. Advanced trench excavation and physically locate underground utilities is advised to keep within the project schedule. Discovery of any unforeseen site conditions shall be reported to Architect as soon as they are encountered.
2. Exact location of piping, direction of flow and fluid being handled shall be confirmed by Contractor prior to installing new piping to assure compatibility of system, fluid being pumped, and pipe sizes

## J. INSTALLATION

1. Install in accordance with manufacturer's instructions.

2. Provide all work, labor, materials and equipment to construct the underground utility distribution system into a complete, convenient and operating system.
3. Group piping with other site piping work whenever practical.
4. Establish elevations of buried piping to ensure not less than 4.0 ft. of cover.
5. Route pipe in straight line unless noted otherwise.
6. Slope pipe as shown on profiles to match final elevations without dips or crowns in the piping.
7. Maintain 4 inch clearance between pipe conduits, minimum.
8. Install pipe to allow for expansion and contraction without stressing pipe or joints.
9. Provide for pipe movement by installing bolster padding as indicated on the shop drawings.
10. Install piping straight and true to bear evenly on trench floor.
11. Equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ANSI B31.3, except as modified herein.
12. Protection against Hazardous Conditions: The Contractor shall notify Architect if a hazardous condition exists or conditions for a potential hazardous situation arises. If, in the opinion of Architect, a hazardous condition exists, work shall cease until such condition has been corrected.
13. Cleaning of Piping: Keep the interior and ends of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

#### **K. EXCAVATION AND BACKFILL**

1. The Contractor shall excavate a minimum of 200 linear feet of trench prior to welding piping to fully assess field conditions.
2. Trenching:

- a. Notify the Design Professional of unexpected subsurface conditions.
- b. Cut trenches wide enough to allow inspection of installed utilities.
- c. Hand trim excavations. Remove loose matter.
- d. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
- e. Remove excavated material that is unsuitable for re-use from site.
- f. Remove excess excavated material from site.
- g. Do not remove or damage any shrubbery, landscape, or trees except as specifically shown on plans. Notify Design Professional of any and all discrepancies.

3. Dewatering:

- a. Contractor shall furnish all labor, materials, and equipment to keep the work free of water either from surface sources or from underground sources, or from both. The selection of the equipment and method of the removal of the water shall be the sole responsibility of the Contractor. The Contractor shall be responsible for all damage incurred in handling site water conditions.

4. Backfilling:

- a. Backfill to contours and elevations indicated on the site drawings using unfrozen materials.
- b. Employ a placement method that does not disturb or damage other work.
- c. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- d. Place and compact bedding courses on trench bottoms and where indicated. All trenches shall be excavated a minimum of 6-inches below pipe bottoms and refilled with sand, tamped to stabilize base, and then covered with 12-inch minimum cover of clean sand. The sand shall be compacted to 95% standard Proctor dry density prior to installation of piping. Trench bottoms shall form a straight line free of dips or humps with no offsets in any plane other than shown on the drawings. The initial 2-feet of backfill over piping shall be placed in 4-inch layers and hand tamped. The remainder of backfill may be machine tamped.
- e. Compaction density unless otherwise specified or indicated shall be not less than 90% of maximum dry density.

## L. PIPE AND FITTINGS

### 1. General

- a. Inspect, test, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Reducing branch connections in steel piping may be made with forged branch outlet reducing fittings for branches two or more pipe sizes smaller than mains. All changes in direction shall be made with factory-fabricated welded pipe fittings, and all elbows shall be long radius. Tees are used on the outlets, but the use of fittings formed from pipe sections shall not be permitted.
- b. All pipe shall be accurately cut to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation shall not be permitted. Pipe ends shall have burrs removed by reaming and pipe shall be installed to permit free expansion and contraction without damage to joints.
- c. Pipe nipples 6 inches long and shorter shall be Schedule 80 pipe. Make changes in piping sizes through tapered reducing pipe fittings.

2. Fittings and End Connections: Install threaded fittings and end connections for sizes less than one inch; threaded or socket-welding or butt welding fittings and end connections for sizes 1 to 2 inches; threaded connections for threaded valves, traps, strainers, and threaded connections to equipment; butt welded fittings and end connections for sizes 2.5 inches and larger; and flanged connections for flanged valves, and flanged connections to equipment as otherwise specified.

## M. WELDING

### 1. Welding Responsibility

- a. Responsibility of Contractor for Fusion Welding:

- i. The Contractor is entirely responsible for the quality of the welding required for the underground piping distribution system.

### 2. Qualifications of Welders:

- a. Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform to ANSI B31.1 for the qualification of procedures, welders and welding operators. The Contractor shall be required to follow the qualification of procedures by destructive testing as outlined in paragraph QW302 of Section IX of the ASME Boiler and Pressure Vessel Code. The welders shall be certified under rules of the National Certified Pipe Welding Bureau and qualified by either the National Certified Pipe Welding Bureau or an

independent testing laboratory. Copies of the welder's certificates shall be made available to the Owner and Design Professional upon request.

- b. Documentation of the welding procedure and the welder qualification shall be presented in the form of a Welding Procedure Specification (WPS), and Procedure for Qualification. The welder or welding operator must submit a welder certification verifying his qualification to the procedure. The Welding Procedure Specification (WPS) shall meet the requirements of this specification.

3. Beveling:

- a. Field bevels and shop bevels shall be done by mechanical means. All beveling shall conform to the Welding Procedure Specification (WPS).

4. Welding Rings:

- a. Welding rings shall not be used on this project.

5. Erection:

- a. Piping shall not be split, bent, flattened, or otherwise altered either before, during, or after installation.
- b. During erection care shall be taken to remove all dirt, scale, and other foreign matter from inside the piping by use of a pipe swab or pipe "pig" before tying in sections, valves, or fittings.
- c. Where the pipe temperature falls to 32 degrees F or lower, the pipe shall be heated to approximately 100 degrees F for a distance of 1 foot on each side of the weld before welding, and the weld shall be finished before the pipe cools to 32 degrees F.

6. Defective Welds:

- a. Defective welds shall be replaced and re-inspected at no additional cost to the Owner. Repairing defective welds by adding weld material over the defect or by peening will not be permitted.
- b. Welding repairs will be performed in accordance with an approved welding repair procedure. The repair procedure shall be submitted to the Engineer for approval before performing repairs.
- c. When the quality of a welder's work appears to be below the requirements of the acceptance criteria, the inspector shall require the welder to demonstrate his ability to produce sound welds by means of complete requalification.

7. Electrodes:

- a. All low hydrogen electrodes shall be stored in a storage oven that is kept free of moisture and dampness during fabrication operations.
- b. Low hydrogen electrodes shall not remain out of the storage oven for more than four (4) hours at a single time.
- c. If the electrodes are placed back into the storage oven, they shall remain for a minimum of 24 hours before being used.
- d. Electrodes that demonstrate contamination, loss of coating or any other form of damage shall be discarded.

## **N. PROTECTIVE COATING**

### 1. Damaged Materials:

- a. Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations shall be clean, dry, grease free, and primed before application of tape.
- b. Pipe coating and adhesive undercoat surfaces to be wrapped with tape shall be primed with a compatible primer prior to application of tape. Primer shall be as recommended by tape manufacturer and approved by pipe coating manufacturer.
- c. Waterproof shrink sleeves may be provided in lieu of tape and shall overlap the pipe coating not less than 6 inches.

### 2. Pipe Coating:

- a. Residual material from pipe coating shall be pressed into the break or trimmed off.
- b. Apply tape spirally with one-third overlap as tape is applied.
- c. A double wrap of one full width of tape shall be applied at right angles to the axis to seal each end of the spiral wrapping.
- d. All damage to the piping shall be repaired in accordance with the manufacturer's recommendations.

### 3. The Finishing Coating:

- a. Stretch and apply first layer of tape to conform to component's surface.
- b. Apply and press a second layer of tape over first layer of tape.

4. Flange, Valve, and Irregular Surface Coating:
  - a. Apply coal tar base coating to a minimum dry film thickness of 30 mils.

#### **O. FLUSHING STANDARDS AND SPECIFICATIONS FOR WATER DISTRIBUTION SYSTEM CARRIER PIPING**

1. Fill and flush with clean water.
2. Refill with clean water, then add cleaning chemicals as recommended by the chemical water treatment vendor, supplied and supervised by the water treatment vendor. Refer to Section 23 2500.
3. The piping shall be initially cleaned utilizing a high pressure "hydro-jet" process. The equipment shall be capable of providing a minimum of 50 GPM at 2000 PSIG. The piping shall be cleaned in one direction to allow debris and water to exit in one location. This cleaning procedure shall be performed twice until the flush water runs clear.
4. Install chemicals and circulate water, using temporary pumps as required, in each system for 48 hours. Minimum water velocity is 6 feet per second.
5. At the end of each 48 hours, remove and clean strainers. Blow-off low points.
6. Do on-line flushing using a fast "feed and bleed" procedure for 24 hours. Be sure all parts of the system are on-line during the cleaning. Circulate all dead legs of the system. Provide temporary piping crossovers as required.
7. Do final system drain and blow off low points.
8. When cleaning is completed, fill systems with clear and clean water, and notify Owner and Design Professional of completion of these steps.
9. Use and disposal of chemicals shall comply with local, state, and federal regulations.
10. The contractor is responsible for monitoring the draining procedures to prevent flooding on the site.

#### **P. BURIED UTILITY WARNING TAPE**

1. Bury tape with the painted side up at a depth of 6-inches above top of sand backfill. Locate a second tape buried at 6-inches below grade where top of pipes are buried at 6-ft. or greater depth.

**Q. PIPING TESTS - VISUAL EXAMINATION (VT)**

1. General: Visually examine all pipe welds per ASME B31.1. As described below, visual examination of welds may be performed by the Construction Manager or an independent testing agency.
2. Welding Tests: Twenty-five percent (25%) of all field welds shall be inspected using this method.
3. Acceptance Standards:
  - a. The acceptance standards for visual examination shall be as defined in ASME B31.1. The following indications are unacceptable:
    - i. Cracks-external surface.
    - ii. Undercut on surface which is greater than 1/32 inch deep.
    - iii. Weld reinforcement greater than that specified in Table 127.4.2. of ASME B31.1.
    - iv. Lack of fusion on surface.
    - v. Incomplete penetration (applies only when inside surface is readily accessible).
    - vi. Any other linear indications greater than 3/16 inch long.
    - vii. Surface porosity with rounded indications having dimensions greater than 3/16 inch or four or more rounded indications separated by 1/16 inch or less edge to edge in any direction. Rounded indications are indications which are circular or elliptical with their length less than three times their width.
  - b. In addition, acceptance will also be based on the proper lay-out, materials, and methods, as specified.
4. Failed Welds:
  - a. All welds not passing visual examination shall be repaired or replaced at no expense to the Owner.
  - b. Repair shall be performed using the qualified welding procedures applicable to the original weld.
5. Reporting:
  - a. Reports for visual examinations of welds shall be required for all piping larger than 3 inch NPS except for vent and drain services. Reports performed for visual examinations are not required to be submitted, but shall be kept available for review at any time by the Owner or Engineer.
  - b. Each weld report shall include the following:
    - i. Date of weld examination.

- ii. Type of examination.
- iii. Examiner's name.
- iv. Welders' names including all persons who worked on the weld and their work involved.
- v. Piping system.
- vi. Weld location.
- vii. Weld procedure and materials.
- viii. Materials and dimensions of items that were welded.
- ix. Visual examination results.

6. Examiners' Qualifications:

- a. Contractor personnel may perform visual examinations as long as the persons have passed the Contractor's welding quality control program that satisfies the requirements of ASME B31.1.

7. Visual Examination Requirements:

- a. Welds designated for visual examination shall be examined as follows:
  - i. Before welding - for compliance with requirements for joint preparation, alignment and fit-up, cleanliness, condition of welding equipment, quality and condition of base and filler materials to be used, and preheat, when required.
  - ii. During welding - for cracks, conformance to the qualified welding procedure, quality of individual weld passes, interpass temperature, placement and sequencing of individual weld passes, and backgouged surfaces.
  - iii. After welding - for cracks, contour and finish, bead reinforcement, undercutting, overlap, size of fillet welds, finished weld appearance, weld size, weld length, dimensional accuracy of weldment, and monitor post weld heat treatment.
- b. The inspector shall initial and date each field weld using a paint pen for marking on the outer casing.
- c. Records of visual examinations must be kept as described in this Section.

8. Examiner's Scope:

- a. Visual examinations to be performed by the Construction Manager may be performed and interpreted by an employee of the Construction Manager, provided that each individual is certified as specified. As an option, the Construction Manager may obtain the services of an independent testing agency to perform these examinations.
- b. A welder who has performed any work with regard to a specific weld shall not perform the visual examination of the same weld unless approved by the Construction Manager's welding quality control program.

## R. PIPING TESTS - PRESSURE TESTING OF UTILITY PIPING

### 1. General:

- a. Tests shall be conducted before, during, and after the installation of the system.
- b. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the contractor.
- c. Test pressure gages shall have dials indicating not less than 1-1/2 times or more than 2 times the test pressure.
- d. Provide 48 hours notification to the Design Professional and the KSU Facilities Group site representative in advance of each pressure test.
- e. Any deficiencies shall be corrected at Contractor's expense. Failures to correct any deficiencies will be cause for rejection of the system.

### 2. Field Tests: The following field tests shall be conducted on the piping system. If any failure occurs, Contractor shall make such adjustments or replacements as Architect may direct, and the tests shall be repeated until satisfactory installation and operation are achieved.

#### a. Hydrostatic Tests:

- i. Test piping system hydrostatically using water not exceeding 100 degrees F.
- ii. Conduct tests in accordance with the requirements of ANSI B31.1. Test pressure shall be 150 psig.
- iii. Test the piping system after the lines have been cleaned and before any insulation covering has been applied in areas of field welds and the underground conduit system.
- iv. Before making tests, remove or valve off from the system any apparatus that may be damaged by the test pressure.
- v. Install calibrated test pressure gages in the system to observe any loss in pressure.

- vi. Maintain the required test pressure for a minimum of four (4) hours.
  - vii. Inspect all joints and connections for leaks. Perform tests after installation and prior to acceptance.
  - viii. Air testing of carrier piping is not permitted.
- b. Joint Closure Tests:
- i. Test jacket closure at joints with air pressure at 5 psi for a minimum of 15 minutes. Follow installation and testing procedures as recommended by the manufacturer.

## **S. VERIFICATION OF FINAL ELEVATIONS**

1. Prior to covering the top of piping with backfill, but after all temporary supports have been removed, pipe bedding installed and initial backfilling completed, the Construction Manager shall measure and record the elevation of the top of the casing installed at each elbow or change in direction. These measurements shall include each building entrance location. These measurements shall be checked against the contract drawings and recorded by the Construction Manager for documentation to the Owner.
2. The Construction Manager shall measure and record physical dimensions of the piping to a known and durable surface or corner so the piping can be located in the future. These dimensions shall be provided in several locations to adequately identify the pipe routing.
3. The Construction Manager shall measure and record the top elevation of any piping or ductbank that intersects the underground piping route.
4. All elevations shall be recorded using a surveyor's level and survey rod.
5. The Construction Manager shall produce a drawing of the underground utility piping that shows the recorded installation conditions.

## **T. MANUFACTURER'S FIELD SERVICES**

1. A MANUFACTURER'S REPRESENTATIVE of the piping system used shall inspect the installation of the distribution system and shall provide Architect for Owner a certificate on the manufacturer's letterhead stating that the pipe is installed in accordance with the manufacturer's recommendations and provide the manufacturer's warranty.
2. The representative shall be a factory-trained technician with a minimum of two years' experience.
3. The representative shall meet with the installer and confirm that the manufacturer's installation instruction have been read and understood.

4. The technician must observe the following critical periods of construction:
  - a. Unloading of the piping system.
  - b. Welding of at least one hydronic pipe connection and fitting.
  - c. Hydrostatic and air tests of the carrier piping.
  - d. Assembly and testing of one jacket field joint.
  - e. Preparation of pipe bed and the initial backfilling operation.
5. A field report shall be submitted for each site visit documenting the progress of the installation with photographs, and noting any deficiencies. Submit two copies of each report to the Construction Manager, one copy to the Owner, and two copies to the Design Professional.

**SECTION 23 2141 UNDERGROUND HYDRONIC DISTRIBUTION SYSTEMS-POLYPROPYLENE****A. SCOPE OF WORK**

1. Polypropylene piping shall be priced as an Alternate for the underground chilled water distribution system.
2. The Contractor shall provide all labor, equipment, materials and incidentals necessary to install the underground chilled water distribution systems. These systems include but are not limited to factory fabricated piping, equipment room entry, utility trench construction, piping supports, fittings, and accessories. These systems shall be installed and tested as shown on the Contract Drawings and as specified herein.

**B. PERFORMANCE REQUIREMENTS**

1. Provide a complete system for the underground PP piping including carrier piping, fittings and installation accessories.
2. The hydronic water system is designed for not less than 125 psig and an operating temperature between 40 and 250 degrees F.
3. The hydronic water system is a fully heat fusion welded system that expands and contracts within the ground as operating temperatures vary.

**C. QUALITY ASSURANCE**

1. Country of Fabrication:
  - a. All piping, fittings, and piping accessories not manufactured, fabricated, and/or assembled in the United States of America or Canada must be manufactured, fabricated, and/or assembled by an ISO 9001 registered corporation.
  - b. Submit ISO 9001 registration certificates for all corporations where the piping, fittings, and piping accessories are not manufactured, fabricated, and/or assembled in the United States or Canada.
  - c. No piping, fittings, and piping accessories manufactured, fabricated, and/or assembled in China including Taiwan are permitted to be provided in this project Contract.
2. Manufacturer Certification: The pipe manufacturer shall provide a certificate stating that the direct buried piping system was installed in accordance with the manufacturer's recommendations.

**D. DELIVERY, STORAGE, AND PROTECTION**

1. Ship the underground hydronic piping with plastic pipe end covers secured with tape on the piping prior to shipment from the factory. Bag type covers are not acceptable.
2. Accept valves on site in shipping containers with labeling in place. Inspect for damage and store in a protected location.

3. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### **E. EXISTING PROJECT CONDITIONS**

1. Verify the size and flow direction of any connections to existing piping prior to performing any work.
2. Sequence installation to ensure piping connections are achieved in an orderly and expeditious manner.

#### **F. UNDERGROUND HYDRONIC PIPING**

1. Manufacturers:
  - a. Aquatherm Blue Pipe
  - b. Pestan Mechanical Pipe
  - c. Nupi Americas - Niron
2. POLYPROPYLENE (PP-R) PIPE AND FITTINGS
  - a. Pipe shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
  - b. Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
  - c. Polypropylene Fittings: Butt fusion or fusion outlet fittings shall be used for fusion weld joints between pipe and fittings.
  - d. Mechanical fittings and transition fittings shall be used where transitions are made to other piping materials or to valves and appurtenances.
  - e. Polypropylene pipe shall not be threaded. Threaded transition fittings per ASTM F 2389 shall be used where a threaded connection is required.
  - f. Polypropylene pipe shall include a fiberglass-reinforced layer to reduce thermal expansion/contraction.
3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

4. Plastic-to-Metal Transition Fittings
  - a. PP-R one-piece fitting with stainless steel insert and one PP-R fusion weld joint end.
5. Pipe Wall Sizing: SDR-11.

#### **G. UNDERGROUND WARNING TAPE**

1. Manufacturers:
  - a. Brady Identoline
  - b. Seton 210
  - c. Water Works Ind, Inc.
2. Provide detectable aluminum foil plastic-backed tape or detectable magnetic color-coded polyethylene plastic tape for warning and identification of buried piping.
3. Provide tape in minimum 4-inch width rolls, color coded for the utility involved, with warning and identification imprinted in bold black letters.
4. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.
5. Warning tape shall read "CAUTION - BURIED PIPING BELOW" or similar wording at minimum 18-inch intervals over the entire tape length.

#### **H. PIPE SLEEVES**

1. Fit all pipes passing through building walls and floors, with shop fabricated pipe sleeves or core drill with mechanical link seals. Extend each sleeve through its respective wall and cut flush on inside and outside surfaces. Provide sleeve size based on recommended link seal size for pipe or conduit being installed. Pipe sleeve shall be fabricated from Schedule 40, black steel pipe conforming to ASTM A-53, Grade B.
2. Install a mechanical type interlock seal, Buna-N links shaped to fill the annular area between the sleeve and pipe. Link type seal shall be installed on interior end of pipe sleeve.

#### **I. PREPARATION**

1. The Contractor shall survey and lay out the new underground utility distribution route. Advanced trench excavation and physically locate underground utilities is advised to keep within the project schedule. Discovery of any unforeseen site conditions shall be reported to the Design Professional as soon as they are encountered.
2. Exact location of piping, direction of flow and fluid being handled shall be confirmed by Construction Manager prior to installing new piping to assure compatibility of system, fluid being pumped, and pipe sizes

## J. INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines. Contact the manufacturer's representative for training.
3. Provide all work, labor, materials and equipment to construct the underground utility distribution system into a complete, convenient and operating system.
4. Group piping with other site piping work whenever practical.
5. Establish elevations of buried piping to ensure not less than 3.0 ft. of cover.
6. Route pipe in straight line unless noted otherwise.
7. Install fittings for changes in direction and branch connections.
8. Slope pipe as shown on profiles to match final elevations without dips or crowns in the piping.
9. Maintain 4 inch clearance between pipe conduits, minimum.
10. Install pipe to allow for expansion and contraction without stressing pipe or joints.
11. Install piping straight and true to bear evenly on trench floor
12. Protection against Hazardous Conditions: The Contractor shall notify the Design Professional if a hazardous condition exists or conditions for a potential hazardous situation arises. If, in the opinion of the Design Professional, a hazardous condition exists, work shall cease until such condition has been corrected.
13. Cleaning of Piping: Keep the interior and ends of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

## K. EXCAVATION AND BACKFILL

1. The Contractor shall not have more than 200 linear feet of trench open at any given time, except with the Design Professional's approval.
2. Trenching:
  - a. Notify the Owner of unexpected subsurface conditions.
  - b. Cut trenches wide enough to allow inspection of existing installed utilities.
  - c. Hand trim excavations. Remove loose matter.
  - d. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
  - e. Remove excavated material that is unsuitable for re-use from site.

- f. Remove excess excavated material from site.
3. Dewatering:
    - a. Contractor shall furnish all labor, materials, and equipment to keep the work free of water either from surface sources or from underground sources, or from both. The selection of the equipment and method of the removal of the water shall be the sole responsibility of the Contractor. The Contractor shall be responsible for all damage incurred in handling site water conditions.
  4. Backfilling:
    - a. Backfill to contours and elevations indicated on the site drawings using unfrozen materials.
    - b. Employ a placement method that does not disturb or damage other work.
    - c. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
    - d. Place and compact bedding courses on trench bottoms and where indicated. All trenches shall be excavated a minimum of 6-inches below pipe bottoms and refilled with sand, tamped to stabilize base, and then covered with 6-inch minimum cover of clean sand. The sand shall be compacted to 95% standard Proctor dry density prior to installation of piping. Trench bottoms shall form a straight line free of dips or humps with no offsets in any plane other than shown on the drawings. The initial 2-feet of backfill over piping shall be placed in 4-inch layers and hand tamped. The remainder of backfill may be machine tamped.
    - e. Compaction density unless otherwise specified or indicated shall be not less than 95% of maximum dry density.

#### **L. INSTALLER QUALIFICATIONS**

1. Responsibility for Fusion Welding: The Contractor is entirely responsible for the procedures and quality of the fusion welding required for installation of the underground piping distribution system.
2. Heat fusion joints shall be made by trained, experienced operators that can demonstrate the installation of acceptable heat fusion joints using the joining procedures and joining equipment.
3. Documentation of the fusion welding procedure and the operator qualifications shall be written certification that within the last 12 months the operator has received training in the fusion procedures and equipment that is appropriate for the pipe sizes being joined, and that joints made during the training were tested and found to be acceptable.

#### **M. PIPE AND FITTINGS**

1. General
  - a. Inspect, test, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all branch connections. All elbows shall be long radius.

- b. Ream ends of pipes and tubes and remove burrs.
  - c. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - d. Fusion Joints: Fusion join polypropylene pipe in accordance with ASTM D2657, ASTM F 2389, and the manufacturer's instructions.
  - e. The butt fusion equipment used in the joining process shall be capable of meeting all conditions recommended by the pipe manufacturer, including temperature requirements, alignment, and interfacial fusion pressure.
  - f. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
2. Carrier pipe joining shall be accomplished using an authorized butt fusion welding machine preheated to the correct pipe temperature for fusion welding. All heating surfaces shall be clean and free of dirt and residue before applying to ends of pipe to be joined. After heating, the softened ends are pressed together by the machine and held until the joint has hardened. The butt fusion joint shall have a weld strength equal to or greater than the tensile strength of the piping material. Improperly accomplished, uneven, or joints with questionable appearance shall be cut out and re-joined. Transitions to other piping materials shall be accomplished using suitable flanged adapters.
  3. End Connections: Flanged connections of PP piping system shall be provided with a flange adapter where connected above grade to building systems steel piping.

#### **N. UNDERGROUND VALVES**

1. Set valves on solid bearing with concrete base as detailed.
2. Provide valve with square operating nut and provide extension to underneath bottom of C.I. valve box cover.
3. Center and plumb valve box over valve. Set box cover flush with concrete pad on finished grade.
4. Placement of valve stations shall be approved by the Architect Design Professional for final coordination with the site landscape design.

#### **O. FLUSHING STANDARDS AND SPECIFICATIONS FOR WATER DISTRIBUTION SYSTEM CARRIER PIPING**

1. Fill and flush with clean water.
2. Refill with clean water and circulate, using temporary pumps as required, in each system for 48 hours. Minimum chilled water velocity is 6 feet per second.
3. At the end of each 48 hours, remove and clean strainers. Blow-off low points.
4. Do final system drain and blow off low points.

5. When cleaning is completed, fill systems with clear and clean water, and notify CCS of completion of these steps.
6. Use and disposal of chemicals shall comply with local, state, and federal regulations.
7. The contractor is responsible for monitoring the draining procedures to prevent flooding on the site.
8. Introduce closed system treatment from the campus Central Energy Plant chilled water piping loop connection, supplied and supervised by the water treatment vendor. Refer to Section 23 2500.

#### **P. BURIED UTILITY WARNING TAPE**

1. Bury tape with the painted side up at a depth of 6-inches above top of sand backfill. Locate a second tape buried at 6-inches below grade where top of pipes are buried at 6-ft. or greater depth.

#### **Q. PIPING TESTS - VISUAL EXAMINATION (VT)**

1. General: Visually examine all fusion pipe welds. As described below, visual examination of welds may be performed by the Construction Manager or an independent testing agency.
2. Acceptance Standards: The acceptance standards for visual examination of the heat fusion joints shall be in accordance with the ASTM Standard and the pipe manufacturer's fusion procedure guidelines.
3. Failed Heat Fusion Welds:
  - a. All heat fusion welds not passing visual examination shall be repaired or replaced at no expense to the Owner.
4. Reporting:
  - a. Reports for visual examinations of fusion joints shall be required for all piping. Reports performed for visual examinations are not required to be submitted, but shall be kept available for review at any time by the Owner or Design Professional.
  - b. Each fusion joint report shall include the following:
    - i. Date of examination.
    - ii. Examiner's name.
    - iii. Fusion operator's names including all persons who worked on the fusion joint and their work involved.
    - iv. Piping system.
    - v. Fusion joint location.
    - vi. Materials and dimensions of items at each joint.
    - vii. Visual examination results.

5. Visual Examination Requirements:

- a. Joints designated for visual examination shall be examined as follows:
  - i. Before fusion welding - for compliance with requirements for joint preparation, alignment and fit-up, cleanliness, condition of fusion equipment.
  - ii. After fusion welding - for finish and appearance of the melt bead in accordance with industry standard quality requirements for heat fusion joints.
- b. Records of visual examinations must be kept as described in this Section.

6. Examiner's Scope:

- a. Visual examinations to be performed by the Construction Manager may be performed and interpreted by an employee of the Construction Manager, provided that each individual is certified as specified. As an option, the Construction Manager may obtain the services of an independent testing agency to perform these examinations.

**R. PIPING TESTS - PRESSURE TESTING OF UTILITY PIPING**

1. General:

- a. Tests shall be conducted after the installation of the system.
- b. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the contractor.
- c. Test pressure gages shall have dials indicating not less than 1-1/2 times or more than 2 times the test pressure.
- d. Provide 48 hours notification to the Design Professional and Kennesaw State University site representative, and the project CCS in advance of each pressure test.
- e. Any deficiencies shall be corrected at Construction Manager's expense. Failures to correct any deficiencies will be cause for rejection of the system.

2. Field Tests: The following field tests shall be conducted on the piping system. If any failure occurs, Construction Manager shall make such adjustments or replacements as the Design Professional may direct, and the tests shall be repeated until satisfactory installation and operation are achieved.

a. Hydrostatic Tests:

- i. Test piping system hydrostatically using water not exceeding 100 degrees F.
- ii. Conduct tests in accordance with the requirements of ASTM F 2389.

- iii. Before making tests, remove or valve off from the system any apparatus that may be damaged by the test pressure.
- iv. Install calibrated test pressure gages in the system to observe any loss in pressure.
- v. Inspect all joints and connections for leaks. Perform tests after installation and prior to acceptance.
- vi. While still accessible all piping shall be pressure/leak tested to the manufacturer's standards. Tests shall be carried out using water. The test pressure shall be as indicated in the pressure leak testing procedures required by the manufacturer. Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines.
- vii. The piping system shall be restrained from uncontrolled movement in the event of a failure.

#### **S. VERIFICATION OF FINAL ELEVATIONS**

1. Prior to covering the top of piping with backfill, but after all temporary supports have been removed, pipe bedding installed and initial backfilling completed, the Construction Manager shall measure and record the elevation of the top of the piping installed at each elbow or change in direction. These measurements shall include each building entrance location. These measurements shall be checked against the contract drawings and recorded by the Construction Manager for documentation to the Owner.
2. The Construction Manager shall measure and record physical dimensions of the piping to a known and durable surface or corner so the piping can be located in the future. These dimensions shall be provided in several locations to adequately identify the pipe routing.
3. The Construction Manager shall measure and record the top elevation of any piping or ductbank that intersects the underground piping route.
4. All elevations shall be recorded using a surveyor's level and survey rod.
5. The Construction Manager shall produce a drawing of the underground utility piping that shows the recorded installation conditions.

#### **T. MANUFACTURER'S FIELD SERVICES**

1. A MANUFACTURER'S REPRESENTATIVE of the piping system used shall inspect the installation of the distribution system and shall provide the Design Professional for the Owner a certificate on the manufacturer's letterhead stating that the pipe is installed in accordance with the manufacturer's recommendations and provide the manufacturer's warranty.
2. The representative shall be a factory-trained technician with a minimum of two years' experience.

3. The representative shall meet with the installer and confirm that the manufacturer's installation instruction have been read and understood.
4. The technician must observe the following critical periods of construction:
  - a. Unloading of the piping system.
  - b. Fusion Welding of at least one hydronic pipe connection and fitting.
  - c. Hydrostatic tests of the carrier piping.
  - d. Preparation of pipe bed and the initial backfilling operation.
5. A field report shall be submitted for each site visit documenting the progress of the installation with photographs, and noting any deficiencies. Submit two copies of each report to the Construction Manager, one copy to the CCS, and two copies to the Design Professional.

## **SECTION 23 2500 – HVAC WATER TREATMENT**

### **A. QUALITY ASSURANCE**

1. Chemical treatment company shall be subcontracted directly by the general contractor. The chemical treatment company may not be subcontracted by the mechanical contractor.

### **B. GLYCOL**

1. Type: Propylene glycol.

### **C. PREPARATION**

1. Systems shall be operational, filled, started, and vented prior to cleaning. Heating and cooling closed loop systems shall contain 15% propylene glycol by volume.
2. Place terminal control valves in open position during cleaning.

### **D. INSTALLATION**

1. Install in accordance with manufacturer's instructions.
2. Contractor to provide/add propylene glycol during final system filling to achieve 15% propylene glycol mixture in heating and cooling closed loop systems.

### **E. MANUFACTURERS FIELD SERVICES**

1. Provide services of factory trained representative to inspect the piping installation and test the cleanliness of the project's piping systems and make-up water system before chemical treatment, Representative shall drain low points and check system strainers for cleanliness and ensure piping systems are clean and ready for chemical treatment.
2. Factory trained representative shall start-up and calibrate chemical feed controls provided under this Section.
3. Factory trained representative shall test each systems chemical treatment prior to the Observation for Material Completion.
4. Demonstrate system operation to Owner and instruct Owner in required maintenance.
5. Provide start-up certificate certifying that the piping systems have been cleaned and treated as specified in the format prescribed by the General Conditions.
6. Utilize the state contracted vendor for these tasks.

## SECTION 23 3100 – HVAC DUCTS AND CASINGS

### A. MATERIALS

1. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
2. Provide Paint-Grip finish on exposed galvanized ducts for field painting.
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - b. VOC Content: Not more than 250 g/L, excluding water.
  - c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

### B. DUCTWORK FABRICATION

1. General:
  - a. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.
3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Exposed Duct:
  - a. Exposed duct in finished spaces shall be medium pressure Spiral duct and fittings.
  - b. Exposed duct finish shall be mill phosphatized for field painting.
  - c. Provide segmented standing seam elbows on exposed duct in finished spaces.

### **C. LAUNDRY DRYER VENT DUCTWORK**

1. Construct of manufactured spiral duct with fabricated fittings, with the interior free of sheet metal screws and obstructions. Secure with rivets. Seal duct joints with duct sealer.

### **D. FUME HOOD EXHAUST**

1. General: Stainless Steel duct from fume hood to exhaust fan, unless noted otherwise. Round Ductwork shall conform to SMACNA Round Industrial Duct Construction Standards, 2nd Edition. Rectangular duct shall conform to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
2. No screws or rivets shall be used to fasten duct together.
3. Grind welds to be smooth with adjacent material and polish
4. Flanged connections shall have acid resistant gaskets.
5. Round Manual Volume Dampers: Figure No. 2-14.C, type 304 stainless steel with locking quadrant.
6. Duct below ceilings shall be satin brushed finish with longitudinal joint against wall and stainless steel hangers.

## SECTION 23 3600 – AIR TERMINAL UNITS

### A. SINGLE-DUCT, VARIABLE-VOLUME UNITS

#### 1. Manufacturers:

- a. Titus ESV
- b. Other acceptable manufacturers offering equivalent products: Carrier, Envirotec SDRWC, Johnson Controls, Krueger LMHS, Metal-Aire, Tempmaster, Trane VC, Tuttle&Bailey SDV.

#### 2. General:

- a. Factory-assembled, AHRI 880 rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
- b. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

#### 3. Airflow Sensor:

- a. Factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration.
- b. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.

#### 4. Hot Water Heating Coil

- a. Coils shall be two row coils, minimum.

#### 5. Controls:

- a. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.
- b. Control Sequence:
  - i. Refer to See Section 23 0994.

### B. FAN-POWERED SERIES UNITS

#### 1. Manufacturers

- a. Titus TQS. Straight through design.
  - b. Other acceptable manufacturers offering equivalent products: Carrier, Krueger QFC, Metal-Aire Series 400 FCI, Tuttle&Bailey FPC, Nailor 35P, Trane Model VP.
2. General:
- a. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.
3. Series Units:
- a. General:
    - i. Factory assembled and wired, AHRI 880 rated, horizontal fan powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.
4. Airflow Sensor:
- a. Factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration.
  - b. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.
5. Hot Water Heating Coil:
- a. Base performance data on tests run in accordance with AHRI 410.
6. Electrical Requirements:
- a. Single-point power connection.
  - b. Equipment wiring to comply with requirements of NFPA 70.
7. Controls:
- a. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.
  - b. Control Sequence: See Section 23 0994.

**SECTION 23 4000 – HVAC AIR CLEANING DEVICES****A. DISPOSABLE, EXTENDED AREA PANEL FILTERS(EAPF)**

1. Manufacturers: Air Guard, CamFil-Farr 30/30,Purolator.
2. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid .
  - a. Nominal size: 24 x 24 inches.
  - b. Nominal thickness: 2 inches.
3. Minimum Efficiency Reporting Value (MERV): 8 and “A” rating, when tested in accordance with ASHRAE Std 52.2.

**B. EXTENDED SURFACE HIGH EFFICIENCY MINI-PLEAT FILTERS (ESHF)**

1. Manufacturers: Eco-Air EcoCell Minipleat, CamFil-Farr Opti-Pac.
2. Media: Pleated, water-resistant glass fiber or synthetic fiber with fire retardant and moisture resistant bonding agents. Provide separators to maintain the pleat configuration.
  - a. Frame: Moisture resistant Cardboard.
  - b. Nominal size: 24 x 24 inches.
  - c. Nominal thickness: 4 inches.
3. Minimum Efficiency Reporting Value: MERV – 12 and “A” rating when tested in accordance with ASHRAE 52.2.

**C. FILTER GAGES**

1. Manufacturers:
  - a. Dwyer Instruments, Inc.: [www.dwyer-inst.com/#sle](http://www.dwyer-inst.com/#sle)
  - b. H.O. Trerice Co: [www.trerice.com/#sle](http://www.trerice.com/#sle)
  - c. Weiss Instruments: [www.weissinstruments.com/#sle](http://www.weissinstruments.com/#sle)
2. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

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## SECTION 23 5216 – CONDENSING BOILERS

### A. MANUFACTURERS

1. Cleaver Brooks ClearFire.
2. Fulton Model Endura+.
3. Lochinvar Corporation; Model Crest.

### B. MANUFACTURED UNITS

1. The boiler shall be of the packaged, factory fabricated and assembled type complete with burners, fuel train, controls, heat exchanger, insulation, housing, relief valve, and items required for a ready-to-operate installation. The boiler shall be a modulating, high mass, condensing design for firing natural gas and shall be power vented. The boiler shall fit through a standard 3' doorway without disassembly.
2. The boiler shall be a sealed combustion system, taking only outside air for combustion with plastic schedule 80 PVC pipe. The exhaust vent shall be piped with a double-wall flue-gas conduit fabricated from 316L or Duplex stainless steel, suitable for condensing equipment producing flue gas temperatures not exceeding 550 deg. F utilizing 15% glycol solution.

### C. BOILER CONSTRUCTION

1. The pressure vessel and burner components shall be fabricated of carbon steel, type 316L stainless steel, or cast aluminum. The heat exchanger shall be tubular 316L or duplex stainless steel.
2. Jacket: Plastic or galvanized steel with factory applied baked enamel, insulated with foil faced fiberglass insulation.

### D. FACTORY INSTALLED CONTROLS

1. Operating Controls: Pre-wired, factory assembled electric controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to CSA requirements. Electrical power supply shall be 120 volts, 60 cycle, single phase. Option for internal or external (0-10) VDC control.
2. Boiler Management System:
  - a. The boiler manufacturer shall supply as part of the boiler package a completely integrated boiler management system to control all operation and energy input of the multiple boiler heating plant. The system shall be comprised of a

microprocessor based control to communicate with the standalone boiler control panels. The controller shall have the ability to operate all boilers and associated isolation valves installed in the plant, and shall be interfaced with the DDC - Building Automation System (BAS).

## SECTION 23 5239 - FIRE-TUBE BOILERS

### A. MANUFACTURERS

1. Cleaver-Brooks: [www.cleaver-brooks.com/#sle](http://www.cleaver-brooks.com/#sle).
2. Hurst Boiler Manufacturing; Model 400: [www.hurst.com](http://www.hurst.com).
3. Superior Boiler Works, Inc.: [www.superiorboiler.com/#sle](http://www.superiorboiler.com/#sle).

### B. MANUFACTURED UNITS

1. Description: Factory assembled, factory fire tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.
2. Unit: Mount on integral structural steel frame base and include integral forced draft burner, burner controls, boiler trim, refractory, insulation and jacket.
3. Boiler shall be three-pass, wetback design with not less than five square feet of heating capacity per rated boiler horsepower.
4. Boiler shall be equipped with a single point power connection, with all starters and relays mounted in the boiler control panel.

### C. FUEL BURNING SYSTEM

1. General: Forced draft automatic burner integral with front head of boiler designed to burn natural gas and No. 2 oil, shall have modulating firing rate control with low fire ignition position, and maintain fuel-air ratios automatically without the use of VFD for fuel and air.
2. Natural Gas Consumption meter:
  - a. Manufacturers:
    - i. Badger; Model OGT: [www.cleaver-brooks.com](http://www.cleaver-brooks.com).
    - ii. Sponsler, Inc.; Model 5000.
  - b. Precision turbine type meter suitable for natural gas with stainless steel case for flanged mounting and hermetically sealed frequency/pulse transmitter.
  - c. Provide meter with totalizer to record fuel consumption.
  - d. Provide DDC monitoring points.
  - e. Maximum Operating Pressure: 30 psi.

- f. Accuracy: 1-1/2 percent.
- g. Maximum Counter Reading: 10 million standard cubic feet(scf).
- h. Size: 1/2 inch.

## SECTION 23 6416 – CENTRIFUGAL WATER CHILLERS

### A. MANUFACTURERS

1. Daikin McQuay: [www.daikinmcquay.com](http://www.daikinmcquay.com)
2. Trane Inc.: [www.trane.com](http://www.trane.com).
3. York: [www.york.com](http://www.york.com)

### B. CHILLERS

1. Chillers: Factory assembled and tested, packaged, water cooled, chillers consisting of centrifugal compressors, compressor motor, condenser, evaporator, variable frequency drive motor controller, refrigeration accessories, instrument and control panel including gages and indicating lights, auxiliary components and accessories, and motor starters.
2. Rating: Conform to AHRI 550/590 (I-P).
3. Conform to ASME BPVC-VIII-1 for construction and testing of centrifugal chillers.
4. Conform to ASHRAE Std 15 for safe construction and operation of centrifugal chillers.

### C. COMPRESSORS

1. Refrigerant: HFC-134a. Factory pre-charge unit.

### D. EVAPORATOR

1. Provide hinged marine type water boxes, machine welded to heat exchanger with tapped drain and vent connections, and flanged or mechanical joint connections arranged to permit inspection of tubes from either end without disturbing refrigerant and removable without disturbing water piping.
2. Insulate evaporator and cold surfaces with 0.75 inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28.
3. Construction and materials shall conform to ASME BPVC-VIII-1 or ASHRAE Std 15 as applicable to chiller manufacturer and chiller model.

### 4. CONDENSERS

- a. Provide hinged marine type water boxes, machine welded to heat exchanger with tapped drain and vent connections, and flanged or mechanical joint connections

arranged to permit inspection of tubes from either end without disturbing refrigerant and removable without disturbing water piping.

- b. Construction and materials shall conform to ASME BPVC-VIII-1.

#### **E. PURGE SYSTEM (LOW PRESSURE REFRIGERANT)**

1. Provide purge system for machines using low pressure refrigerants incorporating a low temperature refrigeration system to automatically remove non-condensables, water and air.

#### **F. REFRIGERANT RELIEF**

1. Low pressure refrigerants:
  - a. Each refrigeration machine shall be provided with a dual, two-stage relief system which shall protect the machine from refrigerant losses. The relief system shall have two (2) relief devices in series separated by a pressure-rated chamber.
  - b. The primary relief may be rupture-disc type of relief; however, if a rupture-disc is provided for the primary relief, it shall be of the non-fragmenting type.
  - c. The pressure chamber shall be provided with a pressure gage and shall be monitored with an automatic alarm (pressure switch) to indicate loss of seal in the first relief. The secondary relief valve shall be, as a minimum, spring-loaded and of the re-seating type.
2. High pressure refrigerants: Each refrigeration machine shall be provided with a resettable relief system which shall protect the machine from refrigerant losses.
3. The relief system shall be ASME certified and conform to the latest edition of ANSI B9.1 "Safety Code for Mechanical Refrigeration" and shall comply with ASHRAE 15.

#### **G. REFRIGERANT MONITOR**

1. Manufacturer: MSA-Chillguard 5000, Bacharach HGM, Yokogawa.
2. Provide an multizone, multi-gas monitor.
3. Provide concentration sensor and controls to initiate an alarm when ambient refrigerant concentration reaches 50 PPM (R123) or 1000 PPM (R134A).
4. Unit shall have remote sensor and shall be compound specific.
5. Monitor shall be provided by chiller manufacturer to sequence the control functions specified under Section 23 0994. The monitor shall include BACnet interface card for connection into building DDC controls for alarm, operation, and malfunction notifications.

6. Provide multiple remote visual/audible alarm annunciation devices with manual reset. Locate outside each entry door of the Chiller Mechanical Room, and inside the Chiller Mechanical Room.

#### **H. VARIABLE SPEED DRIVE (VSD), UNIT MOUNTED**

1. Furnish chiller with factory-mounted, liquid-cooled variable speed drive (VSD) shipped completely factory-assembled, wired, and tested.
2. Specifically design VSD to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. VSD control logic is to optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If surge is detected, VSD surge avoidance logic is to make adjustments to move away from and avoid surge at similar conditions in the future.

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**SECTION 23 6417 – MAGNETIC BEARING CENTRIFUGAL WATER CHILLERS****A. MANUFACTURERS**

1. Daikin McQuay.
2. York.
3. Trane.
4. Multi-Stack.

**B. CHILLERS**

1. Chillers: Factory assembled and tested, packaged, water cooled, chillers consisting of centrifugal compressors, compressor motor, condenser, evaporator, refrigeration accessories, instrument and control panel including gages and indicating lights, auxiliary components and accessories, and motor starters.
2. Chillers shall have a direct drive, magnetic bearing, completely oil-free, compressor(s).
3. Each compressor shall have a variable frequency drive operating in conjunction with inlet guide vanes for optimized unit part load efficiency.
4. Unit shall be arranged in a stacked shell arrangement to minimize floor space.
5. Provide isolation valves and condenser volume to hold full refrigerant charge in the condenser during servicing or provide a separate pump-out system and storage tank sufficient to hold the charge of the largest unit being furnished.
6. Units shall have Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.
7. Rating: Conform to AHRI 550/590.
8. Conform to ASME (BPV VIII, 1) for construction and testing of centrifugal chillers.
9. Conform to ASHRAE Std 15 for safe construction and operation of centrifugal chillers.
10. Unit shall be manufactured for field disassembly into multiple sub-components of compressor and evaporator/condenser shells for entry into building and re assembly in the mechanical room.

**C. COMPRESSORS**

1. Refrigerant: HFC-134a. Factory pre-charge unit with one of the refrigerants specified.

**D. EVAPORATOR**

1. Provide hinged marine type water boxes, machine welded to heat exchanger with tapped drain and vent connections, and flanged or mechanical joint connections arranged to permit inspection of tubes from either end without disturbing refrigerant and removable without disturbing water piping.
2. Insulate evaporator and cold surfaces with 0.75 inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28.
3. Construction and materials shall conform to ASME (BPV VIII, 1) or ASHRAE Std 15 as applicable to chiller manufacturer and chiller model.

**E. CONDENSERS**

1. Provide hinged marine type water boxes, machine welded to heat exchanger with tapped drain and vent connections, and flanged or mechanical joint connections arranged to permit inspection of tubes from either end without disturbing refrigerant and removable without disturbing water piping.
2. Construction and materials shall conform to ASME (BPV VIII, 1).

**F. REFRIGERANT RELIEF**

1. High pressure refrigerants: Each refrigeration machine shall be provided with a resettable relief system which shall protect the machine from refrigerant losses.
2. The relief system shall be ASME certified and conform to the latest edition of ANSI B9.1 "Safety Code for Mechanical Refrigeration" and shall comply with ASHRAE 15.

**G. REFRIGERANT MONITOR**

1. Monitor shall be provided by chiller manufacturer.
2. Provide an multizone, multi-gas monitor.
3. Provide concentration sensor and controls to initiate an alarm when ambient refrigerant concentration reaches 50 PPM (R123) or 1000 PPM (R134A).
4. Unit shall have remote sensor and shall be compound specific.

5. Monitor shall be provided by chiller manufacturer to sequence the control functions specified under Section 23 0994. The monitor shall BACnet interface card for connection into building DDC controls for alarm, operation, and malfunction notifications.

#### **H. VARIABLE SPEED DRIVES (VSD), UNIT MOUNTED**

1. Furnish chiller with factory-mounted, liquid-cooled variable speed drive (VSD) shipped completely factory-assembled, wired, and tested.
2. Specifically design VSD to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. VSD control logic is to optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If surge is detected, VSD surge avoidance logic is to make adjustments to move away from and avoid surge at similar conditions in the future.

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**SECTION 23 6516 – INDUCED DRAFT COOLING TOWERS****A. STEEL TOWERS**

1. Manufacturers:
  - a. Baltimore Aircoil Company; Model PT-2.
  - b. EVAPCO, Inc.; Model UT.
  - c. SPX; Model MD.
2. The cooling tower shall be designed for quiet operation, and shall produce an overall level of sound not higher than 77 dB(A) measured at 5 ft. from the fan discharge. Sound levels shall be independently verified by a CTI-licensed sound test agency to ensure validity and reliability of the manufacturers published values. Measurement and analysis of the sound levels shall be conducted by a certified Professional Engineer in Acoustical Engineering. Sound pressure levels shall be measured and recorded in the acoustic near-field and far-field locations using ANSI S1.4 Type 1 precision instrumentation and in full conformance with CTI ATC-128 test code published by the Cooling Technology Institute (CTI). All low sound options shall be CTI certified for thermal performance.
3. Construction:
  - a. Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy-gauge 301L or 304 stainless steel. All cut edges shall be cleaned prior to assembly. All fasteners shall be stainless steel.
4. Framework and Casing: Heavy gauge steel with sheets installed vertically with waterproof flanges.
5. Louvers: Corrugated fiberglass reinforced plastic or poly-vinyl chloride.
6. Fan: Propeller-type, incorporating wide-chord acoustic geometry, corrosion resistant marine grade aluminum or FRP blades. Blades shall be resiliently mounted to fan hub and individually adjustable. Fan blades shall be open cavity with suitable drainage to avoid accumulation of moisture. Foam filled blades are not allowed due. Maximum fan tip speed shall be 10,000 ft./min.
  - a. Motor: Single speed totally enclosed air over (TEAO) type with special moisture protection, mounted on welded steel frame in fan deck. Motor shall be suitable for use with a variable frequency inverter duty drive controller.
7. Fan discharge sound attenuation package.
8. Access: Large access doors at both ends of tower to eliminators and air plenum.
9. External Service Platform with Ladder. OSHA compliant platform consisting of handrail, galvanized steel grating, and framework attached to tower assembly. Mounting channels shall be stainless steel. Provide lockable ladder security cover, stainless steel or aluminum construction.

10. Internal Working Platform.

11. Safety: Safety railings, and ladder with safety cage from grade to fan deck.

12. Distribution Basin:

- a. The hot distribution basin shall be of stainless steel, Type 301L or 304 construction, gravity type basin utilizing weirs and plastic metering orifices, with flow control valves and covered with removable or sliding basin covers.

13. Collection Basin (Concrete sump; preferred):

- a. Stainless steel with depressed center section, designed to support tower for mounting over concrete sump.
- b. 18 gauge, 301L or 304 stainless steel, air stops shall be provided to prevent bypass of air below fill material. Baffle shall be provided at bottom of fill unless upper cold basin floor fill support will prevent air bypass under fill during full flow conditions
- c. Tower shall fit on concrete basin as shown on Drawings. Provide shop drawing of exact dimensions for basin fabrication.

14. Fill Device:

- a. Fill device shall be mounted in concrete sump and is specified in another section.
- b. Attempt to re-direct condensate water back to tower sump.

15. Hardware, nuts, bolts, and washers: Stainless steel.

16. Accessories

- a. Removable davit crane and base.
- b. Vibration Limit Switches.

**SECTION 23 7313 – CENTRAL STATION AIR-HANDLING UNITS - FAN ARRAY****A. MANUFACTURERS**

1. Dimensions of units shown on drawings are based upon the composite dimensions of the following manufacturers.
2. Pre-approved Manufacturers:
  - a. Aeon
  - b. Carrier
  - c. Climatecraft
  - d. Daikin
  - e. JCI Inc.
  - f. Seasons-4
  - g. Trane Company
  - h. TMI-Climate Solutions
  - i. Xetex

**B. GENERAL DESCRIPTION**

1. Factory fabricated, applied air handling units with components scheduled housed within modules for field assembly into an complete air handling system.
2. Fabrication: Conform to AMCA 99 and ARI 430.
3. Units shall be fabricated using frame and panel construction with removable casing panels. Each section shall be capable of complete dis-assembly, including frame.

**C. CASING**

1. Construction: Fabricate each section of frame and panel construction capable of disassembly with removable panels, double wall construction with connection pieces for field assembly with gasketing between assembled sections.
2. Insulation: Closed cell foam.
  - a. Minimum 2-inch thick panels.

- b. Minimum R-13 insulation.
    - c. Unit casing shall be designed so that casing and doors will not condense moisture when the air temperature leaving cooling coil is 54 DB and the mechanical room condition on the unit exterior is 85DB/72WB.
  3. Walk-in Access Doors: 30 inch wide and 60 inch height, minimum, of galvanized steel insulated sandwich construction, for flush mounting, with hinges, gasket, latch, and handle assemblies. Provide door handles operable from interior and exterior of the unit. Provide on service side of each section of each air handling unit and on both sides of filter sections and coil sections of units more than 4-feet in width. The door frame shall be foam filled, with a built in thermal break barrier and dual full perimeter gasket. The door hinge assembly shall be completely adjustable. There shall be a minimum of two handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors. Access doors in the all sections shall be provided with a 10 x 10 dual thermal pane safety glass window, UV rated.
  4. Lights: Provide in all accessible sections suitable for damp locations with wire guards, factory wired to switch with pilot light mounted on casing exterior.
  5. Finish:
    - a. Outdoor Units:
      - i. Coat external surface of unit casing with primer and minimum 1.5 mil, enamel paint finish.
    - b. Indoor Units:
      - i. Provide exterior, galvanized steel panels without paint.
  6. Factory Base Rail: Provide factory base rail, minimum 6-in. height, or additional sufficient height to raise the unit condensate connections to provide height for trap as detailed on Drawings and routing of pipe to the floor drains indicated.

#### **D. FANS**

1. General: All fans shall meet the airflow performance specified and shall not exceed the motor horsepower specified in the schedule. Fan framing assemblies shall be fabricated from structural steel. Fan assemblies shall be independently isolated with factory rubber-in-shear or spring vibration isolators. Vibration isolators shall be mounted to a structural angle on the fan base assembly. Fans shall be selected for the altitude at which the fan will be located.
2. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
3. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

4. All motors shall be standard pedestal mounted type, ODP or TEAO, T-frame motors.

#### **E. FAN ARRAY ASSEMBLY**

1. The fan arrays shall consist of multiple, direct driven, arrangement of 4 plenum fans constructed, at a minimum, per AMCA requirements for the duty specified. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. Number of fans in array shall be greater or equal to the number scheduled. The array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan peak static pressure producing capability at the specified fan/motor speed. Each fan/motor cartridge shall be dynamically balanced to meet AMCA Standard 204-05, category BV-3, to meet or exceed Grade G6.3 residual unbalance. Manufacturer shall provide sound data for the entire fan array system. Fan data for individual fans is not acceptable
2. The fan array shall consist of multiple fan and motor "cubes" or steel frame with isolated fan assembly, spaced in the air way plenum cross section to provide a uniform air flow and velocity profile across the entire air way plenum cross section and components contained therein. Each fan cube shall be individually wired to a factory installed MCP (motor circuit protector) panel. The control panel will contain individual motor circuit protectors with auxiliary contacts (BAS contacts), pilot light per fan to indicate fan on-off operation. Variable frequency drives shall be furnished by the manufacturer and field installed and wired by the contractor.
3. Provide a complete spare fan/motor assembly for emergency replacement, one for each type of assembly provided on the unit. Provide two blank-off maintenance plates sized to cover and isolate a fan/motor cube if a fan is down.

#### **F. MOTORS**

1. Motors shall be premium efficiency, IEEE inverter duty rated with appropriate winding insulation to meet NEMA MG 31, part 1 requirements. All motors shall be furnished with integral shaft grounding rings.
2. Maximum fan motor size shall be as scheduled for unit.

#### **G. COILS**

1. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations. Provide casing seals where pipe connections extend through casing.
2. Drain Pans:

- a. Drain pan on unit floor shall be insulated double wall welded 16 gauge 304 stainless steel, pitched for flow to drain connection, sloped in two planes.
  - b. Pan design shall pass the requirements of ASHRAE Std. 62R.
  - c. Provide a minimum of 1-inch from the bottom of the coil casing to the drain pan so the drain pan can be visually inspected and physically cleaned without bypassing airflow, including underneath the coil, without removal of the coil.
  - d. All drain pan connections shall be to the same side of the unit as the coil connections.
3. Coil Capacity: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
4. Water Cooling Coils:
- a. Casing: Die formed channel frame of 304 stainless steel.
  - b. Configuration: Row depth shall be a minimum of 6 rows. Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.
  - c. Face Velocity: Cooling coil face velocity shall not exceed 500 feet per minute.
  - d. Re-direct condensate water to tower if feasible.

## H. FILTER AND AIR CLEANER SECTION

1. Filter Section: Section with filter guides, access doors from both sides with latching handles, for side loading with gaskets, blank-off plates and casing access door(s).
2. Prefilters (EAPF): 2-inch deep disposable, extended area panel filters.
3. Filter (ESHF): 4 inches deep disposable, extended surface high efficiency panel filters.
4. Filter Gauges: Provide for each filter module.
  - a. Manufacturers:
    - i. Dwyer Instruments Inc.
    - ii. H.O. Trerice Co..
    - iii. Weiss Instruments.
  - b. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

- c. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.
- d. Filter Sizes: Minimize filter sizes required per unit (single filter size preferred), maximum two filter sizes per unit.

#### **I. AIRFLOW MEASUREMENT**

1. Flow Meter:
2. Each fan shall include a piezometer type flow meter.

#### **J. TURNING AND DISCHARGE PLENUM SECTION**

1. Provide plenum to efficiently turn and discharge air.

#### **K. CONTROLS**

1. VFD's, starters, disconnects, and control panels are not to be unit mounted.

#### **L. ROOF MOUNTING CURB**

1. Include roof curb and required accessories for each roof mounted unit.

#### **M. ACCESSORY SECTIONS**

1. Access Service Section: Provide a full size, 24-inch long, insulated access sections with walk-in style access doors on service side of unit to provide service access to/ inspection of internal components.

#### **N. DAMPERS**

1. Leakage: Class 1; [8.0] CFM/Sq.FT.inch maximum at 4-inch W.G. pressure difference.
2. Performance: Test in accordance with AMCA 500-D.

#### **O. LIGHTS AND RECEPTACLES**

1. Each compartment shall be provided with lighting arranged for safety and servicing of unit.

2. Lighting fixtures shall be an enclosed and gasketed, vapor-tight, surface mounted fluorescent fixture with glass or acrylic lens and lens guards.
3. Surface mount light switches in type FS box with weather-proof cover.
4. Receptacles: Provide two prewired GFI protected 120v power receptacles. Locate on each side of air unit, below light switches.

## **P. ELECTRICAL CONTROL CABINET**

1. General:
  - a. All equipment provided with unit shall be electrically-self-contained. All electrical and controls components necessary for proper operation shall be furnished, installed, wired and ready for operation.
2. Electrical Raceways and Wiring:
  - a. All wiring shall be routed in conduit raceway. Exposed wiring is not allowed.
  - b. All wiring shall terminate at a wiring terminal.
3. Variable Frequency Controllers:
  - a. Provide multiple Variable Frequency Drive Controllers to start and run all motors in the fan array unit. Each drive shall be capable of operating maximum 50% of the fans in the total fan array.
  - b. Drives shall be field installed and wired.
  - c. Drives shall meet the equipment and installation requirements of Section 23 0514 - Variable Frequency Controllers.

**SECTION 23 8130 – DUCTLESS SPLIT SYSTEM AIR CONDITIONERS (DAC-\* & DCU-\*)****A. MANUFACTURERS**

1. Mitsubishi .
2. LG.
3. Daikin.
4. Trane.
5. Hitachi.
6. JCI.

**B. AIR CONDITIONING UNITS**

1. Description: Packaged, ductless split air conditioning or heat pump system consisting of interior and exterior units and controls .

**C. ACCESSORIES**

1. Factory condensate pump.

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## DIVISION 26 – ELECTRICAL

### A. OWNER'S DESIGN CRITERIA:

1. General: Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.
2. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.
3. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.
4. Energy: Conform to the International Energy Conservation Code, 2015 Edition, with all Georgia State Amendments.
5. Fire Prevention: Conform to Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments.
6. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition with all Georgia State Amendments.
7. Electrical: Conform to the 2017 National Electrical Code (NEC).
8. Life Safety: NFPA 101 - Life Safety Code 2018.
9. Fire Alarm: Conform to the 2013 Edition of NFPA 72 - National Fire Alarm and Signaling Code.

## SECTION 26 0500 – GENERAL ELECTRICAL REQUIREMENTS

### A. GENERAL

1. This document contains design and construction requirements for electrical aspects of construction and renovation projects for Kennesaw State University and is intended for use by engineers involved in such projects. The engineer is expected to use his own specifications and to provide design work in accordance with his standard practice subject to the requirements stated in this guide. This document does not address all aspects of electrical construction. It addresses only those items for which Kennesaw State University Facilities has a specific standard, preference, or methodology.
2. Electrical systems must be designed with flexibility in mind so that the systems will accommodate changes in the electrical requirements of the occupants over the life of the building. Consider potential future alterations and additions and design the electrical system to minimize the need for future equipment upgrades and to facilitate future work with minimal outages.
3. Where budgets are inadequate for the scope of electrical work as required by the project program and as outlined herein, notify Facilities Design and Construction of the condition and provide recommendations for reconciling the scope and budget

### B. DOCUMENTATION AND TRAINING

1. Complete documentation consisting of all operating and maintenance manuals for equipment installed as well as as-built prints, short-circuit and coordination study reports and arc-flash hazard study reports shall be delivered to the Owner.
2. Provide a report of protective device settings and copies of all test reports.
3. Provide training by a manufacturer's authorized service technician for switchgear, switchboards, fire alarm systems, variable frequency drives, lighting control and programmable dimming systems, engine-generator sets, and transfer switches. The contractor shall provide an orientation session for the Owner's personnel in which all aspects of the electrical system are addressed, and video recorded for future reference.

**SECTION 26 0505 – SELECTIVE DEMOLITION FOR ELECTRICAL****A. GENERAL**

1. Coordinate all outages with the owner prior to disabling the system.
2. Remove, relocate, and extend existing installations to accommodate new construction.
3. Remove abandoned wiring to source of supply.
4. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
5. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
6. Disconnect and remove abandoned panelboards and distribution equipment.
7. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
8. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
9. Repair adjacent construction and finishes damaged during demolition and extension work.
10. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
11. Remove all low voltage cabling. No unterminated low voltage cabling may remain above the ceiling.
12. Where breakers become open from demolition, turn to the OFF position and label as spare (in pencil) in the panel schedule.

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**SECTION 26 0513 – MEDIUM-VOLTAGE CABLES****A. MANUFACTURERS**

1. Southwire
2. The Okonite Company: [www.okonite.com](http://www.okonite.com)
3. Prysmian: [www.prysmianusa.com](http://www.prysmianusa.com)
4. Okonite Okoguard URO-J #162-23-3093 is the preferred basis of design.

**B. CABLE**

1. All conductors to be installed in the primary system shall be #500 kcmil copper.
2. Medium Voltage Cable: UL 1072, ICEA S-97-682 and ICEA S-93-639 cross-linked polyethylene insulated cable.
  - a. Cross -linked polyethylene insulation shall be minimum 220 mil. thick, 133% level, tree retardant.
  - b. Voltage: 15 kV, grounded, for operation on 12,470Y/7200 volt, 3 phase, 4-wire, 60 cycle, grounded neutral system.
  - c. Conductor: Copper, concentric, stranded, with foil conductor shield.
  - d. Construction: Single conductor with copper tape shield.
  - e. Thermal Rating: 105C normal service and 140C emergency service
  - f. Insulation Jacket: Each cable shall have a PVC jacket overall.

**C. ACCESSORIES**

1. Connections and Terminations: Terminate primary cables with preformed, self-potting, waterproof, track resistant, shielded connectors and terminators designed for use on single conductor, 15 KV, polyethylene insulated, URD type cable having an extruded semi-conducting jacket and concentric grounded neutral wires as specified herein. When assembled and ready for operation, all cable connectors and terminations shall be submersible. Each terminator and connector shall have a test point.
  - a. 600 Amp Devices: Style/model numbers shown are for ESNA devices. Equal devices by RTE or GE are acceptable.
    - i. 600 Amp permanent straight splice: Style 650S
    - ii. 600 Amp splice system: Style 650LR with tee bodies, dead-end plugs, end caps, connecting plugs, spanner wrench, 600A/200A reducing plug, and other parts as required. Elastimold vault saver splices may be used with prior approval from the Architect.

- iii. 600 Amp permanent wye splice: Style 650Y.
  - iv. 600 Amp straight splice assembly tool: Style 650ATY.
  - v. 600 Amp deadbreak elbow connectors: Style 650LR elbow connector, complete with K650 RTW reducing tap well, #1601A41B6 loadbreak bushing insert, and #160DRGABG insulated cap with ground lead. Each elbow connector shall have a voltage test point.
  - vi. 600 Amp in-oil apparatus bushing: Style 600S1 or 600T1.
  - vii. Drain Shield Connecting Device: Style 21MA or 31 MA.
  - viii. Deadfront Elbow Arrester: RTE 3237015C MOV type; 9kV on 15kV grounded wye system, type 12kV on 15kV delta system.
2. Fireproofing Tape: Provide for all cables exposed in manholes and switching cubicles.

#### **D. FIELD QUALITY CONTROL**

1. After the cables have been installed, terminated, and plugged and before they are spliced into campus system and are energized, the following preparations and tests shall be made.
  - a. Disconnect all equipment before performing tests.
  - b. Clean all manholes and equipment of mud, dirt and debris before testing.
  - c. Terminations shall be cleaned and plugged to prevent erroneous readings. Corona-proof conductor ends of cables by taping to sufficient level to prevent corona. Where cables terminated in 600 amp Elastimold terminators or connectors, install end caps in the Elastimold fittings before testing.
  - d. Ground all conductors except the one to be tested (hereinafter referred to as "the cable").
  - e. Megger (megohm test) all cable to be tested. Three consecutive, identical readings, 10 seconds apart, shall be taken before, and three after a hi pot test.
  - f. Hi-pot test shall consist of applying 80% of the factory DC test voltage to each cable before energizing. Test voltage shall be applied between phase conductor and grounded concentric neutral. Negative side shall be applied to the cable.
  - g. Bring D.C. voltage up to test level in five or more steps, reading the stabilized leakage in microamps at each level.
  - h. Hold voltage at test level for 15 minutes and read leakage in microamps at 30 second intervals for first 2 minutes, then at one minute intervals to the end of the 15 minute period.
  - i. Bring the test set voltage quickly to zero and record the decay voltage at 30 seconds and at one minute.

- j. Disconnect test set from cable and megger. CAUTION: Make certain cable is fully discharged by grounding and use rubber gloves in handling tested cables. Following these tests, a hazardous voltage may be present on the cable.
- k. Test each remaining cable in the conduit in the same manner.
- l. Record all data pertaining to the circuit and plot leakage against applied voltage; and leakage against time at the test voltage (dielectric absorption).
- m. Cables shall be checked for continuity and cable identification tag installed prior to energizing or splicing into the existing underground primary system in order to prevent

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**SECTION 26 0519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****A. CONDUCTOR AND CABLE APPLICATIONS**

1. General:
  - a. All conductors shall be copper and made in the USA.
2. Metal-clad cable is permitted only as follows:
  - a. Concealed in walls - transition to EMT homeruns out of the wall. For lighting circuits concealed above ceilings, EMT to the first light, then MC between fixtures on that circuit.

**B. ALL CONDUCTORS AND CABLES**

1. Conductor Color Coding:
  - a. Color code conductors as indicated. Maintain consistent color coding throughout project.
  - b. Color Coding Method: Integrally colored insulation.
  - c. Color Code:
    - i. 480Y/277 V, 3 Phase, 4 Wire System:
      1. Phase A: Brown.
      2. Phase B: Orange.
      3. Phase C: Yellow.
      4. Neutral/Grounded: Gray.
    - ii. 208Y/120 V, 3 Phase, 4 Wire System:
      1. Phase A: Black.
      2. Phase B: Red.
      3. Phase C: Blue.
      4. Neutral/Grounded: White.
    - iii. Equipment Ground, All Systems: Green.
    - iv. Isolated Ground, All Systems: Green with yellow stripe.

**C. INSTALLATION**

1. Circuiting Requirements:

- a. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted

**SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****A. GENERAL**

1. Grounding and bonding is important, especially in the data closets.
2. Provide ground bars adjacent to any new switchboard (service entrance) and in all data rooms. Each ground bar in the data room shall be bonded together and tied into the ground bar adjacent to the switchboard with nothing less than #1 AWG copper wire.
3. Clearly mark any grounding triads on the as built drawings.

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**SECTION 26 0534 – CONDUIT****A. GENERAL**

1. Conduit shall be made in the USA.
2. Colored Conduit:
  - a. Fire Alarm: RED
  - b. Emergency systems: YELLOW
  - c. Data: ORANGE
  - d. Security: GREEN
3. Route neatly with building lines, parallel and perpendicular.
4. MC cable may be used in the walls - transition to EMT for homeruns.
5. Colored MC Cable:
  - a. Fire Alarm: RED
  - b. Emergency systems: YELLOW
  - c. Data: ORANGE
  - d. Security: GREEN

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**SECTION 26 0537 – BOXES****A. GENERAL**

1. Paint box covers according the service inside:
  - a. Fire Alarm: RED
  - b. Emergency systems: YELLOW
  - c. Data: ORANGE
  - d. Security: GREEN
2. Label boxes with circuit number visible from below (handwritten is acceptable).

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**SECTION 26 0553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS****A. GENERAL**

1. Provide engraved plastic permanent labels on all electrical equipment, indicating NAME and FED FROM information - black on white for normal, red on white for emergency circuits.
2. Provide circuit information on all receptacles and light switches. Use self-adhesive machine generated stickers. Format is "LRI-3". Black on white for normal, Red on White for emergency.

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## SECTION 26 1201 – PAD-MOUNTED TRANSFORMERS

### A. GENERAL

1. At the Kennesaw campus, KSU owns the transformers and distribution across the campus. Any new building will have to coordinate with the school to determine which circuit to connect. On this campus the Contractor shall provide pad mounted transformers as described on the drawings and in these specifications. All cost associated shall be part of the project.
2. At the Marietta campus, the power company owns the primary and transformers. Contractor would be responsible for only the secondary conductors from the transformer into the main service gear.

### B. ACCEPTABLE MANUFACTURERS:

1. Pad-Mount Transformers: ABB, General Electric Co., Cooper.
2. Primary Bushings: Elastimold or RTE.
3. Loop-Feed Switch: General Electric Co., ABB, or Cooper.
4. Pressure-Relief/Air bleed Device: Qualitrol, Beta, or approved equal, meeting or exceeding ANSI C57.12.25, Section 6.4.5.
5. Top Mounted Pressure-Relief Device (300 KVA and Larger Transformers): Qualitrol #208-60 or approved equal.
6. Oil-Immersed Metal Oxide Distribution Arrester: General Electric "Tramquell 1A1". Cooper Power Systems Type AZU, or ABB.
7. Magnetic Overcurrent Indicators: McGraw-Edison Type MHS; H. Horstman Type 317.60X, or RTE Type MRB.
8. Secondary Spade Covers: W.H. Salisbury Co. #SC-4 Homac Mfg. Co. "SB" Series, or approved equal.

### C. MATERIALS:

1. Transformers shall be new, factory-tested, three-phase, pad -mount type, oil-filled, complete with accessories, and have olive, "grass", or "telephone" green color finish. Compartment and tank shall have factory applied undercoating.
2. A primary loop-feed, loadbreak oil switch assembly, consisting of two (2) 2-positive position ON-OFF devices, shall be provided (integrally through 500 KVA) in the primary of each new three-phase, pad-mount transformer, with all controls accessible in the high voltage compartment. A 4-position switch with closed transition is acceptable; without closed transition, is not.
3. Primary Fusing: A combination (series connection) of an oil-immersed, current-limiting fuse and a Bay-O-Net, oil-immersed, dual-element expulsion fuse, coordinated to provide full range protection, with the expulsion fuse, clearing low-current faults or overloads, and the current limiting fuse clearing high-current faults up to 50,000 amperes rms. sym. shall be provided for each phase of the transformer primary. Bay-O-Nets shall be located so that expulsions will not create gas pockets across any phase to phase or phase to ground terminals which might

initiate arcing. Fuses shall be coordinated with specified internal lightning arresters to prevent nuisance fuse blowing as a result of current developed in the transformer due to discharge voltage of the arrester saturating the transformer core. Fuse sizes shall be as recommended by the transformer manufacturer.

4. Bushings:

- a. Six (6) 600 amp deadbreak primary bushings for use on 15 KV Class apparatus, arranged to form a "V" configuration, shall be provided in the primary compartment for receiving dead-front cable connectors. At least six (6) parking stands shall be located in the primary compartment and shall be so arranged that any terminated cable can be disconnected from its bushing and placed on a stand-off plug or a grounding plug mounted in the respective parking stand without straining the cable. Primary bushings must accept and interface with either Elastimold 650 LR or RTE "Bol-T" 600 amp elbow connector or Elastimold 600 BE bushing extender.
- b. Secondary of transformer shall be connected through low voltage bushings with tinned copper terminal spades, each having NEMA spaced holes, (4-thru 15 KVA, 6-thru 500 KVA, and 8\*-750 KVA & larger). Bushing shall be arranged for clearance and cabling from below. A minimum of six inches (6") shall be maintained between the tank wall and the center of the terminal hole nearest the tank.
- c. Primary and secondary bushings shall be field replaceable, externally clamped type, compatible and interfaced to accept cable terminations specified elsewhere herein.
- d. Provide with insulated steel support system, 125# min./spade.

5. E. Insulating Oil:

- a. In lieu of mineral oil, the transformer shall be filled with non-toxic Cooper FR3 seed based oil (or equivalent).

6. Transformer Accessories:

- a. Furnished by transformer manufacturer with or on unit:
  - i. Top-mounted access cover.
  - ii. Primary bushing dust covers, 6-each.
  - iii. NEMA accessory group consisting of 1" drain and 1/2" sampling devices, thermometer, and oil level gauge. Thermometer and oil gauge to be located in secondary compartment and drain/sampling device in primary compartment, except when secondary breakers or panels are specified herein or scheduled on the drawings and obstruct safe viewing or resetting, all shall be located in the primary compartment.
  - iv. Combination pressure-relief/air-bleed device, with 9-11 psi relief pressure rating, 7 or less psi closing pressure rating, and resistant housing such as brass or stainless steel, with O-ring seal and 1/4"-18NPT pipe threads, located in the secondary compartment, except when secondary breakers or panels are

specified herein, or scheduled on the drawings and obstruct safe inspection, testing, or use, shall be located in the primary compartment.

- v. Pressure relief device with 10 psi maximum relief pressure and enclosed in tamper-proof metal enclosure located on top of transformer tank on all transformers 300 KVA and larger.
  - vi. Manual tap changer for de-energized operation shall be located in the primary compartment.
  - vii. Set of controls for primary loop-feed switch shall be located in the primary compartment.
  - viii. Phase and switch identification.
  - ix. Stainless steel nameplate with schematic diagram and other data.
  - x. Installation, operating & maintenance instructions (complete set secured in waterproof holder inside secondary compartment door).
  - xi. Parking stand brackets (at least one per cable termination).
  - xii. Grounding pads ( 2 per compartment).
  - xiii. Oil fill plug.
  - xiv. Oil fuse drip tray.
  - xv. Spare fuses on the order of 10%, but in no case less than three (3) of any type or rating for entire project.
- b. Contractor shall provide and install in the field the following items:
- i. Stand-off insulator plugs, 3 each; dummy receptacle with test point, 3 each; and studs as required.
  - ii. Ground cable bus, extended the entire length of the high-and-low voltage compartments.
  - iii. Secondary Lightning Arrester: Install inside secondary compartment to protect each phase.
  - iv. Magnetic overcurrent indicators, 3 each, set at \* amps, one per phase, for quick identification of cable or equipment faults or severe overloads. Install on "source" side primary cables as recommended by instructions accompanying indicators; otherwise, install over cable over concentric neutral at tie back, above collected wires from concentric. Indicator shall be manually resettable and removable without having to de-energize the circuit. Where a special tool is required to reset devices, provide one per 3-phase installation and provide storage or hanging facilities.
  - v. Concrete pad.

- vi. Secondary spade covers to prevent accidental contact with energized spade connections.
  - vii. Secondary metering when and where shown on the drawings or specified herein.
  - viii. Plug-on elbow mounted end-of-line lightning arresters, one set per radial. (Total of six (6) per loop.)
    - 1. \*McGraw "MHS"- 450
    - 2. \*RTE "MRB"- 400
7. All tap changers shall:
- a. Be externally operated.
  - b. Have the same BIL rating when operated at each tap setting.
  - c. Be provided with positive stops to identify the highest and lowest tap positions.
  - d. Be located in the high voltage terminating compartment.
  - e. Be designed to prevent accidental operation by requiring a preliminary step such as loosening a set screw before the tap position can be changed. This positive locking device shall be clearly visible to field personnel operating the tap changer.
  - f. Have either a permanent clearly marked indicator plate or tap positions stenciled on the transformer tank with oil resistant material.
  - g. Have all components constructed of corrosion resistant material.
  - h. Be designed for operation using hot line tools.
  - i. Rotate in a clockwise direction from the high tap voltage to a lower tap voltage in the high voltage winding.
8. Metal oxide varistor distribution under oil surge arresters shall be provided for each primary phase and be integrally connected and shall be located in oil filled compartment.

**D. RATING:**

- 1. Pad-Mount Transformers:
  - a. Capacity: Self-cooled continuous KVA rating indicated on the drawings.
  - b. Phase/Frequency: Three/60 hertz.
  - c. Temperature Rise: 65°C.
  - d. BIL: 95 KV min. Primary: 30 KV min. secondary.

- e. Primary Voltage: 12,470 Grd Y/7,200, 3-phase, 4-wire.
  - f. Secondary Rating: 480 Grd Y/277 volts, 4-wire as scheduled or indicated on the drawings. Secondary spades shall be compatible with transformer capacity at full load.
  - g. Taps: Four (4) two and one-half percent (2-1/2%) rated taps in high voltage winding, two (2) above and two (2) below normal voltage.
2. Integral Loop-Feed Switch:
- a. Maximum Capacity: 400 amps RMS Continuous and Load Switching.
  - b. Phase/Frequency: Three/60 hertz.
  - c. BIL: 95 KV minimum.
  - d. Voltage: 15.5 KV nominal.
    - i.  $\pm 10\%$  of guaranteed average.
    - ii.  $\pm 7\frac{1}{2}\%$  of tolerance.
  - e. Momentary Make-&-Latch and fault close: 12,000 amps RMS SYM (20,000 amps ASYM).
  - f. 60Hz One Minute Withstand: 34 KV
  - g. Number of Loadbreak Operations at Continuous Amps: 25
  - h. No-Load Mechanical Operation: 500
  - i. Fault Operations: 2
3. Integral Oil-Immersed Distribution Lightning Arrester:
- a. Arrester Rating 9KV rms.
  - b. Maximum Continuous Voltage Capacity --- 7.65 KV rms. (L-G).
  - c. Equivalent Front-of Wave Protection Level\*--35.3 KV-Crest, or less.
    - i. Level\* ----- 35.3 KV-Crest, or less.
  - d. Maximum Discharge Voltage (KV Crest) at Indicated Impulse Currents Using 8 x 20 Microsecond Current Wave:  
1.5KA-26.3 KV; 5KA-29.3: KV; 10KA-31.5 KV; 20KA-35.9 KV
4. Secondary Breakers:
- a. Ampacity: As shown on drawings.
  - b. Poles: 3 poles.

- c. Interrupting Rating: As specified herein.
5. Insulating Liquid (Oil)
    - a. 30KV dielectric strength when tested per ASTM D877.
    - b. \*Equivalent FOW protection level is the discharge voltage for a 10 KA current wave which as a voltage wave cresting in 0.5 micro-seconds.

#### **E. FABRICATION AND MANUFACTURER:**

1. Transformer construction shall be tamper-resistant with no externally removable fastening devices. Low voltage (secondary) air filled terminal compartment shall be located on the right and shall be accessible through a hinged steel door with pad-lockable handle and three-point latches. High voltage (primary) air filled terminal compartment shall be located on the left and shall be accessible through a hinged door only after the secondary compartment door has been opened, and secured by a slotted, hex-head captive bolts. Primary and secondary compartments shall be separated by a barrier. Doors and sills shall be removable to facilitate rolling and skidding the transformer unit into place over conduit stub-ups, making connections, and pulling-in cables.
2. Primary loop-feed switch shall be a three-phase, gang operated, disconnecting device and shall interrupt all three phases simultaneously. Operation shall be for loop-and solid tap, for through feed, alternate feed or sectionalizing. After withstand or closing-in on maximum rated fault current, the loadbreak oil switch shall be operable in normal manner and capable of carrying its rated load current without exceeding temperature rise limitation. Connections to primary of transformers shall be integral with construction of complete pad-mount transformer unit. Construction shall be dead-front. All operating mechanisms and contacts shall be arranged for inspection, maintenance, or replacement and contacts shall be silver plated.
3. Transformers shall have either a five (5) legged core or a triplex design.

#### **F. SECONDARY ARRESTERS:**

1. Arresters shall be a sturdy, weatherproof, service-proven device to immediately drain lightning surges, harmlessly to ground (earth), discharging a surge in a fraction of a second, repeatedly, with no maintenance required.
2. For 3-phase application, one 3-pole, 4-wire system, three 2-pole, 3-wire 650 volt class device shall be used.
3. Devices shall be U.L. & CSA listed and labeled, with approximately 18" leads, pre-stripped, and operated effectively when mounted in any orientation.
4. Arrester shall be furnished by manufacturer with mounting bracket.
5. Connection diagrams and installation instructions shall be provided by manufacturer with each device.

#### **G. END-OF-LINE PRIMARY SURGE ARRESTERS (E.L.L.A'S)**

1. Plug-on elbow mounted E.L.L.A.'s shall be 15KV class, dead-front, 9KV rated, metal oxide varistor elbow assembly, for plugging into 600 amp reducing tap well device. Each arrester

shall be furnished by the manufacturer with a 36" long bare stranded woven copper grounding cable connected to bottom end of arrester.

#### **H. PREPARATION**

1. The earth upon which transformer pad is to sit shall be leveled and compacted to receive the pad. Earth form may be used below grade in firm soil such as clay; otherwise, use wood or metal forms above and below grade

#### **I. INSTALLATION/APPLICATION/PERFORMANCE**

1. Install pad-mounted transformer at location(s) indicated on the drawings on a steel-reinforced concrete pad.
  - a. Obtain exact dimensional data from transformer manufacturer and size pad accordingly.
  - b. Two inches (2") of the pad shall be exposed above finished grade in paved areas, and four inches (4") in unpaved areas unless noted otherwise on the drawings
  - c. Transformer pads poured at the site shall be allowed to cure a minimum of three (3) days before the transformer is installed thereon.
  - d. Location of transformer pad shall be such that transformer shall not be located nearer than ten feet (10') to any building unless located next to an approved fire wall with doors, windows, or other openings not closer than ten feet (10') on either side, or over. At least two feet (3') shall be left for maintenance and operation.
  - e. Overall dimensions of transformer pad shall allow six inches (6") all around beyond furthest horizontal projection of transformer.
2. Primary and secondary cables and conduit shall be installed either before or after transformer is set and leveled on pad. When terminated, each primary cable shall be arranged so that it can be moved in an arc from its respective incoming phase bushing to the same phase outgoing bushing and visa-versa without stretching, deforming, or damaging cable in any way.
3. Make secondary cable connections to transformer using compression 2-hole spade connectors which are compatible with secondary cable conductor and transformer spades.

#### **J. SPARES**

1. Spare fuses on the order of three (3) each of every different size and type installed on this project shall be furnished, tagged with description and location(s) used, and turned over to the Owner's representative at the time of final review of construction and prior to final payment.

#### **K. SECONDARY ARRESTERS:**

1. Install secondary lightning arrester (s) inside secondary compartment of each pad-mounted transformer and connect to protect each phase in accordance with instructions furnished with arrester.

**L. END-OF-LINE PRIMARY LIGHTNING ARRESTERS (E.L.L.A'S):**

1. Install plug-on elbow mounted E.L.L.A.'s inside the primary compartment of pad-mounted transformer. Plug into 600 amp reducing tap well\*, one for each phase (two sets of 3 for each loop).
2. Bond grounding cable connected to arrester to ground bus.
3. When 600 amp apparatus cable connectors are specified herein or indicated on the drawings, provide 600 amp to 200 amp transition for each connection to receive the end-of-line, plug-in elbow arrester:
  - a. Remove insulating plug with its cap from 600 amp connector and store in air-tight heavy-duty plastic bag inside primary compartment.
  - b. Provide reducing tap well\*, Elastimold Style 600RTW or RTE Cat. No. 2637241B01M.
  - c. Provide 200 amp loadbreak bussing plug insert\*, Style1601-3R RTE Cat. No. 2604797B01M.
  - d. Clean and silicon lubricate all mating parts.
4. Install parking stand mounted E.L.L.A.'s inside the primary compartment of pad-mounted transformer(s) designated on the drawings. Plug designated cable 200 amp loadbreak elbows into 200 amp arrester bushing when indicated on the drawings, one for each phase (one set of 3 for each end of loop).
5. Device must be approved by the manufacturer to mate with their particular cable connector. Verify.

## SECTION 26 2413 – SWITCHBOARDS

### A. GENERAL

1. Double Ended Switchgear with a tie breaker will be utilized with each section being feed from a transformer.
2. Spare switchgear breakers of each ampere size will be provided to KSU, shop stock.
3. Where possible, distribute building power loads by separating Receptacle, Lighting and HVAC loads.
4. Provide power meters to monitor each of these loads individually. The total building load should also be monitored and available for review. Acceptable meters include:
5. The meter standard is based on the Shark 200 (or higher series), Emon-Dmon 3200 or 5000, Veris H81XX or E50, or Measurelogic DTS SMX. Values for kW, kWh, pF, kVA, KVAR shall be obtained in 15 min increments, totalized, and transmitted via BACNET protocol to the campus Periscope Dashboard Server, as well as the building management server.
6. All data should be accessible via the campus Periscope system. See Appendix for more details on this system.

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## SECTION 26 2416 – PANELBOARDS

### A. GENERAL

1. Where possible, distribute building power loads by separating Receptacle, Lighting and HVAC loads.
2. Provide power meters to monitor each of these loads individually. The total building load should also be monitored and available for review. Acceptable meters include:
  - a. The meter standard is based on the Shark 200 (or higher series), Emon-Dmon 3200 or 5000, Veris H81XX or E50, or Measurelogic DTS SMX. Values for kW, kWh, pF, kVA, KVAR shall be obtained in 15 min increments, totalized, and transmitted via BACNET protocol to the campus Periscope Dashboard Server, as well as the building management server.
3. Provide power meters to monitor each of these loads individually. The total building load should also be monitored and available for review.
4. All data should be accessible via the campus Periscope system. See Appendix for more details on this system.

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**SECTION 26 2417 – SURGE PROTECTIVE DEVICES (SPDS)**

**A. GENERAL**

1. Provide Surge Protective Devices on the main switchboard and any receptacle panels serving sensitive loads.

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**SECTION 26 2726 – WIRING DEVICES****A. GENERAL**

1. Different type devices shall match in color. Receptacles, light switches, low voltage switches, wall mounted occupancy sensors, etc. shall be the same color with the same type of trim or cover. Provide submittals data indicating this color prior to purchasing.

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## SECTION 26 3213 – ENGINE GENERATORS

### A. GENERAL

1. All new generators shall be natural gas fired.
2. Provide Level II sound enclosures (75db at 23ft) when adjacent to buildings with learning spaces inside.
3. Connect generator to Building Management system, to allow for remote monitoring. Typical monitoring points include engine hours, % loaded, and maintenance reminders. Any alarm at the generator shall be transmitted to the Facilities group via the BMS.
4. Connect all associated ATS's to building management such that the Facilities group is alerted when the ATS has transferred both to and from emergency power.
5. Connect a power meter to the generator when applicable to allow for load tracking.
6. Acceptable generator manufacturers include:
  - a. Generac
  - b. Caterpillar
  - c. Cummins
  - d. Kohler
7. Items to be placed on generator power:
  - a. Life Safety Egress lighting
  - b. Data room receptacles
  - c. Data room cooling
  - d. Fire pump
  - e. At least one elevator

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## SECTION 26 4110 – FACILITY LIGHTNING PROTECTION

### A. GENERAL

1. All new building construction projects are required to have a lightning protection system.
2. Conductors to be copper cable of size and weight to achieve system certification. Aluminum conductors may be used only where necessary to prevent dissimilar metals interaction.
3. Down conductors to be concealed within partitions, chases, column enclosures, cast-in-place concrete columns, etc.
4. Where accessible to personnel walking across the roof, use blunt tip rods.
5. Where lightning rod base plates and cable support base plates are provided on roofing, parapets and/or cap flashing comply with roof membrane manufacturer's recommendations for mounting and sealing base plates in a manner that does not void the roof system warranty.
6. Construction Documents shall indicate a general lightning rod layout that includes an approximate count of rods and downlead locations for the contractor to price. During the submittal process the contractor shall provide the designer shop drawings which indicate exact quantities and locations.
7. To be included in the O&M manuals: Contractor to obtain and provide to KSU a copy of the Underwriters Laboratories, Inc. UL Inspection Certificate.

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## SECTION 26 5100 – INTERIOR & EXTERIOR LIGHTING

### A. GENERAL

1. All new lighting shall be LED type, both interior and exterior. Fluorescent lamps are not allowed without special permission from the Facilities group.
2. There are two site lighting standards - one for the Kennesaw Main campus and one for the Marietta campus. See the Appendix for cutsheets for each.
3. The preferred lamp color choice is 4100k inside, 5000k outside.
4. To allow for easy maintenance, do not place lights directly over stairs.
5. Separate lighting loads from receptacle and HVAC loads to allow for it to be metered separately.

### B. EXTERIOR LIGHTING

1. Kennesaw Campus
  - a. Pedestrian Walkway Lighting - Holophane Utility Arlington LED, ARUE2-P40-40K-AS-GL3-BK-S, pole Holophane Hamilton HL-A-14-F5J-16-P07-ABG-BK.
  - b. Vehicular Traffic & Surface Parking Lighting – Cree BXSP-C-HT-2ME-E-40K-UL-SV, poles to match existing.
2. Marietta Campus
  - a. Pedestrian Walkway Lighting – RAB Lighting ALED-5T-52, poles to match existing.
  - b. Vehicular Traffic & Surface Parking Lighting – RAB Lighting RWLED-3T-125, poles to match existing.

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## SECTION 26 5200 – SENSOR LIGHTING CONTROLS

### A. GENERAL

1. Keep the control scheme for new spaces as simple as possible. Utilize occupancy sensors where applicable. Minimize the use of relay lighting control to large spaces only.
2. Utilize multiple occupancy sensors in larger classrooms, wired such that detection by either sensor activates all of the lights.
3. Utilize dual sensor (Ultrasonic and Infrared) in larger spaces to make them more sensitive to activity and to reduce nuisance lighting outages.
4. Provide line voltage switching downstream of the power packs such that the lights can be forced OFF in the space, while the occupancy sensors control it in the ON position.
5. In small spaces (offices, janitors' closets, etc.) set the occupancy sensor to VACANCY mode, where a manual ON is required.
6. In common areas (corridors) set the occupancy sensor to AUTO mode, where sensor detection turns the lights on.
7. Do not place these spaces on automatic shutoff:
  - a. Data closets
  - b. Electrical rooms
  - c. Mechanical rooms
  - d. Office rooms
  - e. Any space where inadvertent lighting shutoff would endanger the occupant.

### B. SUBMITTAL REQUIREMENTS

1. Submit manufacturer's occupancy sensor layout shop drawings for the Facility Group review prior to installation. These drawings should provide information on the coverage spacing for each occupancy sensor type used.

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## DIVISION 27 – COMMUNICATIONS

### A. OWNER'S DESIGN CRITERIA:

1. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
2. NFPA 70 - National Electrical Code, 2017 Edition; National Fire Protection Association.
3. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.
4. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association ; Rev C, 2009 (with Addenda; 2012).
5. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2014).
6. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables.
7. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).
8. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.
9. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev B, 2012 (with Addenda; 2013).
10. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications ; Rev A, 2002.
11. GTDM - State of Georgia Telecommunications Design Manual; latest edition.

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## SECTION 27 0001 – AUDIO VISUAL SYSTEMS

### A. GENERAL

1. In all cases if new construction and renovation, projects shall include the minimum standard multimedia infrastructure cabling in each classroom, and should be considered for each conference and training room. See Appendix for additional information.
2. Speech reinforcement should be considered for rooms with a capacity greater than 70.
3. A minimum of one (1) 20-Amp circuit per room should be dedicated for classroom multimedia use. Additional circuits might be required. Where additional circuits are required, they shall be on the same phase.
4. Provide One (1) duplex receptacle at AV equipment cabinet location to provide power for Audio/Control Module.
5. Provide One (1) duplex receptacle at AV Input Plate Module location to provide power for instructional source equipment.
6. Provide One (1) duplex receptacle at projector location to provide power to the projector and switching equipment. Mount in ceiling tile next to telecom port. If no ceiling, mount in surface box next to telecom port.
7. Provide One (1) duplex receptacle at all flat panel display locations. Coordinate mounting with telecom port.
8. Provide One (1) junction box with 120v at screen location to provide power for motorized screen. Screens shall have 3-button, low voltage control (LVC) switch.
9. A minimum of Six (6) network connections per room should be dedicated for classroom multimedia use. Additional network connections might be required.
10. A minimum of two (2) cat 6 data cables at AV equipment cabinet location to provide network connection for Audio/Control Module. If room has video conference ability, then one (1) cat 6 voice cable is required at AV equipment cabinet.
11. A minimum of two (2) cat 6 data cables at AV Input Plate Module location. If AV Input Plate is for classroom podium or mobile lectern, then Three (3) cat 6 data cables and (1) RG-6 quadshield coax cable (RG-11 quadshield if over 200') with stainless steel cover plate.
12. Provide Two (2) cat 6 data cables and (1) RG-6 quadshield coax cable at all flat panel locations.
13. Provide plywood backing behind the sheetrock for flat panel mounting.
14. Provide one (1) cat 6 data cable at projector location. Mount in ceiling tile next to power receptacle. If no ceiling, mount in surface box next to power receptacle.

### B. CLASSROOM SPECIFIC

1. Classrooms with 30 or more desks will require the installation of a new projection screen. All projection screens shall be fastened securely to the structural wall or ceiling, attachment to

ceiling grid is NOT acceptable. Screens shall be mounted as close to the indicated wall as possible while far enough away to clear any obstacles. Screen height shall be determined by taking the distance from the last row of seats to the screen location dividing by 6 and rounding up to the next available size. Screen width shall be 16:9 ratio.

2. Rooms with over 70 seats will require the installation of a speech reinforcement system.
3. Rooms with over 50 seats will require the installation of an Assistive Listening System.
4. Assistive listening system shall comply with rule 120-3-20-.44 of the Georgia Accessibility Code, as required by section 120-3-20-.08 (19). Signage complying with the provisions of 120-3-20-.41 of the Georgia Accessibility Code shall be installed to notify students of the availability of a listening system.

## SECTION 27 1006 – TELCOM/DATA INFRASTRUCTURE REQUIREMENTS

### A. GENERAL.

#### 1. Description

- a. The project will involve the installation of a complete cabling infrastructure system as described within these specifications and drawings. See Appendix for additional data requirements.
- b. Overview:
  - i. Data rooms are becoming more and more power dense as servers and POE requirements have increased dramatically. It is important that plenty of circuits be made available to data closets, and that these circuits are dedicated to the data room only. Do not share with adjacent spaces.
  - ii. Where applicable, data room receptacles and cooling should be on the emergency generator.
  - iii. Do not place more than four computers on a single 120V circuit.
  - iv. In each office, place a data backbox in two locations in the room (generally opposite walls).

#### 2. Scheduling

- a. The construction schedule, as approved by the KSU Project Manager, shall be an integral part of the Contract and shall establish interim contract completion dates for the various activities. The schedule must remain adjustable and flexible throughout the length of the project with the completion of the Voice/Data Equipment rooms a top priority.
- b. Certain Fire Marshal inspections may require the fire alarm system to be connected to the outside monitoring service via IP or analog lines. If this is the case, it is critical that the MDF (as a minimum) be clear of dust and properly secured. Connection to outside networks cannot occur without these items. Allow at least 5 working days from a dust free and secured environment for the IT staff to make any outside connections.

#### 3. Project Review

- a. Submit proposed data location drawings to the IT Department for review per the following schedule:
  - i. Design Development
  - ii. 50% Construction Documents
  - iii. 95% Construction Documents

#### 4. D. Ceiling Space Coordination

- a. The General Contractor shall coordinate and schedule the installation of work above ceiling with the KSU Telecom cabling technicians and other trades so as to avoid installation conflicts. The KSU Telecom cabling staff/technicians shall participate in special project meetings (if requested) for the purpose of ceiling space coordination. Such coordination shall include, but is not limited to, the following work:
  - i. Ceiling Grid and Ceiling Tile Installation
  - ii. Ductwork, HVAC Piping, and Conduits
  - iii. Electrical Wiring
  - iv. Telephone/Data Wiring

#### 5. Inspection Requirements

- a. The contractor shall be solely responsible for determining, verifying and complying with inspection requirements relative to the scope of work.

### **B. BUILDING VOICE AND DATA CABLE- OUTSIDE PLANT ENTRANCE**

#### 1. Buried Entrance Conduit

- a. Buried building entrance conduit shall extend into undisturbed earth to prevent shearing (24-inch [60 cm.] minimum depth) and will be run in a conduit trench back filled with appropriate material.
- b. An Orange detectable plastic warning tape shall also be placed in the trench a minimum of eighteen (18) inches above the conduit to provide additional detection measures.
- c. The conduit shall further be encased with 2500 psi minimum strength concrete.
- d. When boring under roadways or railways, corrosion-resistant steel pipe can be used as a substitute for concrete encasement.

#### 2. Connecting Conduit

- a. The connecting conduit run shall be limited to a maximum of two (2) 90-degree bends (or an equivalent number of sweeps and/or radiused bends). Conduit runs installed by the Contractor should not exceed 350 feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull boxes. Pull box sizes will be determined by KSU Telecom personnel during the construction project.
- b. The radius of a conduit bend must be at least 6 to 10 times the diameter of the conduit, depending on its size. If the conduit has an internal diameter of 2 inch or less, the bend radius must be at least 6 times the internal conduit diameter. If the conduit has an internal diameter of more than 2 inches, the bend radius must be at least 10 times the internal conduit diameter.

#### 3. Quantity of Conduits/Innerducts

- a. Contractor shall verify exact termination point of service with the utility prior to roughing.
- b. All cable conduits shall extend four (4) inches beyond the surface from which it emanates.
- c. The ends of all metallic data/voice conduits should be reamed, bushed, and grounded according to the National Electrical Code.
- d. All conduits and/or innerduct shall contain kevlar pull strings with a minimum test rating of 200 lb. pulling tension.
- e. Two conduits to be utilized for voice are to be void of innerduct. One of these conduits shall contain a continuous true tape from end to end.
- f. Two conduits to be utilized for data (fiber optic), shall contain innerducts. Each data conduit shall contain four (4)-  $\frac{3}{4}$  inch innerducts.

#### 4. True/Prove of Conduits

- a. All conduits must be true to ensure that the interior of the conduit does not change to less than 3-1/2" from end to end. KSU Personnel must be present to ensure verification.

#### 5. Conduits Entering Building

- a. Outside plant (nonfire-rated) entrance cable must be terminated within fifty (50) feet upon exiting the conduit inside the building.
- b. If the termination point is greater than fifty (50) feet from the entrance point, the cable must be run in rigid metallic conduit to within fifty (50) feet of the termination point and the conduit shall be grounded.
- c. The inside-the-building end of the voice/data cable conduit(s) shall be sealed to prevent vermin and environmental elements from entering the building.

### **C. BUILDING VOICE AND DATA CABLE- ENTRANCE TERMINATION MDF (MAIN DISTRIBUTION FRAME AND BACKBONE RISER SYSTEM IDF (INTERMEDIATE DISTRIBUTION FRAME))**

1. MDF must be completed in early stages of the building project using both KSU and BellSouth specifications. This will allow KSU and BellSouth to install entrance copper and fiber cables necessary to provide dial tone/data required for certifications, i.e. elevator, fire alarm, HVAC, etc.
2. The building entrance cable shall be terminated at the Voice/Data Main Distribution Frame (MDF).
3. The MDF/IDF Telecommunications rooms shall include the following:
  - a. MDF/IDF Locations:
  - b. Wall, Floor, Ceiling, and Door Requirements

- i. The MDF/IDF rooms shall be lined on all four walls with  $\frac{3}{4}$ " fire-retardant plywood painted WHITE on all sides. If not using fire-retardant plywood, it should be painted on all sides with WHITE Intumescent Fire Retardant Paint.
- ii. Placement of the plywood shall begin within twelve (12) inches of the entrance door and shall be placed continuously around the room. All  $\frac{3}{4}$ " plywood backboards will be 4 feet wide x 8 feet high and will be installed vertically beginning 20" A.F.F., or above electrical outlets.
- iii. The MDF/IDF room floor shall not have a floor covering other than being sealed or a vinyl covering. No carpet is to be installed in the MDF/IDF rooms.
- iv. The MDF/IDF room shall not have a finished ceiling such as sheetrock or drop construction. Room to be no less than 9' in height to the building structure.
- v. The door to the MDF/IDF room shall be a B18 GA-22 Gauge Stiffners-Honeycomb core steel door, with a (3) hour fire rating.
- vi. Card lock to be installed by KSU locksmith.

c. Electrical Power and Lighting

- i. All electrical outlet locations in MDF/IDF to be determined by KSU Telecom personnel at time of installation. Additional electrical outlets will be required to data racks upon build-out of data room.\*
- ii. \*All Network data racks to have one (1) dedicated twenty (20) ampere, 120-volt independently breakered and grounded quad outlet. Installation of these outlets to be coordinated with KSU Networking personnel upon installation of data racks in each MDF/IDF.
- iii. The MDF/IDF room shall be properly powered with a minimum of three (3) dedicated twenty (20) ampere, 120-volt independently breakered and grounded quad outlets.
- iv. If required, location of the following item will be determined by KSU Telecom during the construction project:
- v. Two (2) dedicated thirty (30) ampere, 208-volt independently breakered and grounded (NEMA L6/30 Twist Lock) outlet in MDF only.
- vi. Electrical outlets shall be flush with the plywood backboards, or located below installed backboards. All electrical outlets in the MDF/IDF shall also be connected to the emergency power circuits or facility generator in case of utility power outages.

d. Environmental Control (HVAC)

- i. The MDF/IDF room shall have either dedicated HVAC (heating/ventilation/air conditioning) equipment or access to the main HVAC delivery system. The HVAC system must be capable of functioning properly at all times (24 hours per

day, 365 days per year). If the HVAC system is a dedicated unit it shall be connected to the emergency power circuits or facility generator in case of utility power outages. Either system must be fitted with manual controls located in the MDF room. The HVAC control systems for the MDF/IDF shall meet or exceed the standards shown below:

ii. Environmental Factor Requirement

1. \*Temperature 64 to 75 Degree F.
2. \*Relative Humidity 30 to 55 Percent
3. \*Heat Dissipation:
  - a. MDF to accommodate approximately 62,291 BTUs/hr
  - b. IDF's to accommodate approximately 40,975 BTUs/hr

iii. Location of the HVAC unit and relief duct must be coordinated with KSU ITS-Telecom to avoid locating above data racks, which could cause possible water damage from malfunctioning units or drainage. If possible, locate above or near door.

e. Shafts and Raceways

i. Riser shafts and raceways shall be located and designed to provide adequate space for the amount of cable to be installed, meet structural loading requirements, and enable cable to be routed within distance limitations.

f. Sleeves

- i. Sleeves shall be located adjacent to a wall on which the backbone cables can be supported without obstructing the wall termination space. Sleeves shall be designed to conform to the NEC and local fire codes and must be fire stopped as part of the installation procedure following the pulling of the cable.
- ii. Sleeves shall extend four (4) inches above/below the entrance into the MDF/IDF room. The ends of all metallic data/voice conduits should be reamed, bushed, and grounded according to the National Electrical Code.

g. Horizontal Distribution Pathways

- i. The layout and capacity of the data cable pathway shall have the following characteristics:
- ii. Meet ANSI/EIA/TIA-569 and ANSI/NFPA 70 (Clearance from EMI sources) requirements. For special or heavy EMI/RFI environment installation situations, the home run conduit method shall be considered.
- iii. Conduit runs installed by the contractor should not exceed 100 feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull

boxes. To avoid electromagnetic interference (EMI), all pathways shall provide clearance of at least:

1. Four (4) feet from motors or transformers.
  2. One (1) foot from conduit and cables used for electrical power distribution.
  3. Five (5) inches from fluorescent lighting.
- iv. Provide for maintenance of the horizontal cabling with minimal disruption of occupant activities through easy access.
  - v. The pathway design shall allow for a minimum of four (4) Cat 6 cable runs per individual work area. (2 voice/2data)
  - vi. All horizontal pathways from classrooms must go back to the same Telco room. This includes all wall and floor box locations within the room.
  - vii. All horizontal pathways that penetrate fire-rated barriers must be fire-stopped in accordance with applicable codes.

#### h. Cable Trays

- i. Cable tray systems shall be made of straight sections, fittings, and accessories as defined in the NEMA standards publication VE-1. Cable trays shall be UL classified as equipment grounding conductors.
- ii. Cable trays shall be located in hallways or corridors whenever possible to minimize disruption of occupant activities. Cable trays located in hallways shall be placed off-center to avoid fluorescent lights.
- iii. The distance from the cable termination point in the MDF/IDF room to the telecommunications workstation outlet boxes through the cable tray configuration shall not exceed 295 feet (excluding the patch cable length)
- iv. The general area for the feeder cable tray to exit the IDF room shall be located to avoid sources of EMI. The cable tray shall not extend into the IDF more than six (6) inches.
- v. The total weight of the cable tray when loaded with cable shall be considered when designing supports to secure the cable tray to the building structure. The working load capacity of a cable tray system shall be determined by both the length of the support span and the static load capacity of the tray.
- vi. Materials and Finishes: Straight section and fitting side rails and rungs shall be extruded from aluminum.
- vii. Tray Types: Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced nine (9) inches on center. Rung spacing in radiused fittings shall be

measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inches with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.

1. Tray Size: Trays shall have an overall nominal depth of six (6) inches with a minimum usable loading depth of four (4) inches.
  2. Straight section side rails shall be I-beam, C rail or Z rails. All straight sections shall be supplied in standard lengths of twelve (12) feet.
  3. Minimum tray widths shall be twelve (12) inches or as shown on the drawings, whichever is larger.
- viii. Sweeping or radiused bends shall be used. 90-degree corners in the cable tray are not allowed. Fitting radius shall be thirty-six (36) inches. Side rails of straight sections and fittings shall be compatible so that standard splice plates can be used to join straight sections and fittings. Fittings shall have three (3) inch tangents beyond the curved section to accommodate the standard splice plates. Provide standard radius fittings for turns. Provide standard fittings with required radii for elevation transitions. Provide standard 90-degree down radius at cable tray termination locations.
- ix. Splice Plates: Splice plates shall be the bolted type, using either square neck or ribbed-neck carriage bolts and serrated flange lock nuts. The resistance of fixed splice connections between an adjacent section of tray shall not exceed .00033 ohm. The cable tray shall be designed so that a splice plate located anywhere along the span shall not decrease the strength of the cable tray system. Splice plates shall be furnished with straight sections and fittings, and shall be included in unit prices.
- x. Accessories: Covers and other special accessories shall be furnished as required to protect, support, and install a cable tray system.
- xi. Cable tray shall meet NEMA class 12A. Cable tray shall be made to manufacturing tolerances as specified by NEMA VE1-2.03 and VE1-2.04.
- xii. Support: Provide trapeze-type support system consisting of horizontal channel and hanger rod of sizes recommended by NEMA (publication VE-1, latest edition) for ten (10) foot simple spans. Rod shall be threaded at each end or as required for connections. Connection shall be made with fittings and hardware specifically welded. Hanger rods shall not extend more than one (1) inch below bottom of trapeze channel. Support horizontal spans on ten (10) foot intervals. Provide a support within two (2) feet of any termination (end-point of run). Refer to detail on plans for location of supports at elbows and terminations.
- xiii. Sway-brace shall be one piece channel attached between outside midpoint of elbow radius (or end-point of termination) and nearest building structural component. Make attachments to structure only; do not attach to piping, ductwork, or non-structural walls, floors, etc. Attachments to the structure shall be by one of the following means:

1. Toggle bolts on hollow masonry units
  2. Expansion anchors on solid masonry
  3. Concrete machine screws on steel work
  4. Beam clamps on structural steel
  5. Wood screws on wood members
- xiv. Penetration of Fire/Smoke Rated Partitions. Provide an eighteen (18) gauge galvanized steel sleeve solidly set in the fire smoke barrier to allow passage of the cable tray through the partition. The sleeve dimensions shall be one (1) inch larger than the cross sectional dimensions of the cable tray. Fill the entire space within the sleeve with Dow Corning TRV foam or #M Barrier compounds (leaving no voids around the cable tray or cables) to maintain the integrity of the partition fire or smoke rating.
- i. Grounding
- i. In MDF: Provide a four (4) lug #6 ground buss bar(3M 4140 copper ground buss bar or equivalent) with AWG #6 insulated wire terminated on a ground bar 20” A.F.F. for telephone dial tone provider (BellSouth). Must be located near the building entrance conduits. Ground bar shall be connected to the approved building ground. Leave a minimum of 8 ft. slack of ground wire.
  - ii. Provide a #6 AWG copper ground bonded to the cable tray, spanning the entire length of cable tray. Bond points shall occur at every section.
- j. Utilization of MDF/IDF Space
- i. ALL wall space in MDF's and IDF's is to be utilized by KSU equipment only. There shall be no other equipment installed either on the walls or within the room without the prior approval of KSU Telecom personnel.
  - ii. PROHIBITED: Locating other non-OIT resources in Telecommunications rooms.
  - iii. PROHIBITED: Using Telecommunications rooms as a route for other facilities to pass through.
  - iv. PROHIBITED: Using boiler rooms, air exchange rooms, janitorial closets, Electrical distribution closets or areas with water sinks for Communications. It is essential that these spaces be dedicated to Telecommunications.

#### **D. WORKSTATION COMMUNICATION OUTLETS**

1. When the individual work area is 100 square feet or less, a single 4-square box with a 2-gang mud ring is required.
2. An individual work area larger than 100 square feet shall have at least two (2) 4-square boxes, each with a 2-gang mud ring, and are to be located on opposite sides of the work environment.

3. Each back box shall have an individual 1" conduit terminated as close as possible, using the shortest most direct route, to the nearest cable tray on that floor.
4. All conduits shall be fitted with a minimum 200 TS polyline pull string to run the length of each conduit.
5. All workstation communication outlet boxes shall be placed in close proximity to standard electrical outlets. Outlet boxes shall be mounted at either standard electrical outlet height or above counters.
6. All voice/data outlets and floor boxes must go back to the appropriate telco room keeping within the 295' maximum cable distance requirement.

#### **E. ELEVATOR LINES, ALARM CIRCUITS, EMERGENCY AND COURTESY PHONES**

1. A written request must be sent to KSU Telecom, requesting appropriate number of voice and data cable that will be required, as well as giving locations where cable is to be pulled and terminated. Voice and data cable will not be terminated and active until MDF and IDF Telco closets have been completed by KSU personnel.
2. Conduit must be provided for all elevator lines and alarm circuits, from appropriate mechanical room to nearest cable tray on that floor, using the shortest most direct route, or to nearest Telco closet.
3. Conduit must be provided for emergency and courtesy phones, from outlet to nearest Telecommunications room. These outlets must comply with ADA requirements.

#### **F. GROUNDING AND BONDING LABELING**

1. Telecommunications Main Grounding Busbar (TMGB).
2. The telecommunications main grounding busbar must be labeled "TMGB" to comply with standard requirements.
3. Telecommunications Grounding Busbar (TGB).
4. Telecommunications grounding busbars located in each equipment room must bear the prefix "TGB". The room numbers in which the TGBs are installed must be labeled accordingly.
5. TGB-1-A through TGB-1-D on the first floor.
6. (Example: TGB-1-A is the Telecommunications Grounding Busbar on the first floor, cable A)
7. Telecommunications Backbone Bonding Conductor (TBBC).
8. The telecommunications backbone-bonding conductor shall be labeled with the prefix "TBBC".
9. Grounding Electrode Conductor (GEC).
10. The grounding electrode conductor shall carry the prefix of "GEC" followed by the type of electrode to which it is grounded.
11. Telecommunications Equipment Bonding Conductor (TEBC).

12. The telecommunications equipment-bonding conductor shall have a prefix of "TEBC". In installations with more than one (1) equipment rack, the suffix shall indicate the rack in which the TEBC terminates. The TEBC shall also be labeled at both ends. (Example: TEBC-1 would be bonding conductor #1).

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**SECTION 27 1300 – OUTSIDE PLANT (OSP) CABLING, PATHWAYS, AND COMPONENTS****A. GENERAL**

1. All new building on campus require a fiber connection to the campus loop. Coordinate exact locations with KSU IT during the Design Development phase.
2. See Appendix for more details on site related fiber requirements.

## **DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

### **A. OWNER'S DESIGN CRITERIA:**

1. NFPA 70 - National Electrical Code, 2017 Edition.
2. NFPA 72 - National Fire Alarm Code, 2013 Edition.
3. NFPA 101 - Life Safety Code, 2018 Edition.

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**SECTION 28 2000 – VIDEO SURVEILLANCE****A. GENERAL**

1. Coordinate camera locations with the KSU Public Safety during the Design Development phase.
2. In general, provide a conduit path to the data rooms from the following locations:
  - a. Entrances
  - b. Stairwells
  - c. Elevator lobbies
  - d. Area with heavy foot traffic
3. Conduit paths for cameras should be continuous from the data room to prevent tampering with the cable.

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**SECTION 28 3100 – FIRE ALARM SYSTEM****A. GENERAL**

1. The KSU Kennesaw campus sole source standard for Fire Alarm is the Edwards EST-3 system. Provide all programming required to integrate into the Campus Fireworks EST server.
2. The KSU Marietta campus sole source standard for Fire Alarm is the Honeywell FCI system.
3. Install any new systems according to NFPA 72.
4. In addition to basic code compliance, ensure the following devices are included where applicable:
  - a. Add carbon monoxide detectors in mechanical spaces where combustion occurs.

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**SECTION 28 5001 – DISTRIBUTED ANTENNA SYSTEMS****A. EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM (BDA SYSTEM)**

1. Provide a Distributed Antenna System (DAS) for any new building on the main Kennesaw KSU Campus that is over 50,000 square feet. This system shall be integrated into the building fire alarm panel.
2. Cobb County is enforcing compliance with IFC 510, which requires any new building over 50,000 square feet to pass a field test when complete that shows good 1st Responder radio coverage through the structure. In order to accomplish this, a Distributed Antenna System (DAS) is required. As of this writing only the Notifier system was UL listed, although other manufacturers may be considered. A sample specification is provided below:
3. Provide an in-building radio signal amplification system to provide complete coverage in the building for the public safety agencies as required by the local fire department and other agencies and authorities having jurisdiction. System users shall receive and transmit radio broadcasts from their portable radio units within the building. This shall be accomplished utilizing the following components:
  - a. Bi Directional Amplifiers (Signal Boosters)
    - i. Plenum rated Coaxial Cable
    - ii. Antennas
    - iii. Cable taps
    - iv. Connectors
    - v. Power dividers
    - vi. Other components and interconnecting circuitry as required
  - b. The system shall comply with the requirements of UL2524 1st Edition (pending) In-building 2-Way Emergency Radio Communication Enhancement Systems, NFPA 72 2010 Edition, NFPA 1221 2016 Edition and IFC 2018, as referenced.
  - c. The entire system shall meet with approval of the Fire Department, the Building Department and all other agencies and authorities having jurisdiction (AHJ).
  - d. The work in this section shall include the responsibility for all filings with the AHJ. Where filings require engineer's signature, documents shall be submitted for his review and signature. This responsibility shall include furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms.
  - e. Early completion of the in-building emergency radio communication enhancement system will be required as to permit a Certificate of Occupancy to be obtained in a timely manner

- f. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included as the part of the required work.
- g. The in-building emergency radio communication enhancement system shall use a UL2524 1st Edition (pending), NFPA-72 2010 Edition, NFPA 1221 2016 Edition and IFC 2018 compliant NOTIFIER® signal booster or approved equal.

#### 4. Design requirements

- a. In-building emergency radio communication enhancement systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.
- b. Critical Areas such as emergency command center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas shall be provided with 100% floor area radio coverage.
- c. General building areas shall be provided with 95% radio coverage, or as specified by AHJ.
- d. The In-building emergency radio communication enhancement systems must provide the following signal strengths:
  - i. Downlink - Minimum signal strength of -95 dBm throughout the coverage area.
  - ii. Uplink - Minimum signal strength of -95 dBm received at the AHJ Radio System.
- e. The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations, and for its operations described hereinafter.
- f. EC shall sub-contract an approved manufacturer or a qualified and approved vendor to supply, test and determine locations of components which are required for proper operation as well as to supply, deploy, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.
- g. All tests shall be conducted, documented, and signed by a person in possession of an FCC General Radio Telephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.
- h. The system design shall be based on the NOTIFIER® line of Public Safety Signal Boosters UL2524 1st Edition (pending), NFPA-72 2010 Edition, NFPA 1221 2016 Edition, IFC 2018 Edition and FCC compliant to establish standards of quality for materials and performance. The naming of a specific manufacturer or a catalog number does not waive any requirement or performance of individual components described in the specifications.

- i. Assembly and installation of all components of the Emergency Responder Radio Communication Enhancement System shall comply with all applicable sections of the National Electrical Code.
- j. Survivability from attack by fire shall meet NFPA 72, National Fire Alarm and Signaling Code, 2010 edition and NFPA 1221 2016 edition.
- k. The system must comply with all applicable sections of the FCC rules. Signal booster shall have FCC certification prior to installation.
- l. Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions

#### 5. Technical Specifications and Performance Requirements

- a. The system specified shall be based upon NOTIFIER® line of Public Safety UL2524 1st Edition (pending), NFPA-72 2010 Edition, NFPA 1221 2016 Edition, IFC 2018 Edition compliant signal boosters
- b. The signal booster shall be a Class B Public Safety type as designated by the FCC and as required by the AHJ.
- c. The secondary power supplies, battery chargers and system monitoring shall be fully compliant with NFPA-72, 2010 edition and NFPA 1221, 2016 edition. The signal booster shall have both the primary and the secondary power supplies built in a fully sealed NEMA-4 type approved enclosure.
- d. All signal boosters and other active system components must have FCC certification prior to installation. The equipment FCC ID must be shown on the product datasheets and technical submittals. The ID must also be displayed on the product as required by the FCC.
- e. The signal booster shall be set and tuned by the equipment manufacturer to pass frequencies as specified by the local fire department.
- f. To reduce the possibility of unwanted interference affecting the operation of the system, signal boosters shall be band or channel selective type with a maximum 3dB channel bandwidth of 200KHz (Fc +/- 100KHz). Wide-band signal boosters shall not be accepted, unless required to cover multiple channels within the same band.
- g. Signal Boosters shall have oscillation prevention circuitry to protect the public safety radio system in case of signal booster malfunction.
- h. Signal Booster gain shall be rated at minimum of 80dB and the gain shall be adjustable in a minimum of 25dB range. System gain shall be set and documented at the time of the final system test.
- i. Maximum Propagation delay of the signal booster system shall be 14μs (microseconds) or as specified by AHJ.

- j. The signal booster system shall include built-in automatic alarming of malfunctions of the signal booster and battery system as per NFPA 1221 2016 Edition Section 9.6, NFPA 72, 2010 Edition, Sections 24.5.2.6.1, and 24.5.2.6.2. Aftermarket equipment add-ons and modifications to comply with this specification will not be accepted.
- k. A dedicated supervised monitoring panel shall be provided within the emergency command center or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
  - i. Normal AC power
  - ii. Signal booster trouble
  - iii. Antenna Failure
  - iv. Loss of normal AC power
  - v. Failure of battery charger
  - vi. Low battery capacity
- l. The signal booster system shall include a built-in NOTIFIER® addressable monitor module for NOTIFIER® Fire Alarm Panel connection for monitoring the signal booster.
- m. The vendor shall verify the system monitoring requirements with the AHJ prior to system installation. System monitoring shall be fully compliant with the AHJ requirements.
- n. External filters, attachments or other aftermarket modifications of the original equipment shall not be accepted.
- o. All signal booster components shall be contained in a NEMA4-type approved waterproof cabinet. All enclosures shall be painted red with signage in bright yellow or as required by AHJ

## 6. Installation Requirements

- a. Assembly and installation of all components of the Emergency Responder Communication Enhancement System shall comply with all applicable sections of the National Electrical Code, NFPA-70 and the National Fire Alarm and Signaling Code, NFPA-72, NFPA 1221 current enforceable editions.
- b. At least 2 independent and reliable power supplies shall be provided as specified in sections 2 and 3 below.
- c. The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with NFPA-70 National Electrical Code, NFPA 72, National Fire Alarm and Signaling Code, 2010 edition and NFPA 1221 2016 edition.
- d. The emergency responder radio coverage enhancement system shall be equipped with a secondary source of power. The secondary source of power shall be a battery

system with a dedicated battery charger powered by a separate, dedicated twenty (20) ampere branch circuit. The secondary power supply shall supply power automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage enhancement system for a period of at least 24 hours. The battery system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a non-vented NEMA4 Type approved enclosure. Batteries shall be enclosed in a separate, vented NEMA 3R Type approved enclosure.

- e. The signal booster shall be designed to allow degraded performance in adverse conditions, such as high temperatures in the event of heat from a nearby fire, voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) are not acceptable. External UPS (Uninterruptable Power Supplies) are not acceptable. It is the purpose of this specification to assure the maximum possible level of communications to public safety personnel depending upon the signal booster, even to the extent of damaging the signal booster, as long as some communications benefit can be provided during the emergency.
- f. System design shall be such that neither the failure of the normal power source, the transfer to an emergency source, nor the re-transfer to the normal source shall cause a change in system status.
- g. The amplifier shall be housed in a 2-hour fire rated room or other suitable space as approved by the Engineer, or where specifically shown on the drawing.
- h. Radiating cable, if used, shall be run without conduit. All other cable can be run in conduit if required for mechanical protection of the cable, or where specified by the electrical engineer.
- i. RF Coaxial Cable shall be a fire-resistant, low-smoke type, U.L. classified as plenum. The classification shall be clearly marked on the outer surface of the cable regular intervals.

## 7. Acceptance and Test Procedures

- a. Acceptance testing for an in-building radio system is required upon completion of installation.
- b. The coverage testing shall be done in accordance with NFPA 72, National Fire Alarm and Signaling Code, 2010 edition, NFPA 1221 2016 edition and as required by the local AHJ
- c. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio Operator License.
- d. All test records along with system diagrams, equipment specifications, user manuals, RF link budget calculations, battery backup calculation and other design data shall be submitted upon completion of the project.

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## DIVISION 32 – EXTERIOR IMPROVEMENTS

### SECTION 32 1313 – CONCRETE PAVING

#### A. GENERAL

1. 4" thickness for standard pedestrian travel and 7" for truck access, including (especially) fire truck lanes. 5000 psi Fibermesh concrete in both mix designs. NO WIRE MESH.
2. Both walk designs should be built on 95% compacted earth, or suitable granular fill to match.
3. Expansion control and crack jointing shall be tooled in wet concrete, in panels nominally equal to the width of the sidewalk, as a minimum. Saw cutting of joints is not recommended.
4. Expansion control joints are developed with ½" cane board and sealed with backer rod and pourable NP 701 sealant or equal joint sealer.
5. BOTH 4" and 7" truck access walks shall have greased/sleeved ½" steel dowels, spaced 30" maximum at all expansion joints and reinforcement at corners/radius to prevent cracking. All sidewalks shall thicken in depth at these expansion joints to accommodate the dowel to a maximum of 8" depth.
6. The vehicular access walks shall be a minimum of 10 feet wide, 12 feet preferred, and if fire trucks drive on 10 feet walks there shall be 'GrassPave' to make up the difference.
7. Provide 8'-0" wide sidewalk for maintenance golf cart path.
8. Medium to stiff broom finish, depending on walkway gradient, and perpendicular to path of travel. Apply 'Cure and Seal' or similar application after the concrete is finished. Backfill to grade with topsoil after forms are removed, and straw/seed per landscaping specifications.

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**SECTION 32 1416 – BRICK UNIT PAVING**

**A. GENERAL**

1. No pavers permitted.

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**SECTION 32 1700 – PAVING SPECIALTIES****A. GENERAL**

1. Street and parking lot layouts shall comply with standards of municipality in which project is located.
2. Select traffic pavement type for specific soil conditions and anticipated loading. Use Georgia Department of Transportation standard pavement specifications.

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**SECTION 32 3100 – FENCES & GATES**

**A. GENERAL**

1. All chain link fencing should be black vinyl.

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**SECTION 32 3300 – SITE FURNISHINGS**

**A. GENERAL**

See Appendix.

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**SECTION 32 8000 – IRRIGATION****A. GENERAL**

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

**B. MANUFACTURERS**

1. Rainbird, Maxicom compatible, components.
2. Any Maxicom hardware must be installed by a certified installer.

**C. LOCATIONS**

1. 12-month drip in landscaped areas. Permanent irrigation only as required by project specific programmatic requirements
2. Provide for all landscaped areas
3. Provide drip irrigation in all planting areas against the building.
4. Provide sprinkler for turf grass
5. Fixed spray irrigation using standard 12" pop up sprinklers shall be installed in all annual and perennial beds.
6. 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" minimum above grade.

**D. COMPONENTS**

1. All isolation valves shall be full port brass valves located inside a 10" valve box.
2. Install within 10" 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.
3. 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 LJF wire, blue in color.
4. Flow meter shall be installed after the master valve using the manufacturing installation 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.
5. Brass quick connects shall be placed around the property allowing for easy access to water.
6. All electric valves shall be installed in a 10" valve box.
7. Communication wire must meet all Maxicom specifications.

8. Controller must have the ability to communicate with the Maxicom Cluster Control Unit.
9. Drip irrigation shall be staked to stable ground every 4'.
10. All wire connectors must include a wire nut enclosed inside a waterproof gel.
11. Any above ground irrigation line must be installed using Sch. 40 PVC.
12. Install Sch. 80 PVC under roadways, walkways, etc.

## **SECTION 32 9000 – PLANTING**

### **A. GENERAL**

1. To the fullest practical extent possible, add soil amendments to planting & turf areas in a manner recommended by KSU Plant Operations Grounds Department.
2. Provide one (1) year maintenance contract
3. Refer to Appendix for KSU Plant List.
4. Provide bollards where there are vehicular passageways i.e. loading docks, driveways next to building. This is to protect the building, dock, etc. from vehicular damage. See Appendix.
5. Do not plant in proximity of underground sewer lines.
6. Provide a paved access up to building for maintenance.

### **B. TURFS AND GRASSES**

1. Grass should be replaced between April 1 and September 1 as follows: Match existing turf with Tifton Tifway '419' Bermuda grass sod or Meyer Zoysia grass sod. (Annual Rye grass may be used, 400 pounds per acre, only if restoration takes place outside of the above time frame). Match existing mulch with Hardwood Blend dyed Forest Brown (made by Wood Tech).

### **C. PLANTING ACCESSORIES**

See Appendix

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## **DIVISION 33 – UTILITIES**

### **SECTION 33 0010 – GENERAL UTILITY REQUIREMENTS**

#### **A. GENERAL**

1. All devices containing significant amounts of oil (electrical transformers, generators, elevator pistons, etc.) to have EPA approved containment to prevent flow into storm drain systems.
2. Design drainage structures and surface runoff to remove water efficiently from the site with proper retention as required. Water runoff to be retained on site with an engineered underground structure with appropriate release rates, (if needed). No above ground ponds or weirs are allowed unless approved by Owner in writing.
3. Use PVC outside sewer pipe- except under street or slab use ductile iron, concrete lined.
4. Provide Trace Tape for all underground utilities including fiber optic cable.
5. Street and parking lot layouts shall comply with standards of municipality in which project is located.

**END**

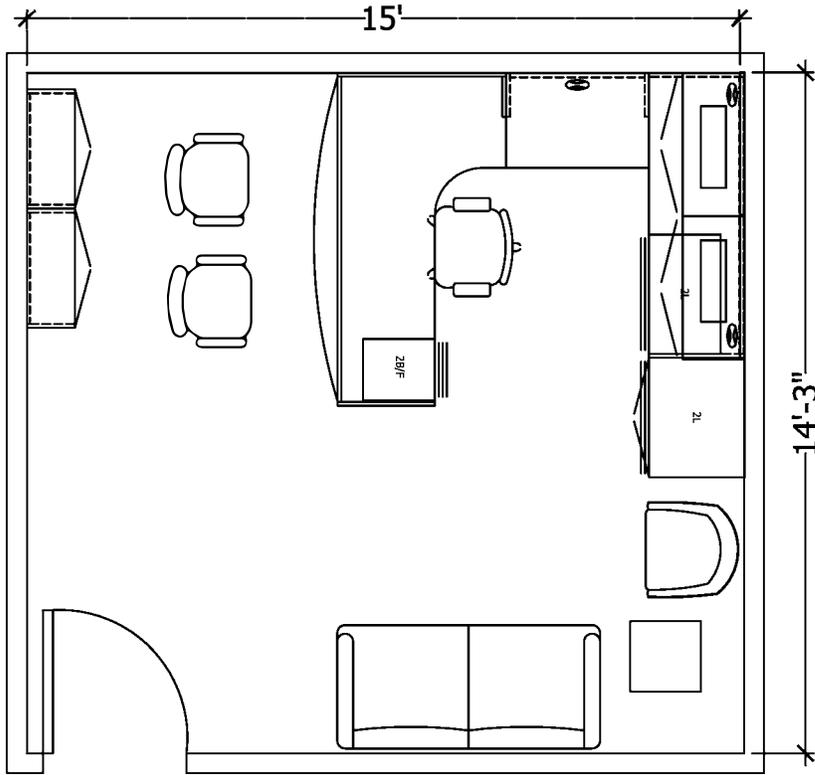
# APPENDICES

- APPENDIX 01 – FURNITURE DESIGN CRITERIA – PLANS/AXONOMETRICS
- APPENDIX 02 – PROTOTYPICAL ROOM DESIGN CRITERIA – PLANS/ELEVATIONS (*UNDER DEVELOPMENT*)
- APPENDIX 03 – TELECOM/DATA INFRASTRUCTURE SPECIFICATIONS
- APPENDIX 04 – AUDIO VISUAL DESIGN CRITERIA
- APPENDIX 05 – ENVIRONMENTAL, HEALTH & SAFETY
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- APPENDIX 07 – REGISTERED VISITOR & PARKING REQUIREMENTS
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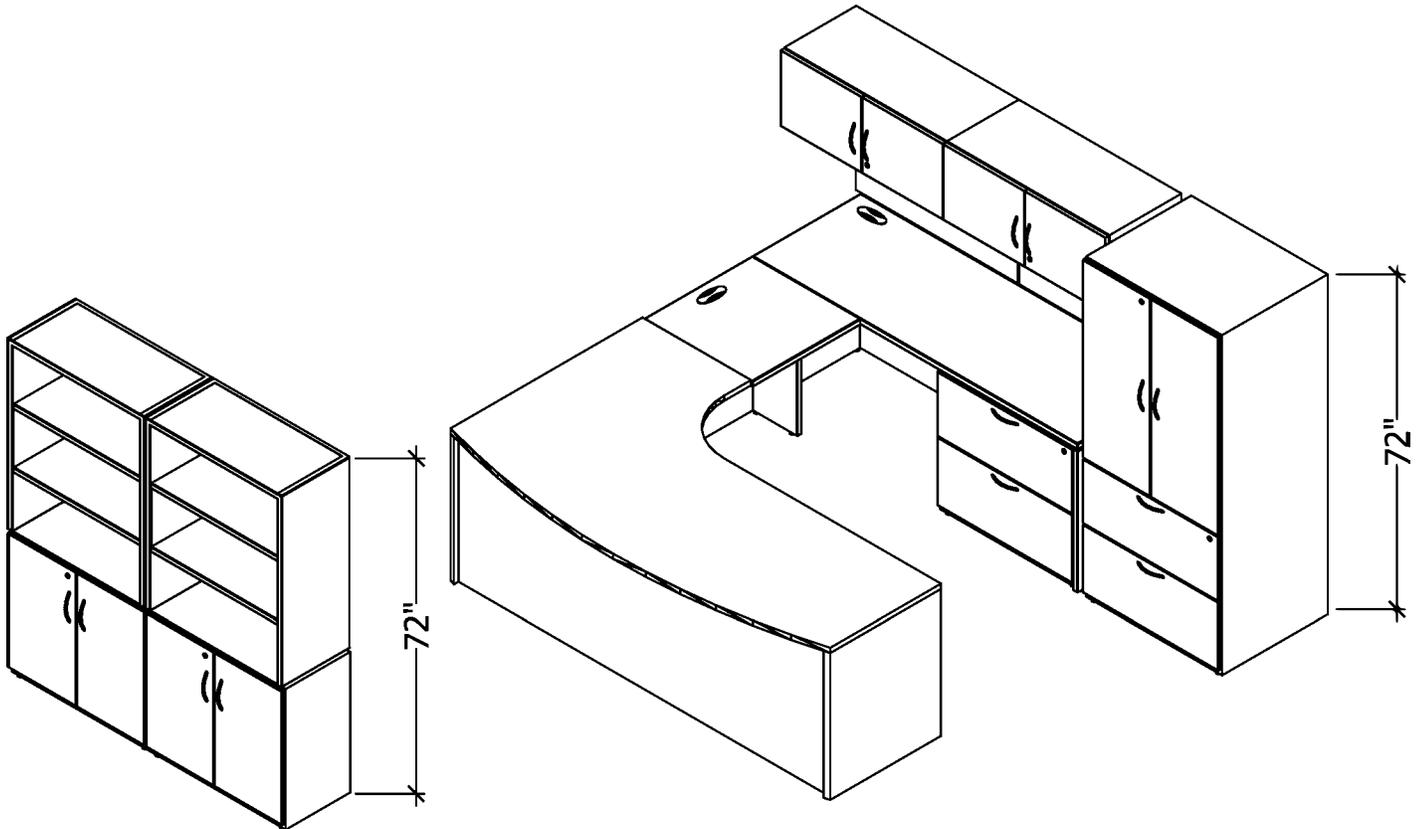
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**APPENDIX 01 – FURNITURE DESIGN CRITERIA – PLANS/AXONOMETRICS**

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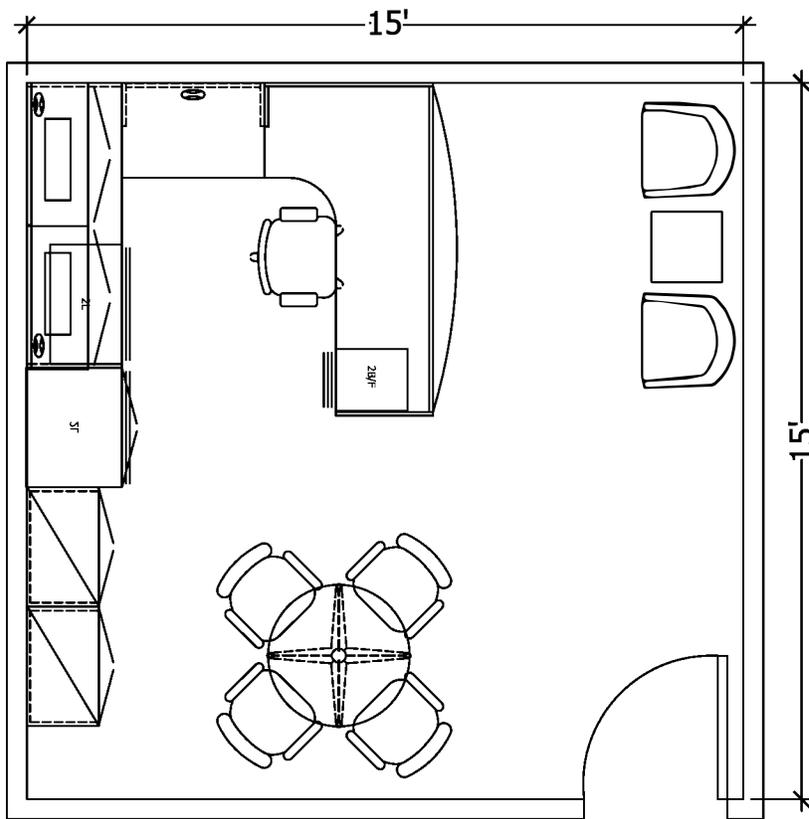
**F1**  
**Option 1**  
**220 sqft**



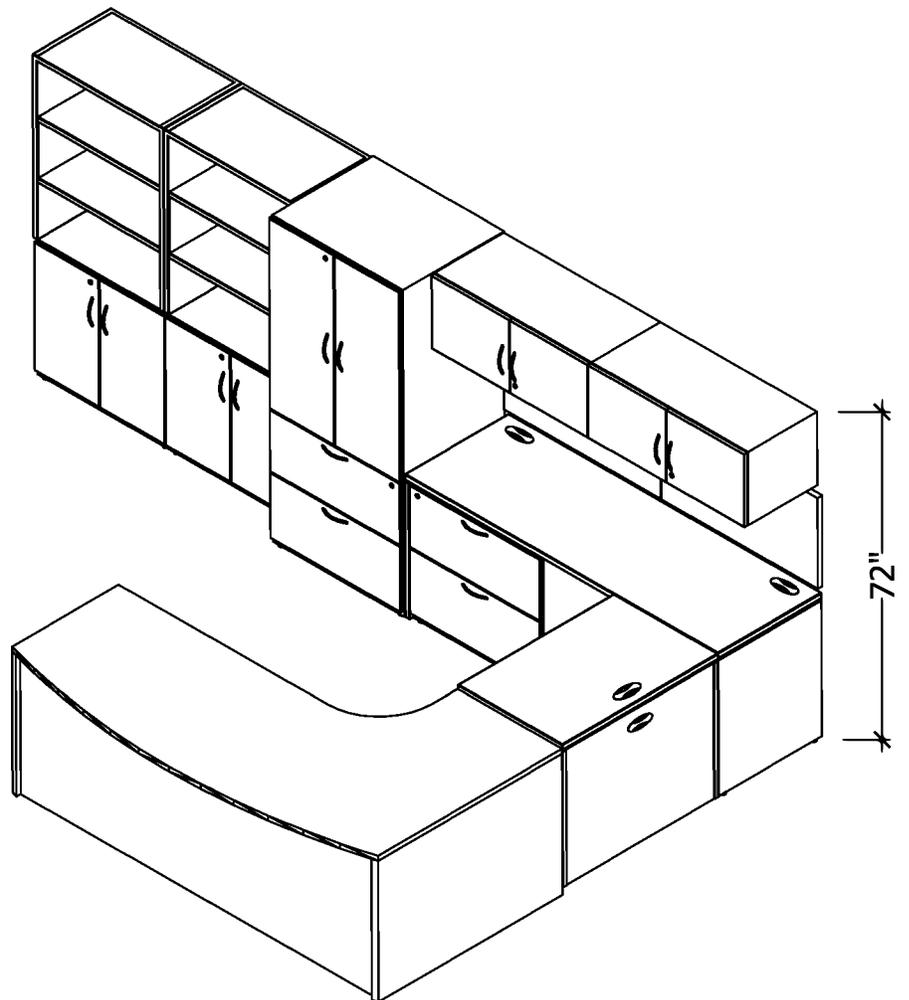
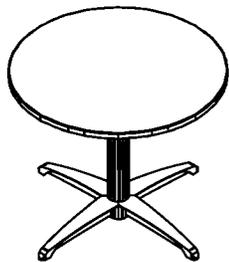
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 BY JOG  
 SCALE NTS



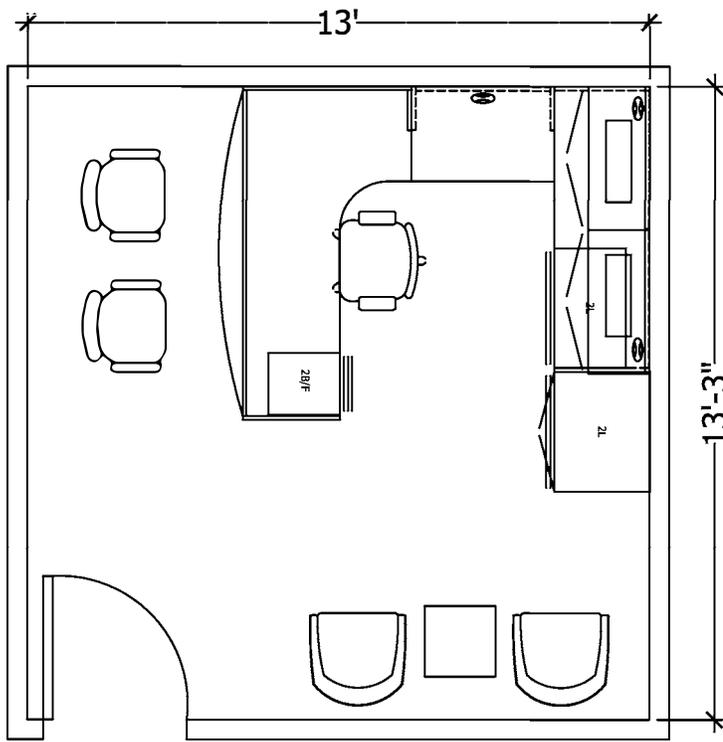
F1  
Option 2  
220 sqft



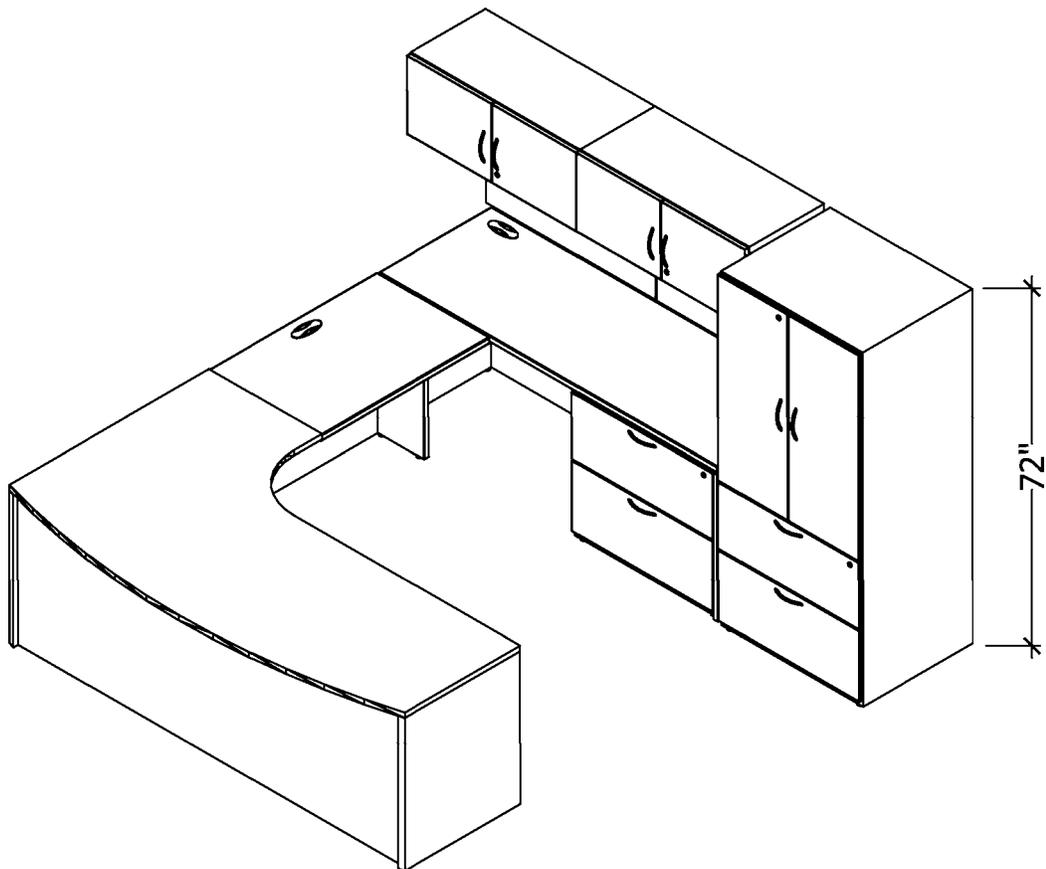
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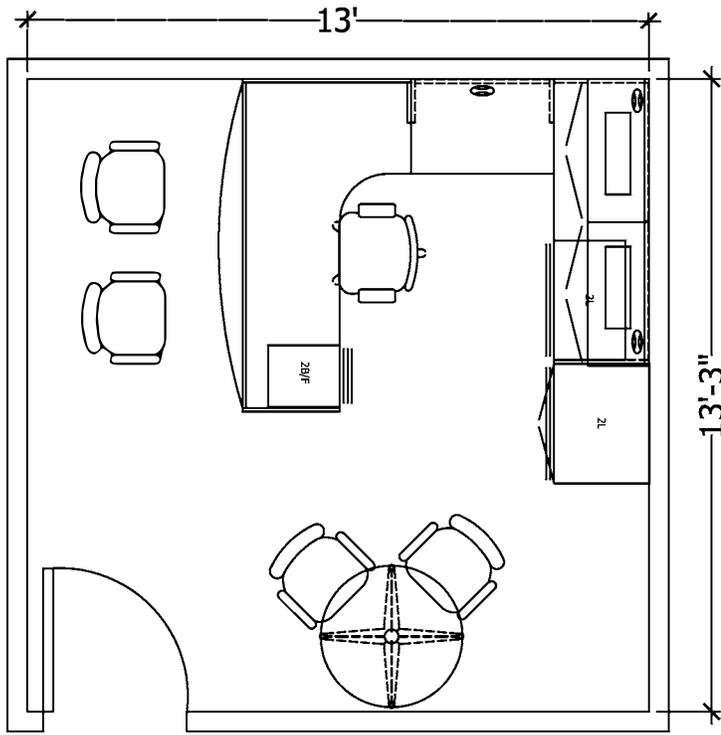
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Option 1  
175 sqft



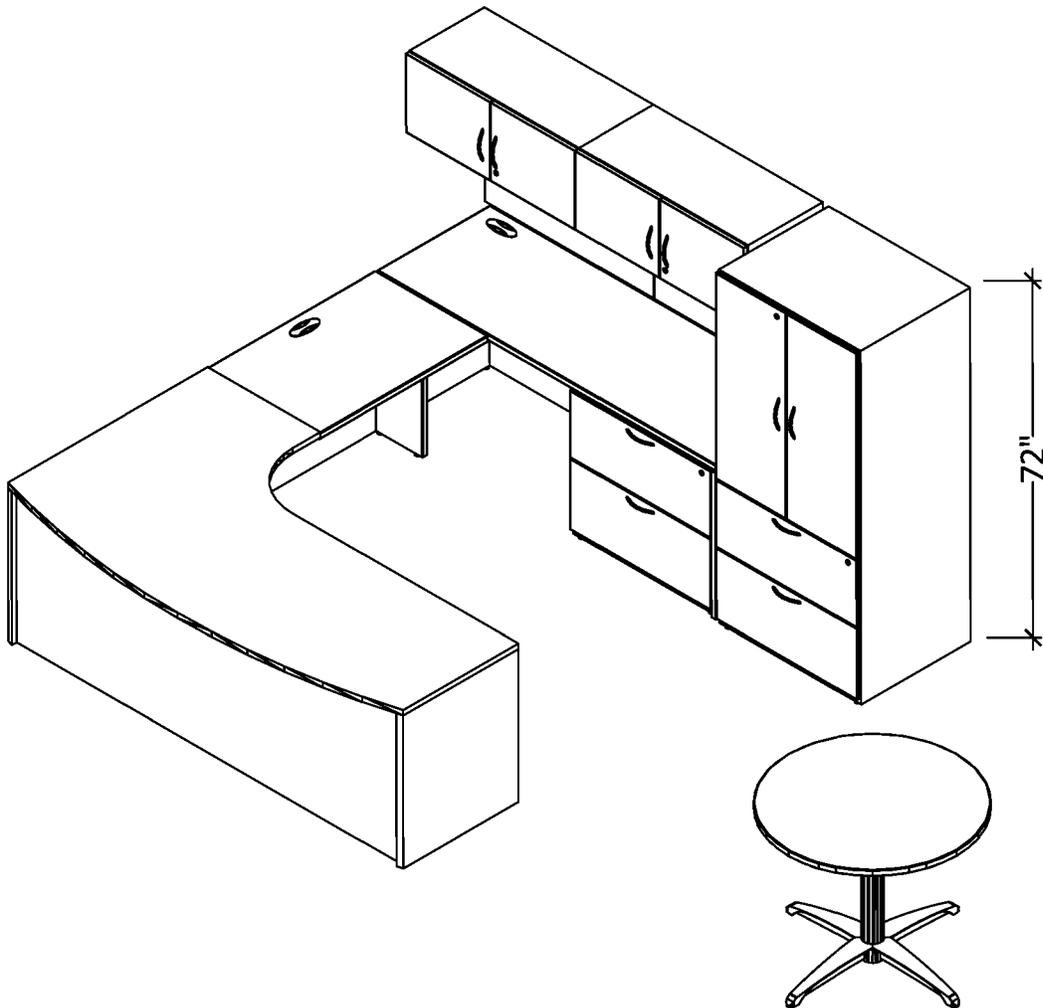
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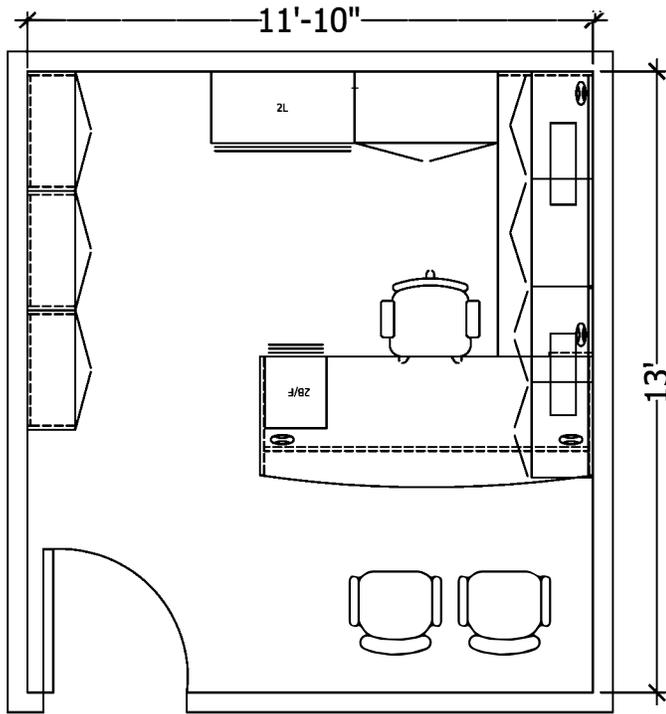
F2  
Option 2  
175 sqft



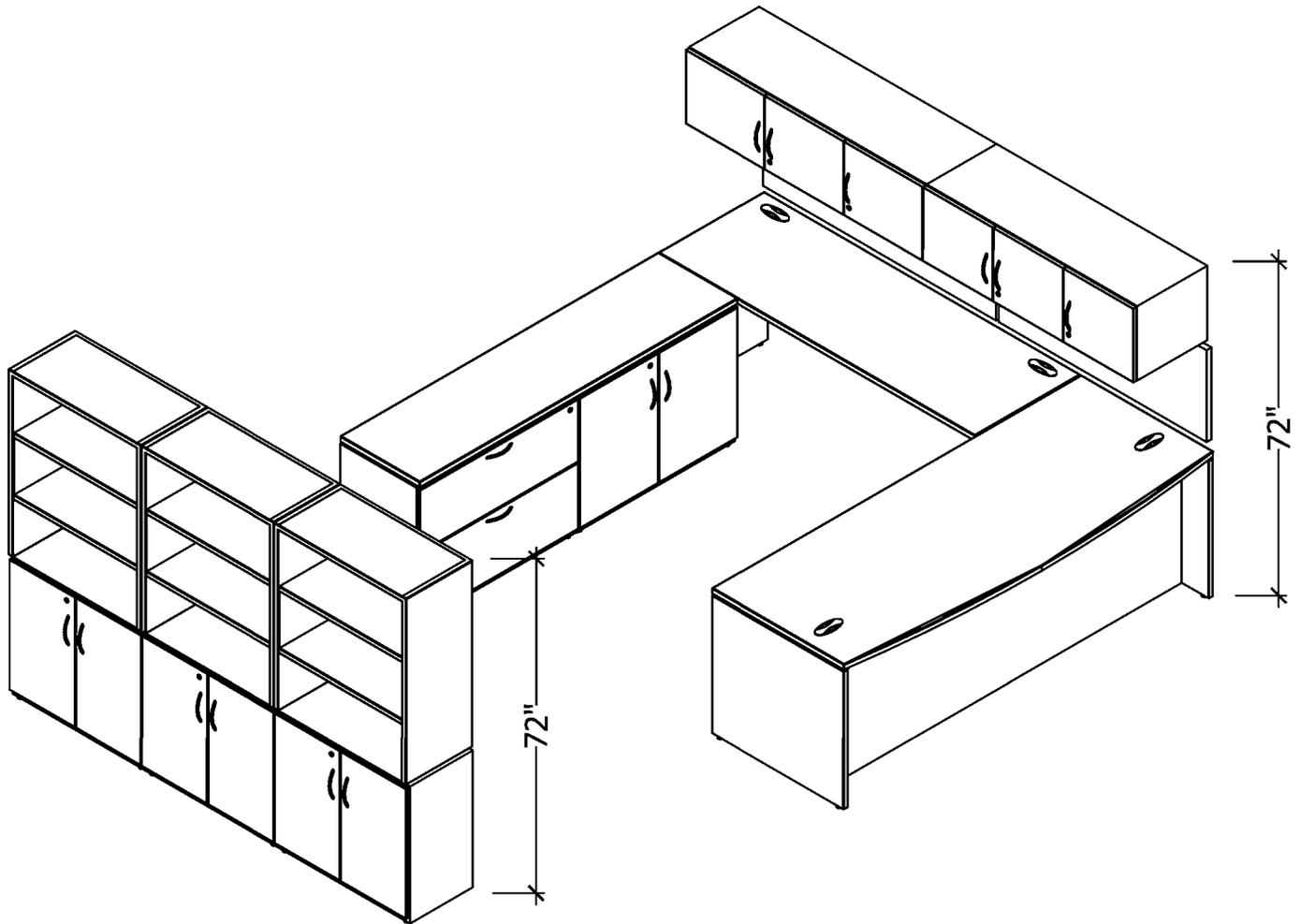
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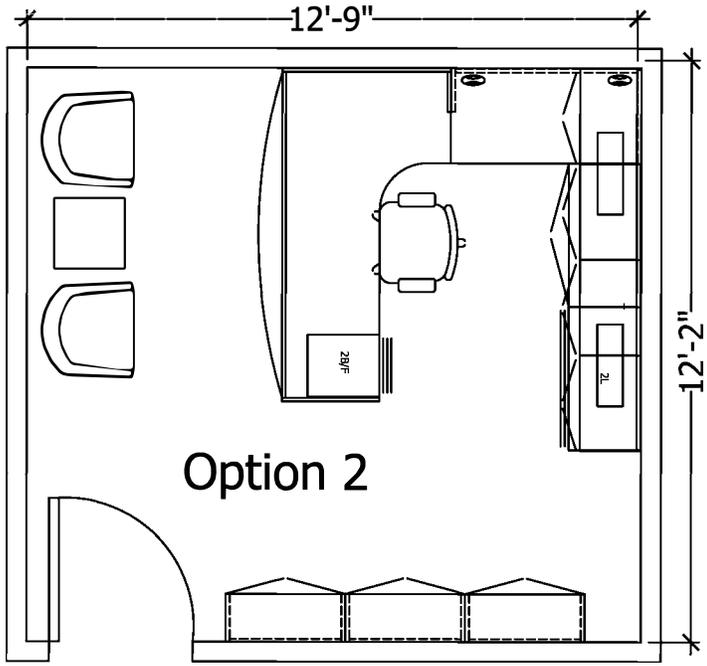
**F3**  
**Option 1**  
**150 sqft**



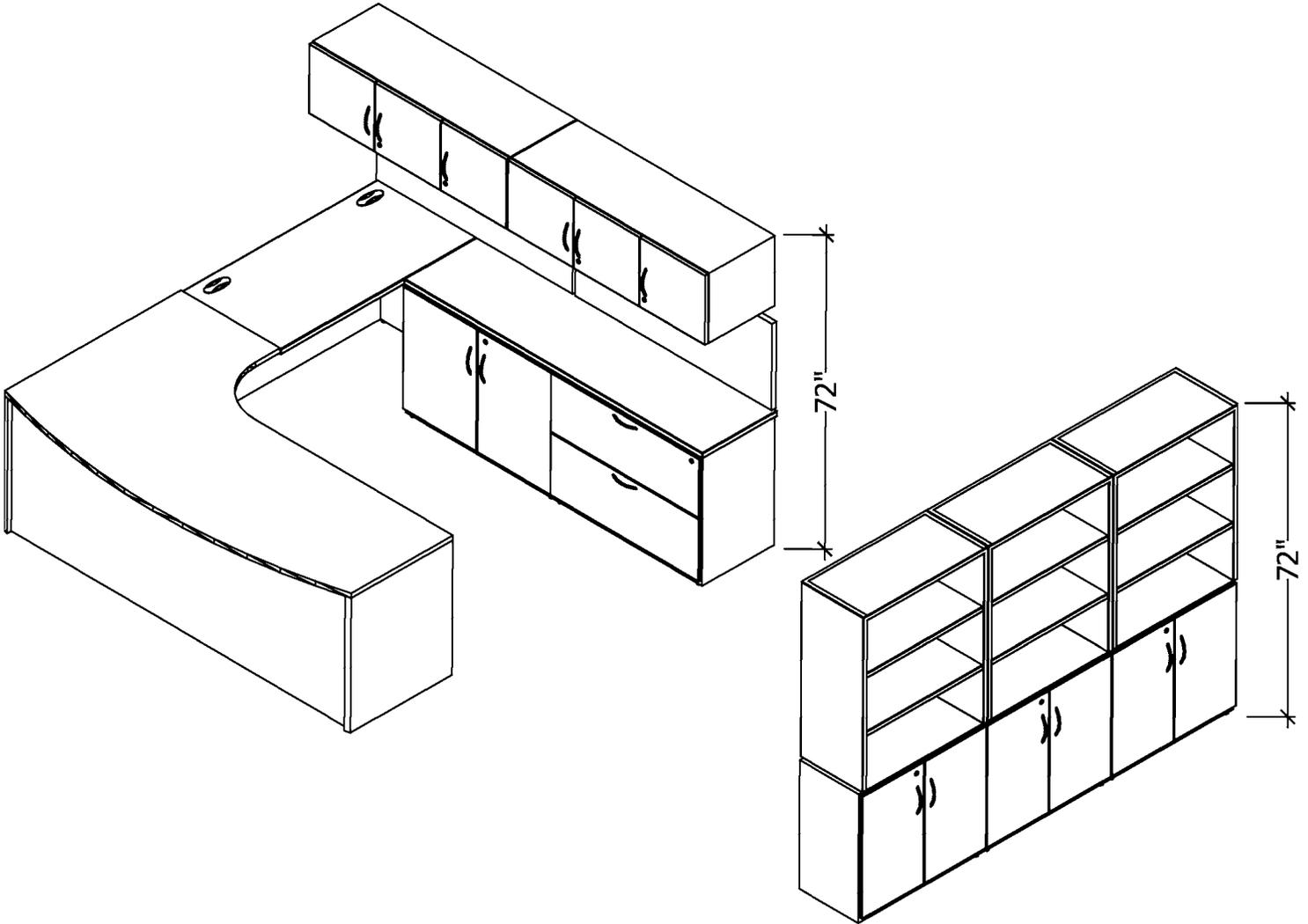
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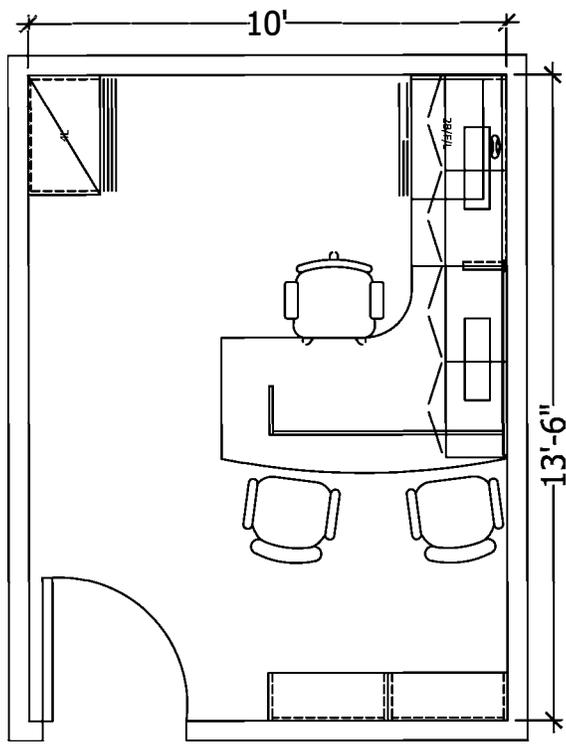
F3  
Option 2  
150 sqft



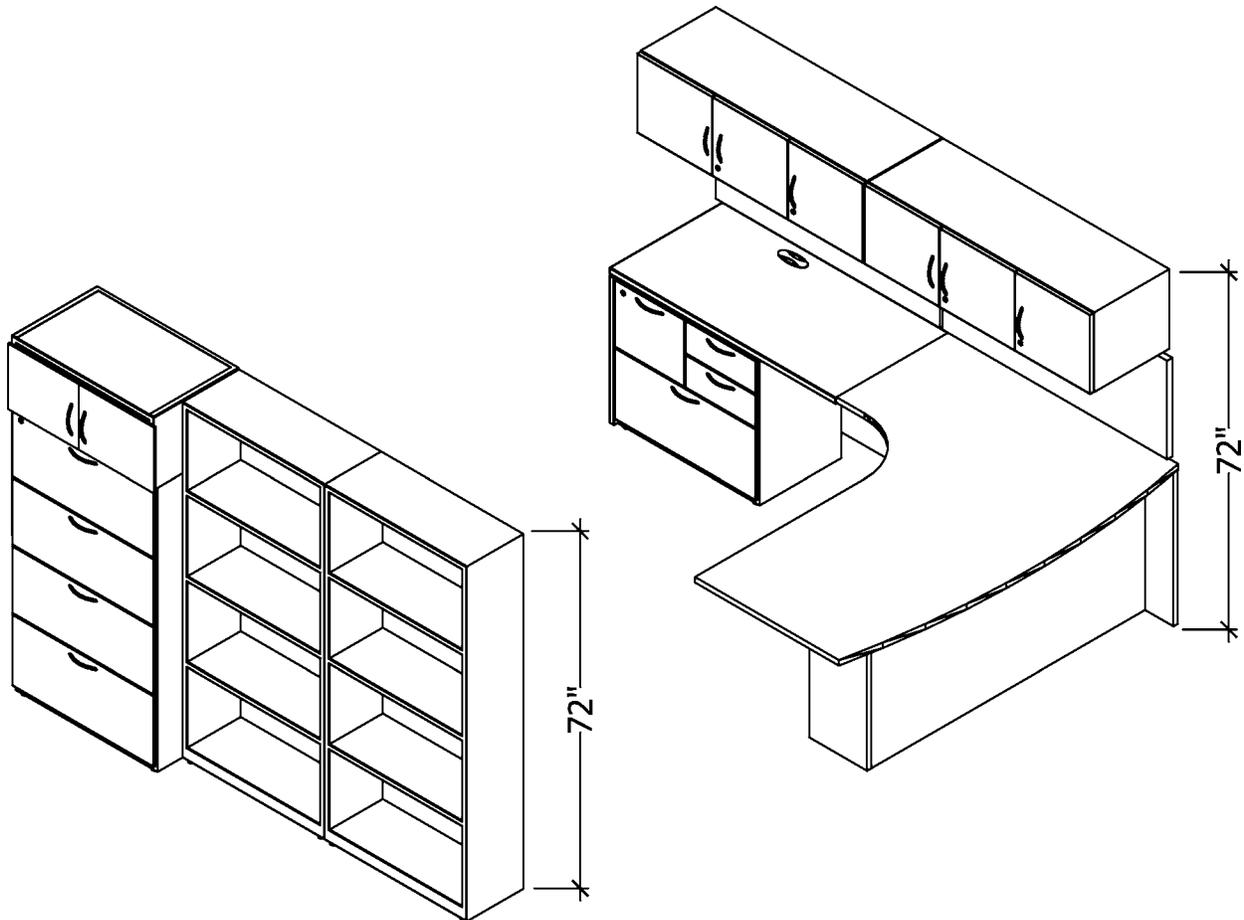
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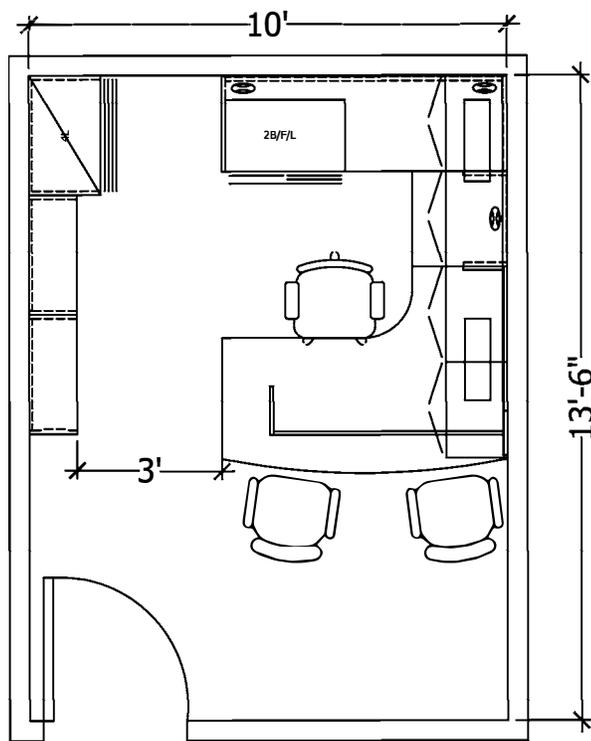
F4  
 Option 1  
 135 sqft



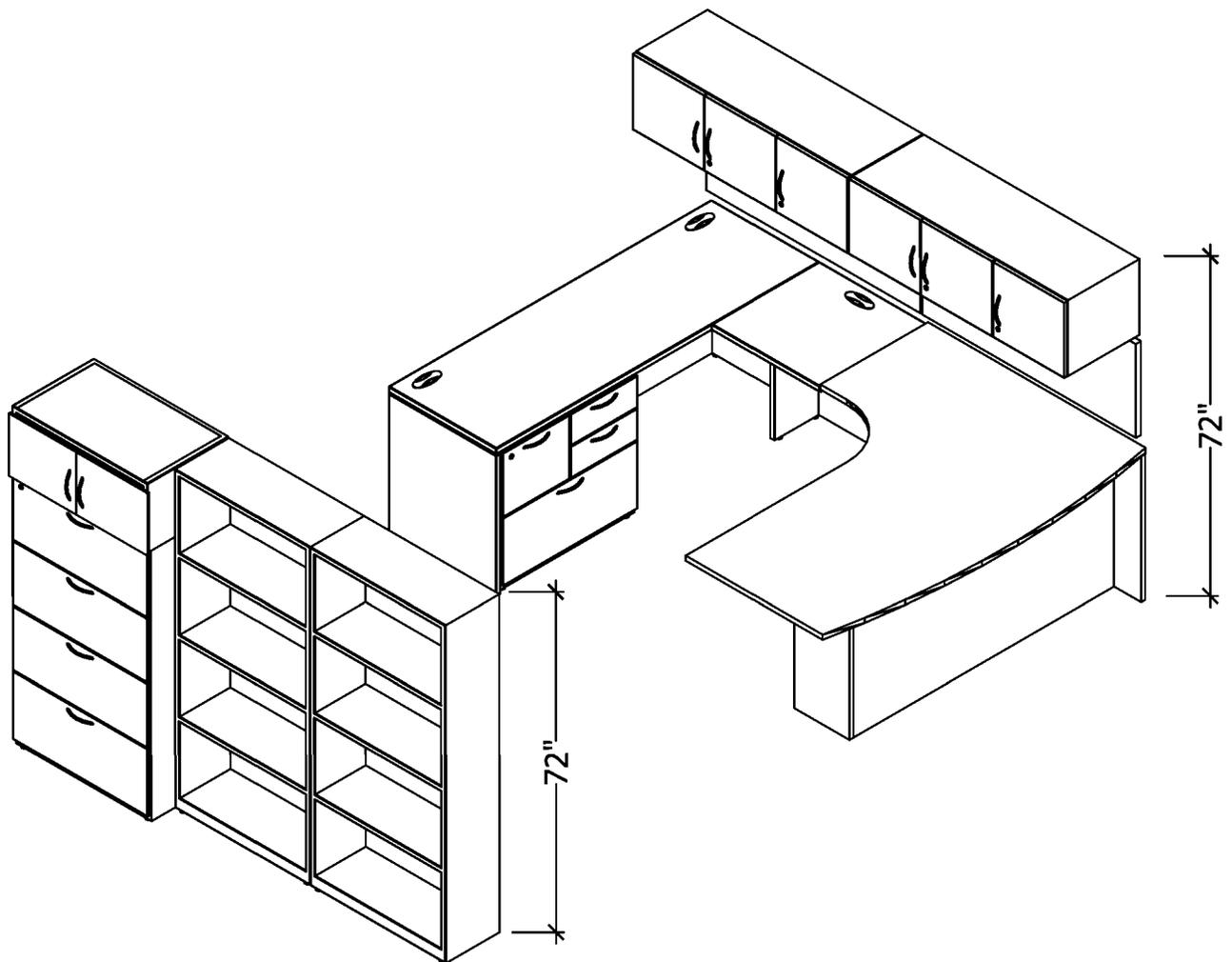
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 SCALE NTS



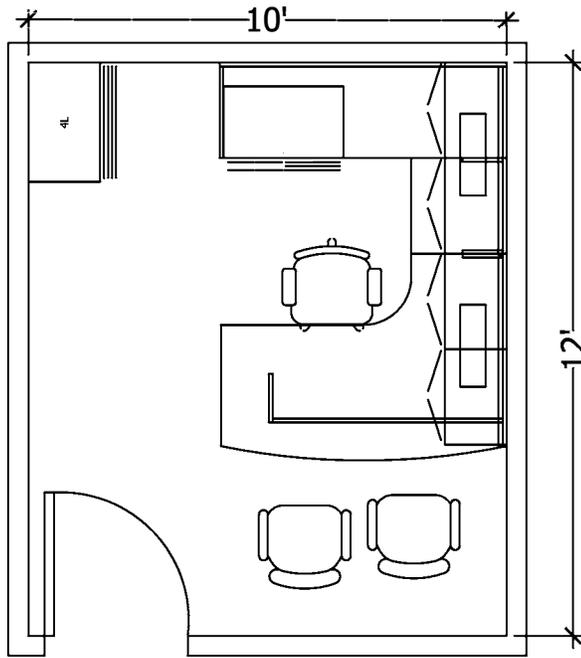
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 Option 2  
 135 sqft



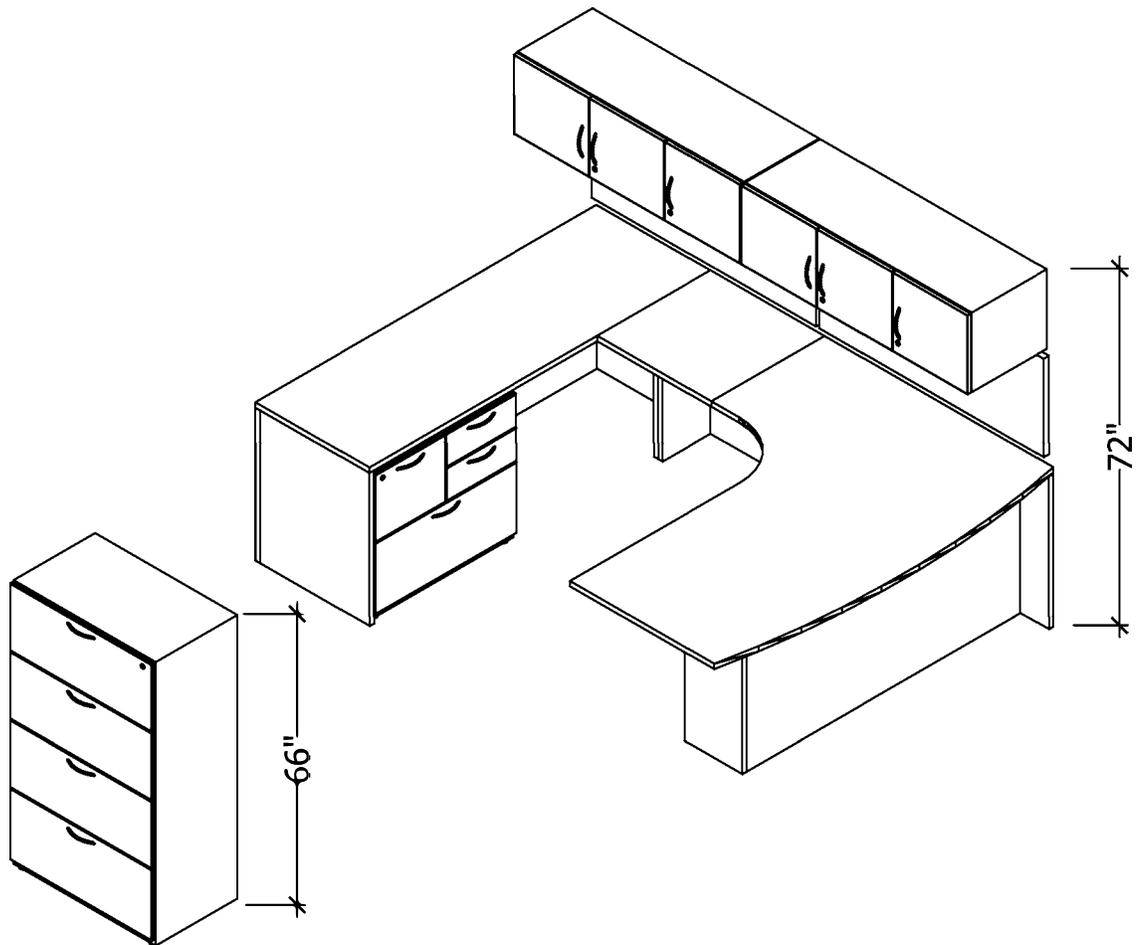
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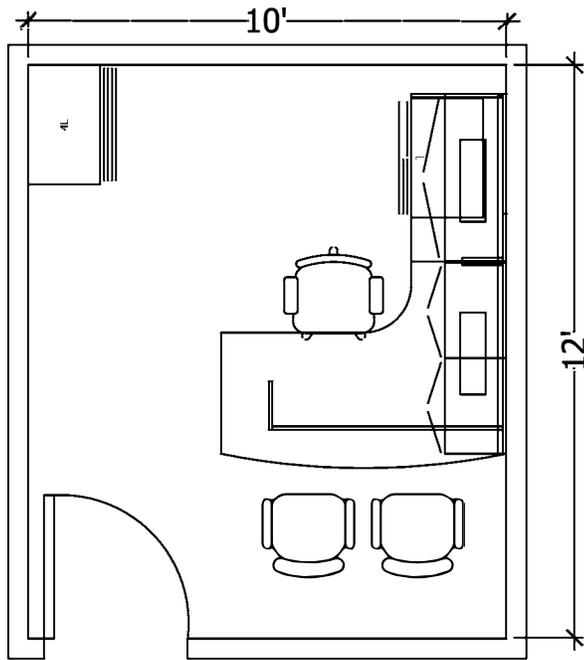
F5  
Option 1  
120 sqft



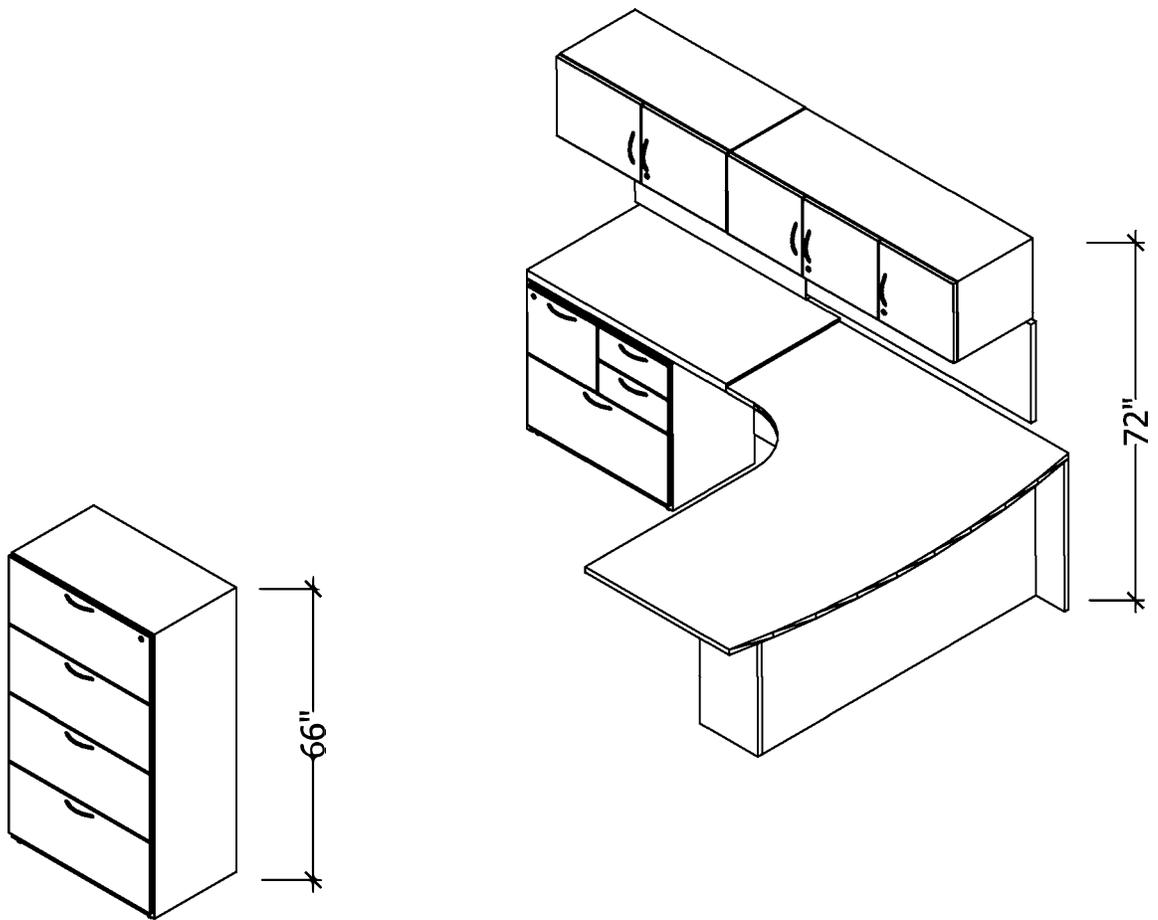
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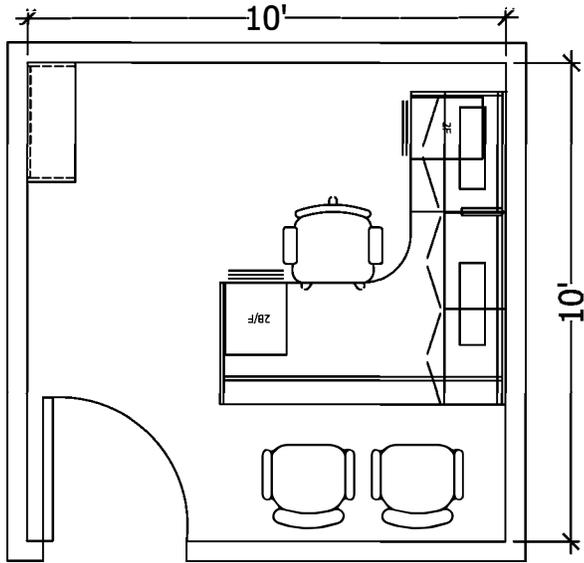
F5  
Option 2  
120 sqft



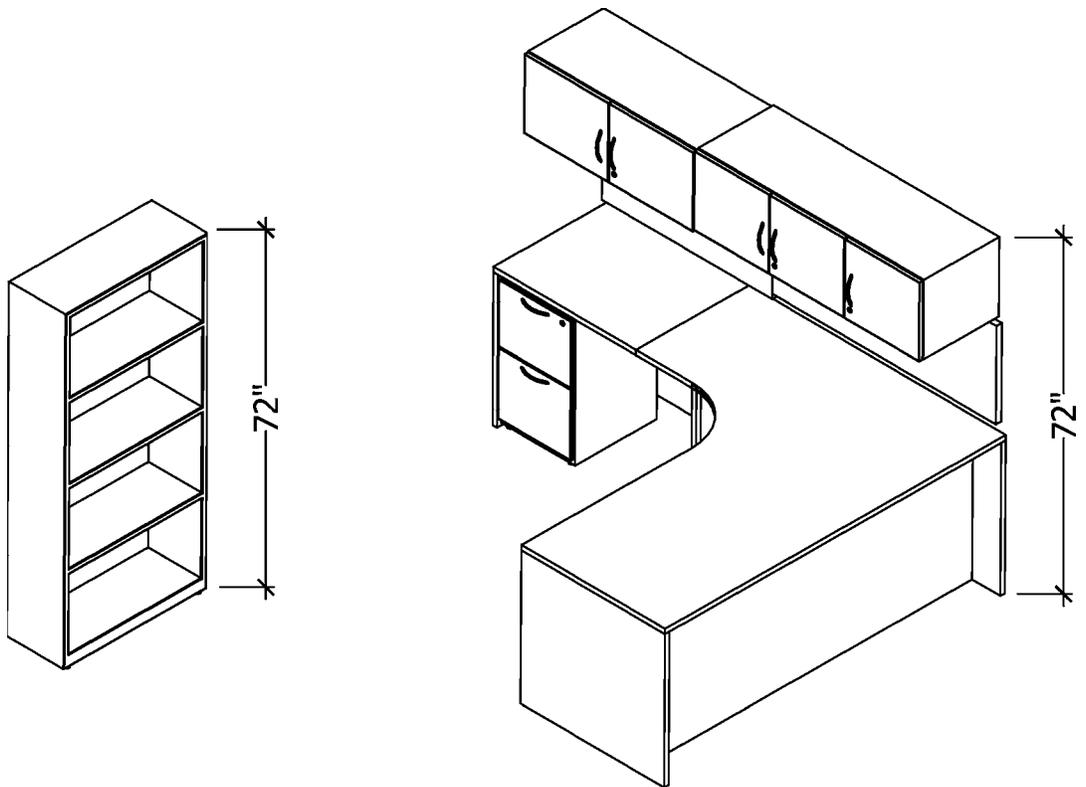
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BY JOG  
SCALE NTS



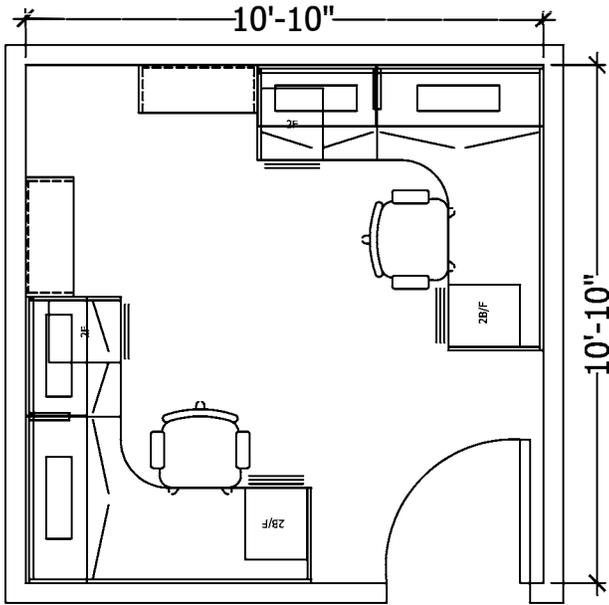
F6  
Option 1  
100 sqft



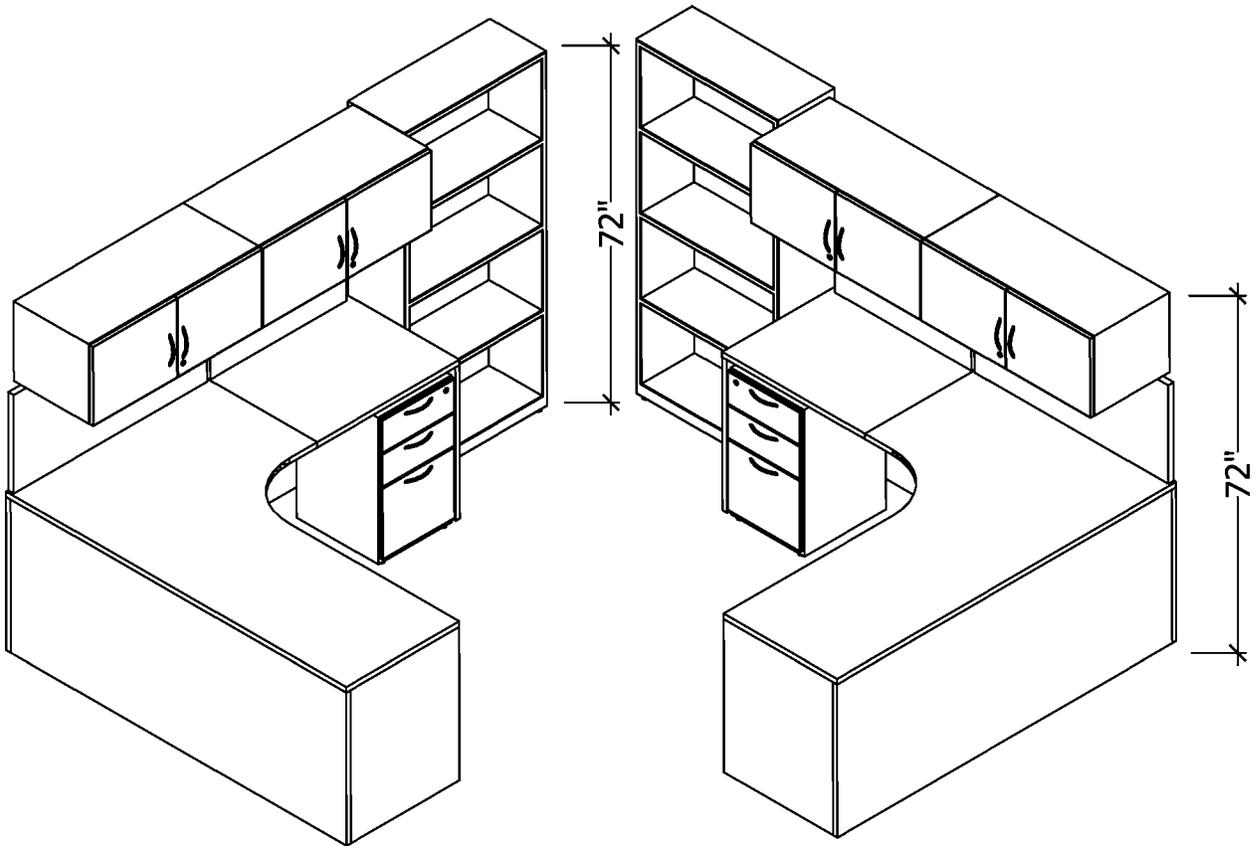
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BY JOG  
SCALE NTS



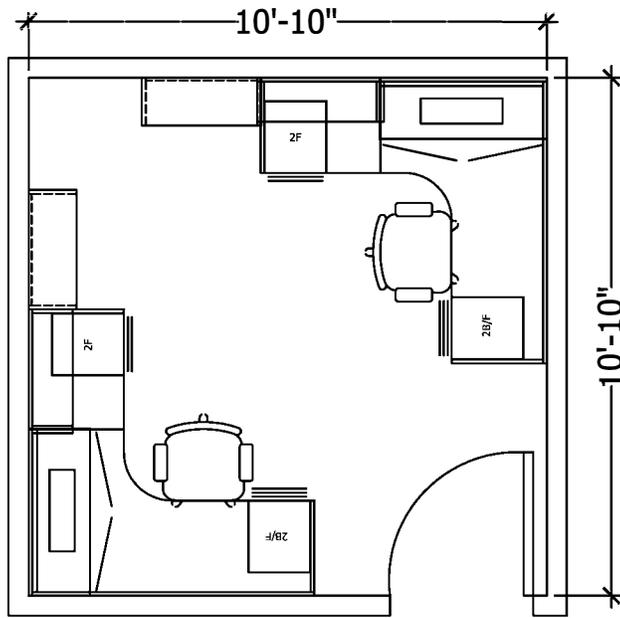
F6  
 Shared Space  
 Option 1  
 120 sqft



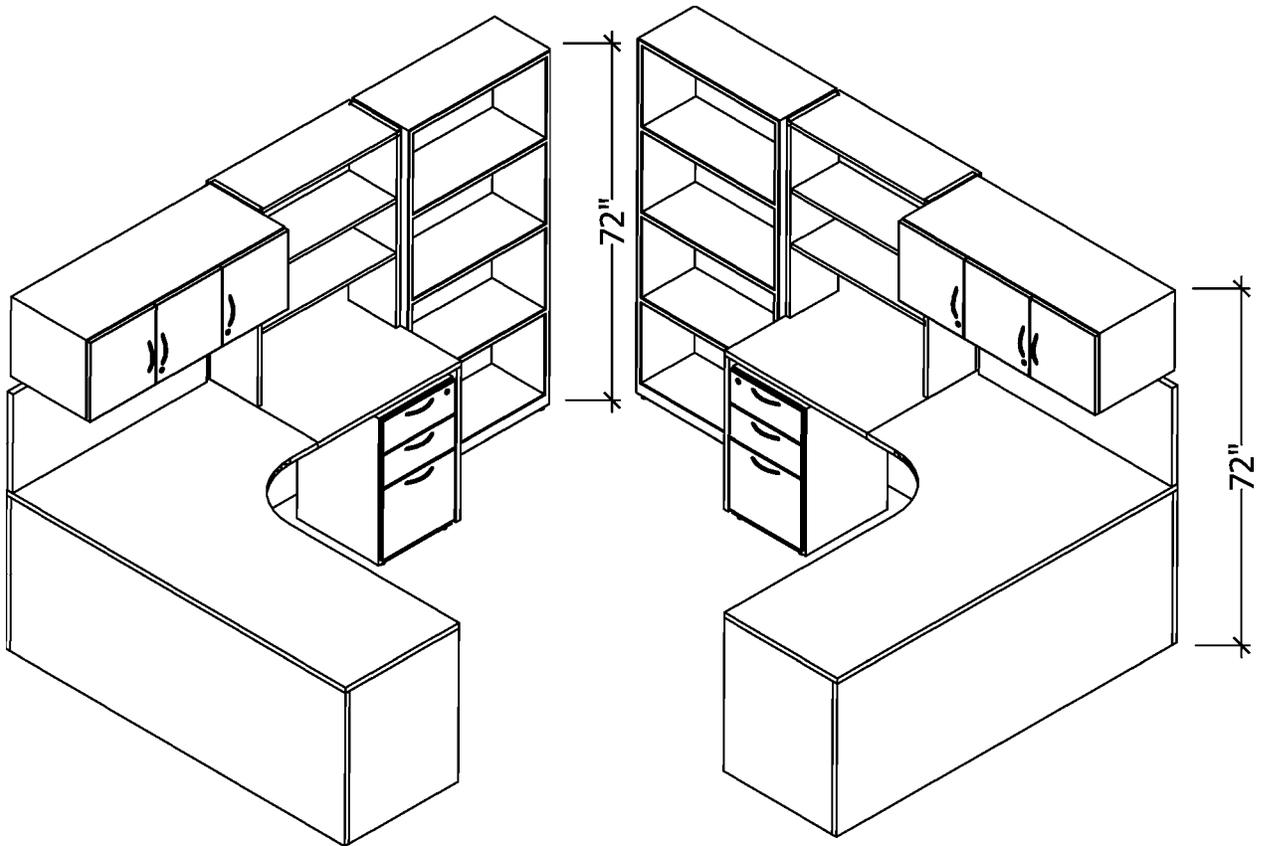
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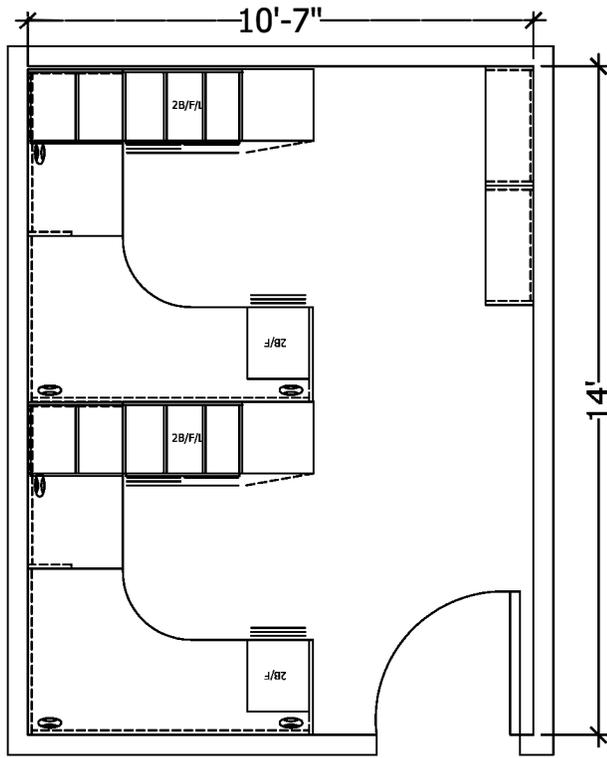
KSU Faculty Office/Furniture Standards  
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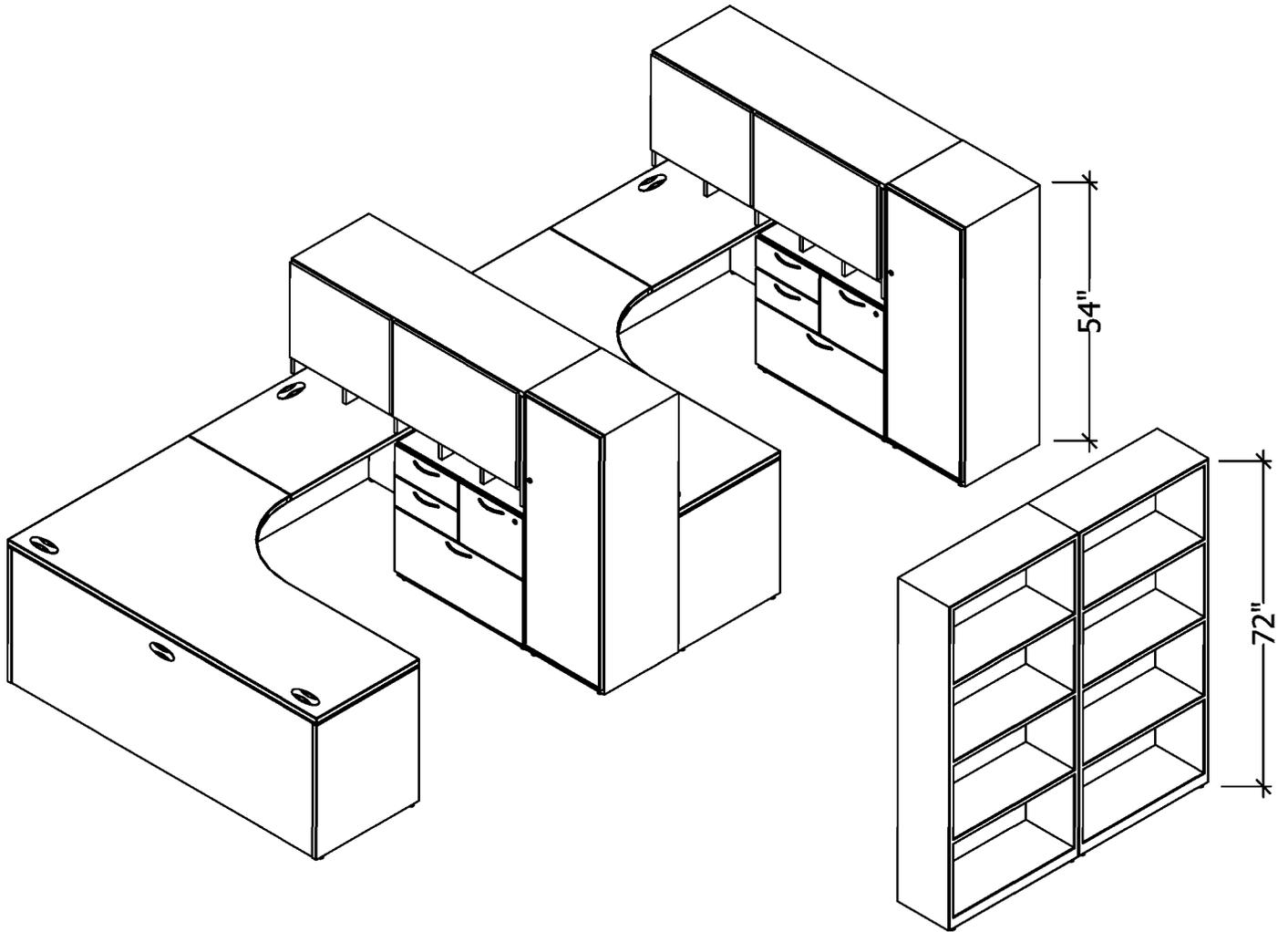


F6  
 Shared Space  
 Option 2  
 120 sqft





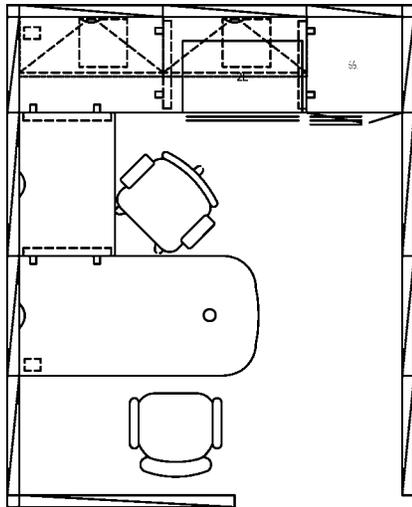
F6  
 Shared Space  
 Option 3  
 150 sqft



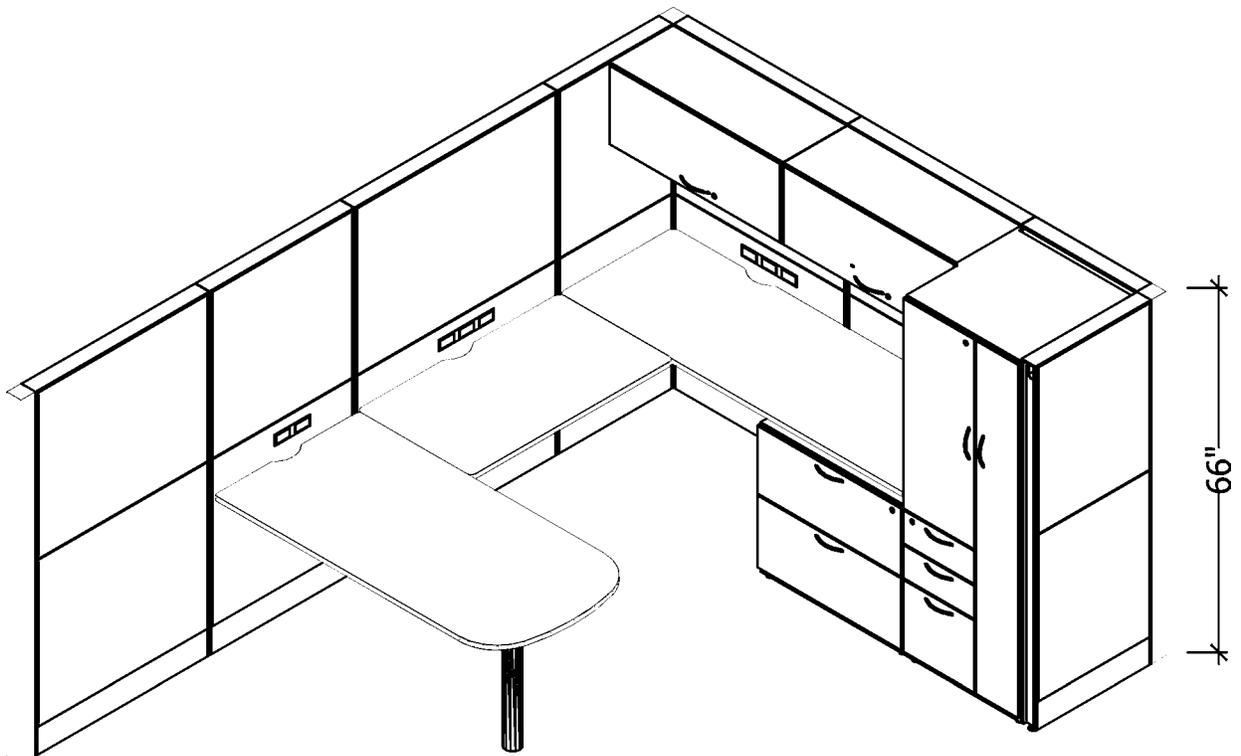
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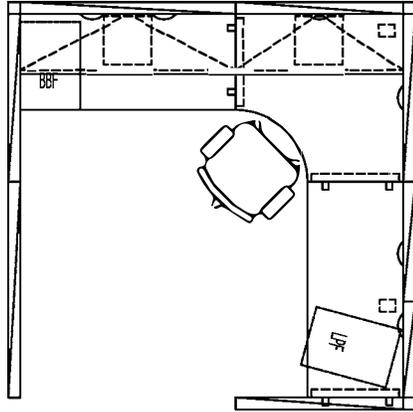
F7  
8x8



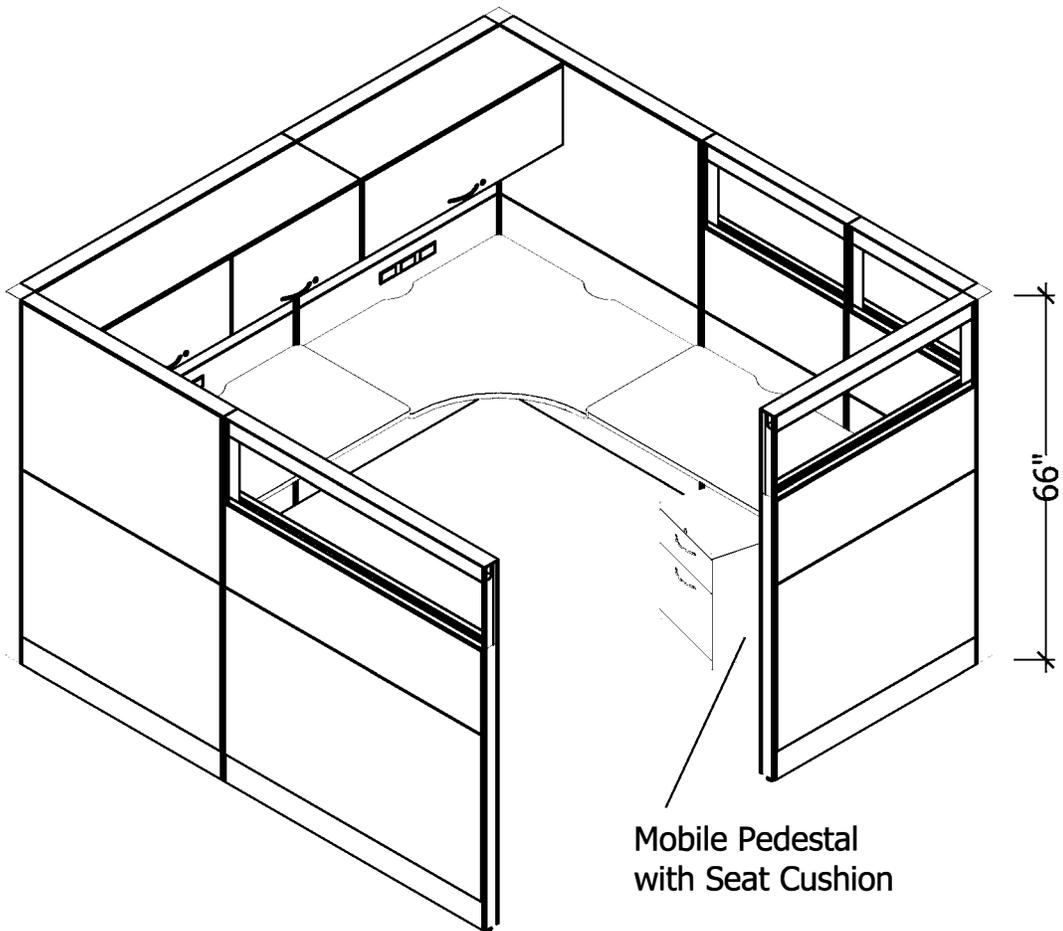
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F8  
Option 1  
8x8

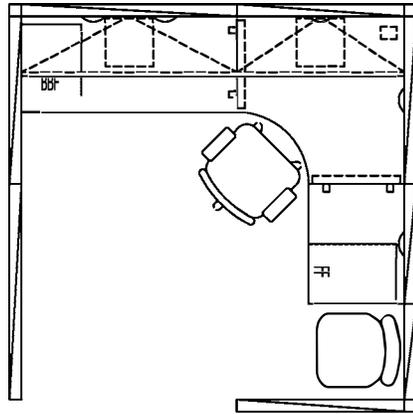


Mobile Pedestal  
with Seat Cushion

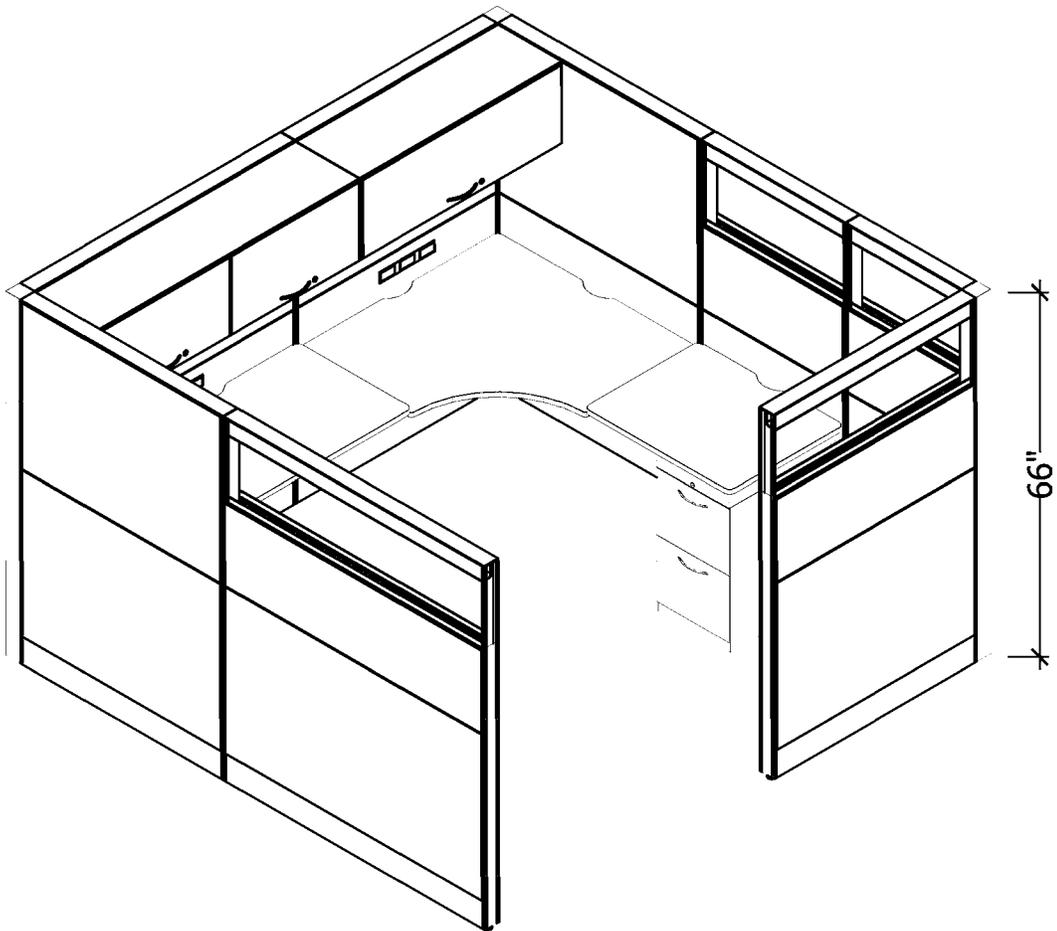
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BY JOG  
SCALE NTS



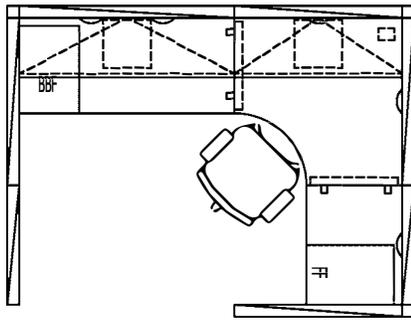
F8  
Option 2  
8x8



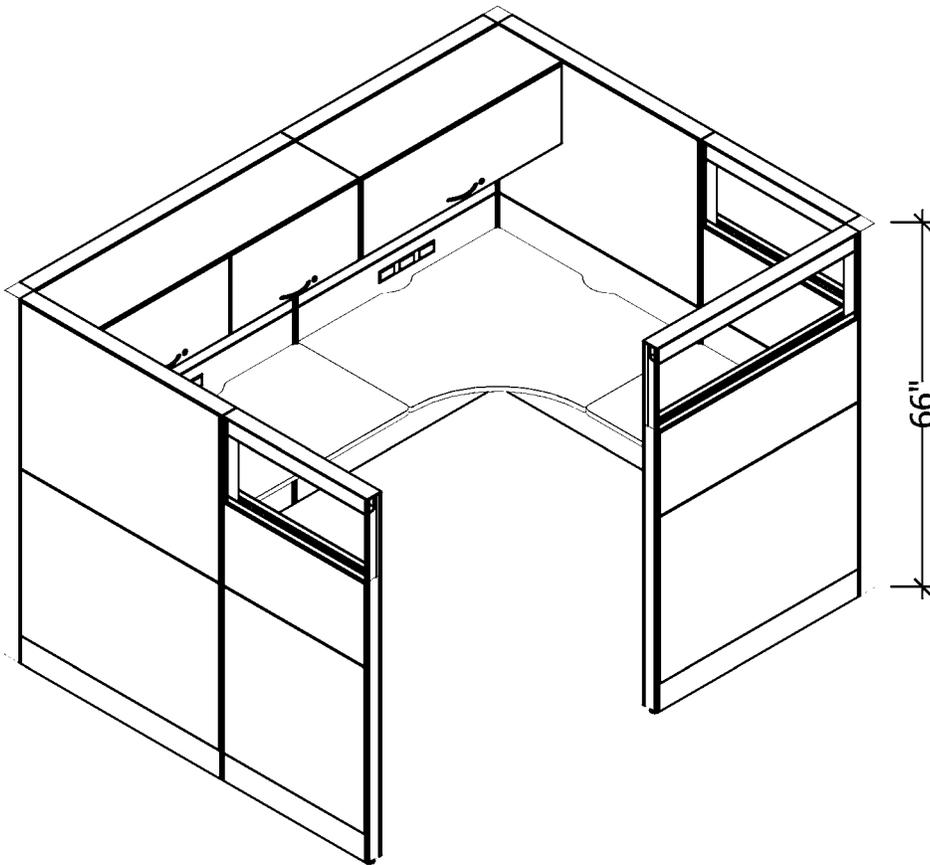
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BY JOG  
SCALE NTS



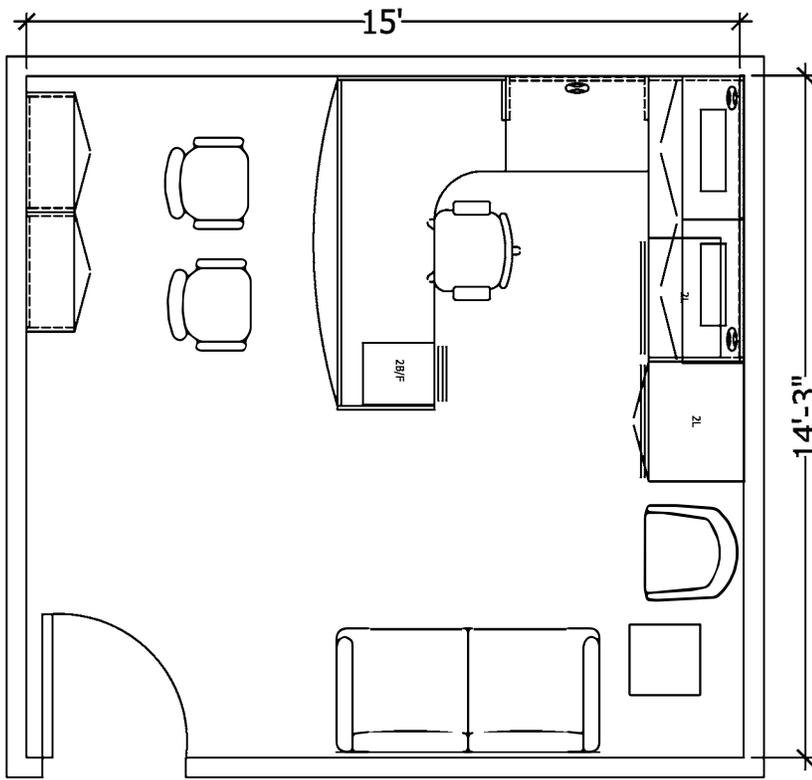
F9  
8x8



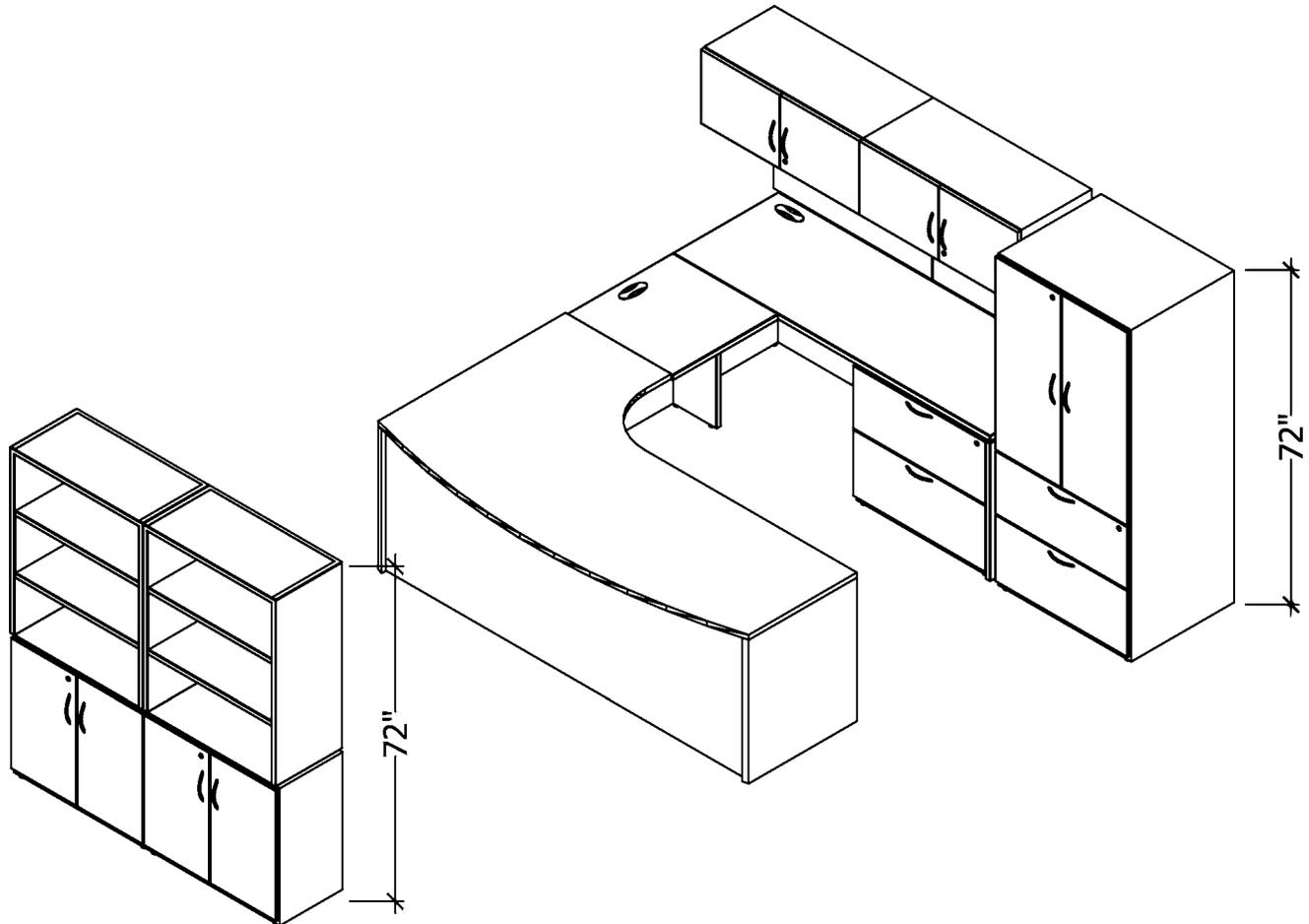
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BY JOG  
SCALE NTS



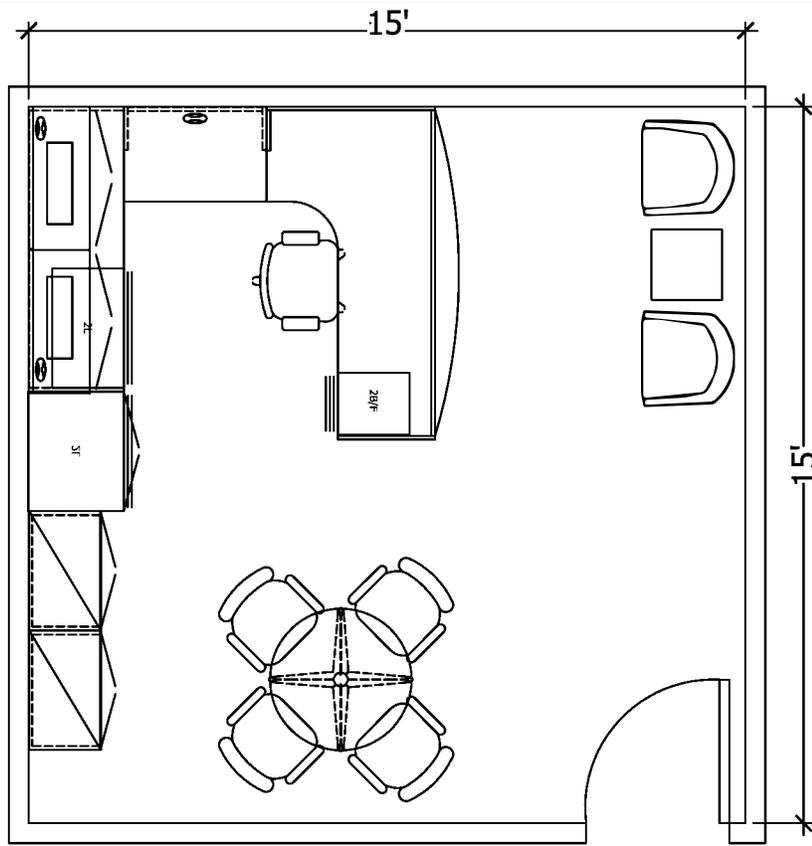
**S1**  
**Option 1**  
**220 sqft**



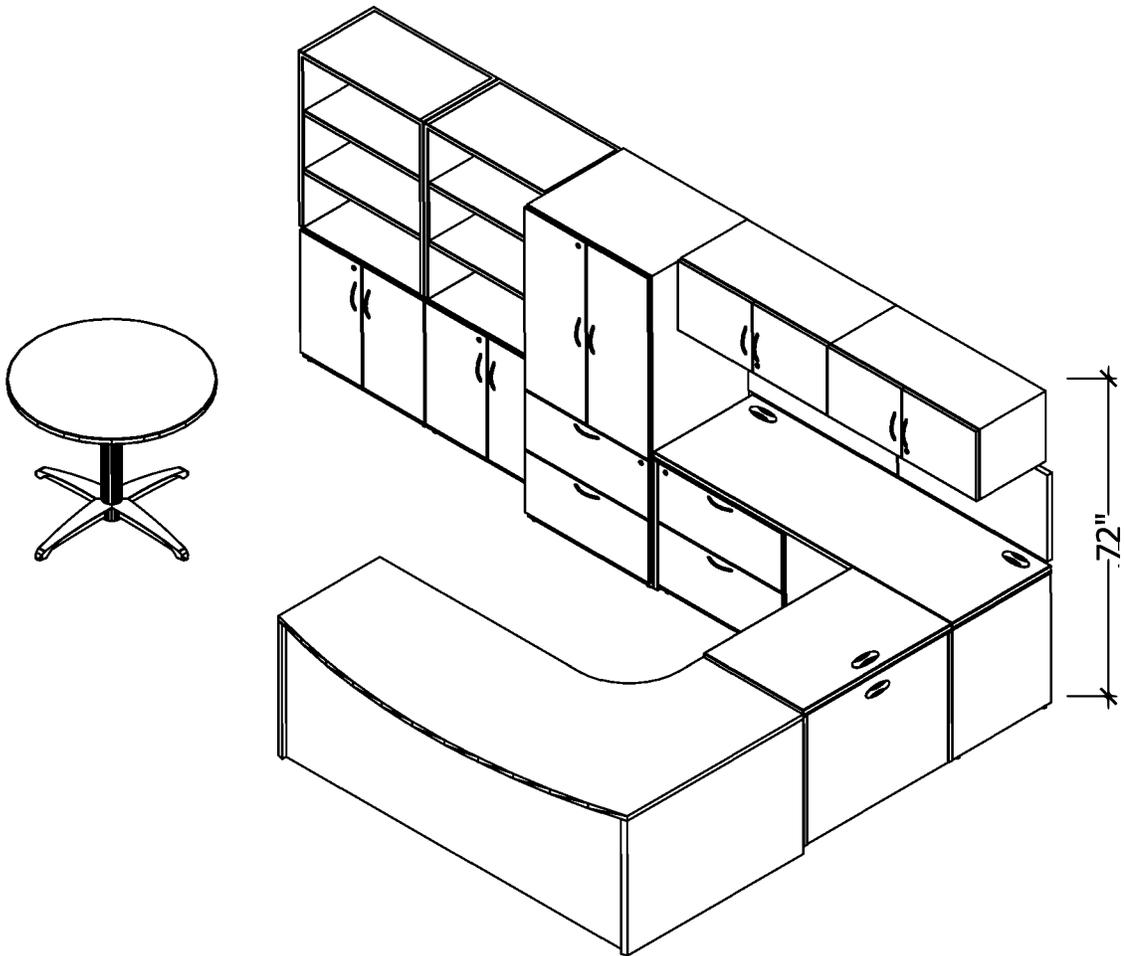
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 BY JOG  
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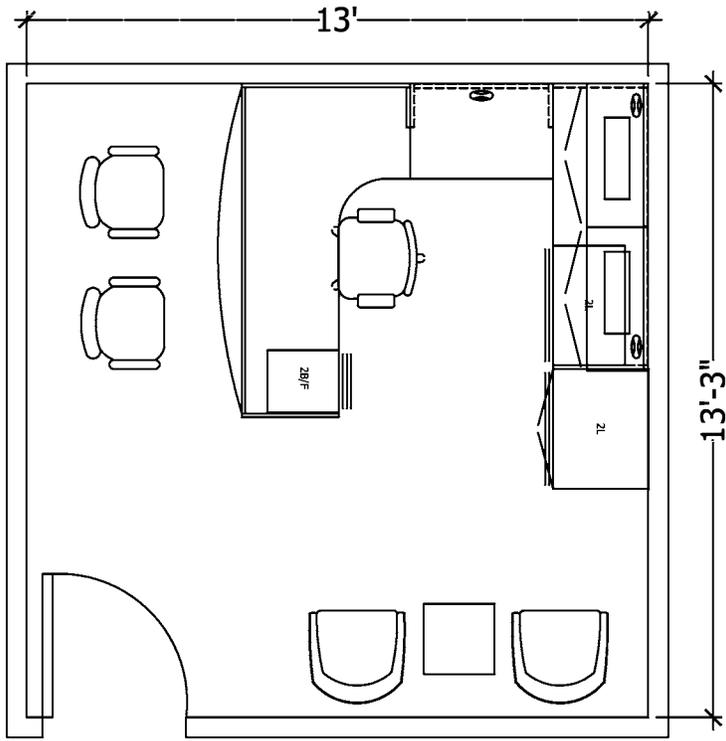
S1  
Option 2  
220 sqft



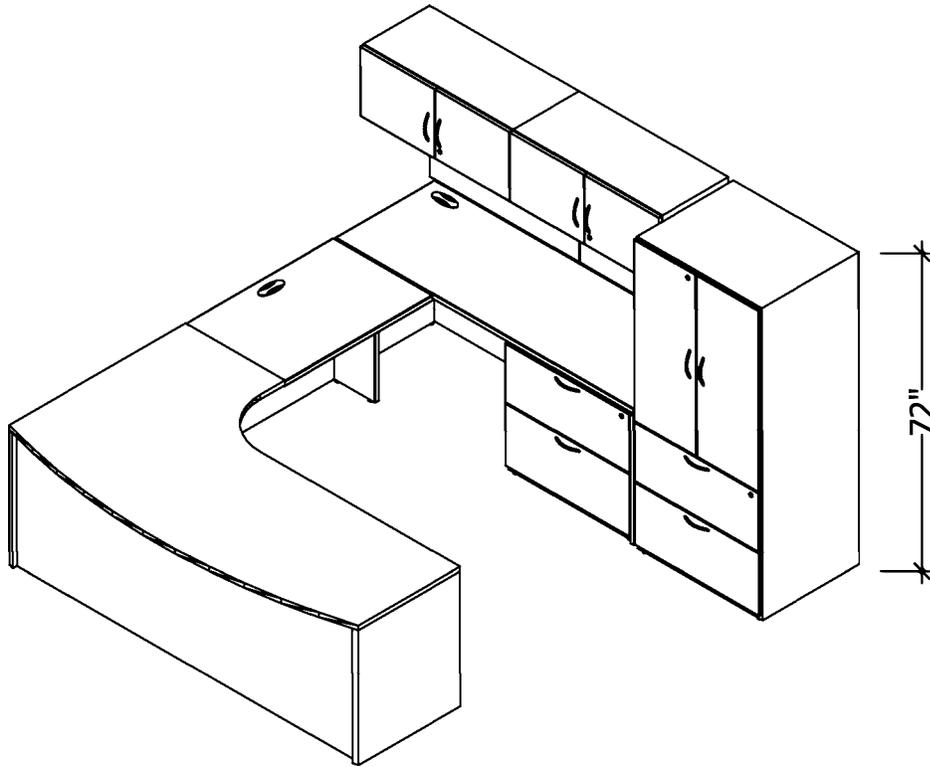
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BY JOG  
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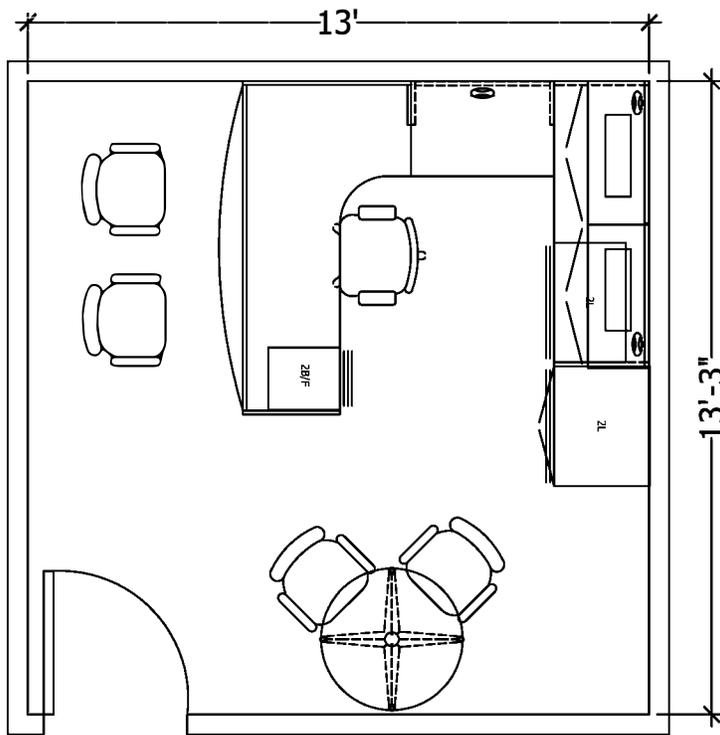
S2  
Option 1  
175 sqft



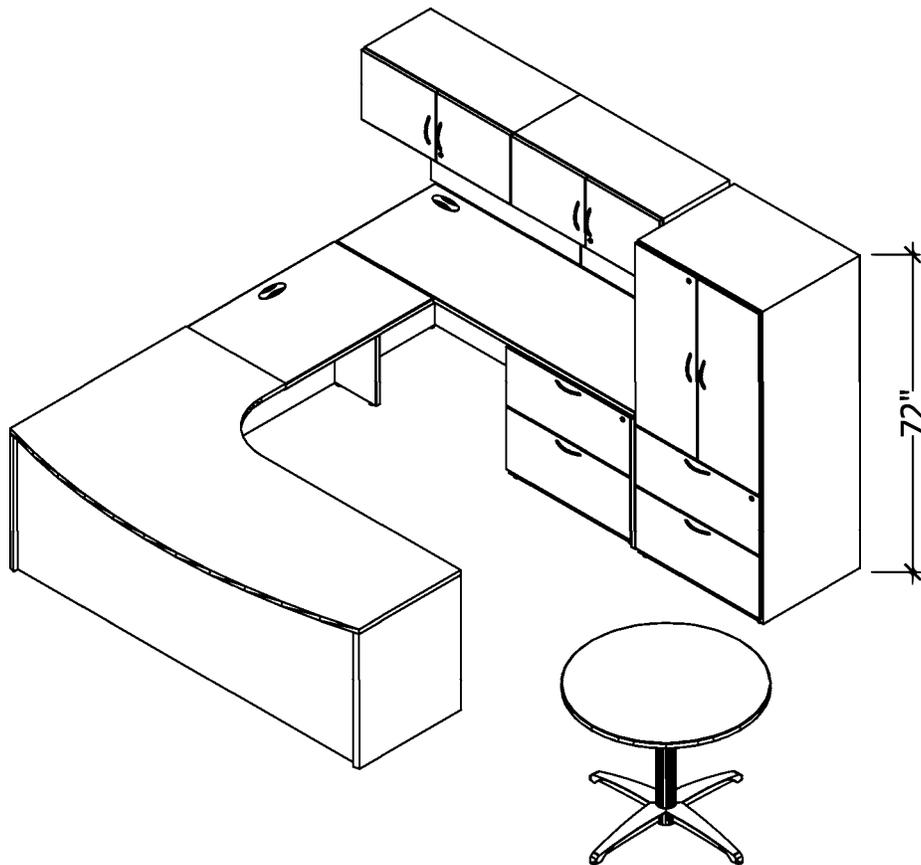
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BY JOG  
SCALE NTS



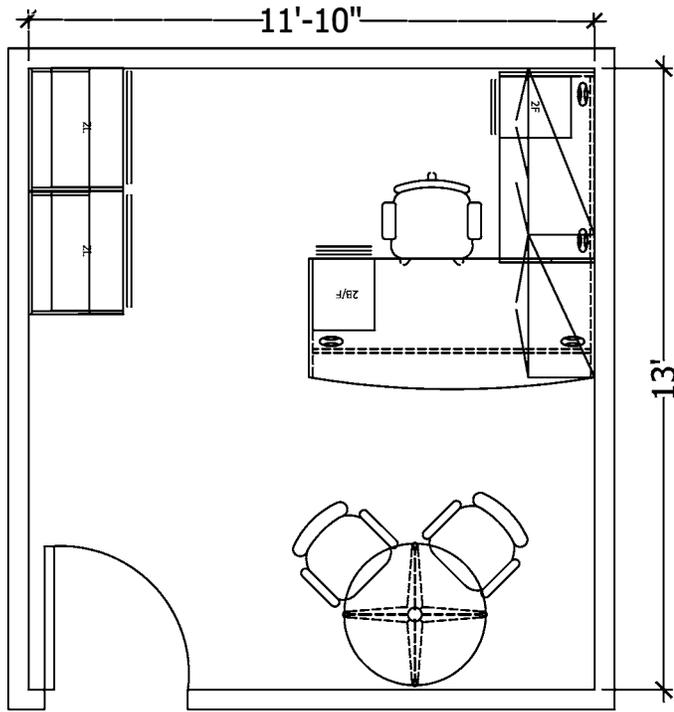
S2  
Option 2  
175 sqft



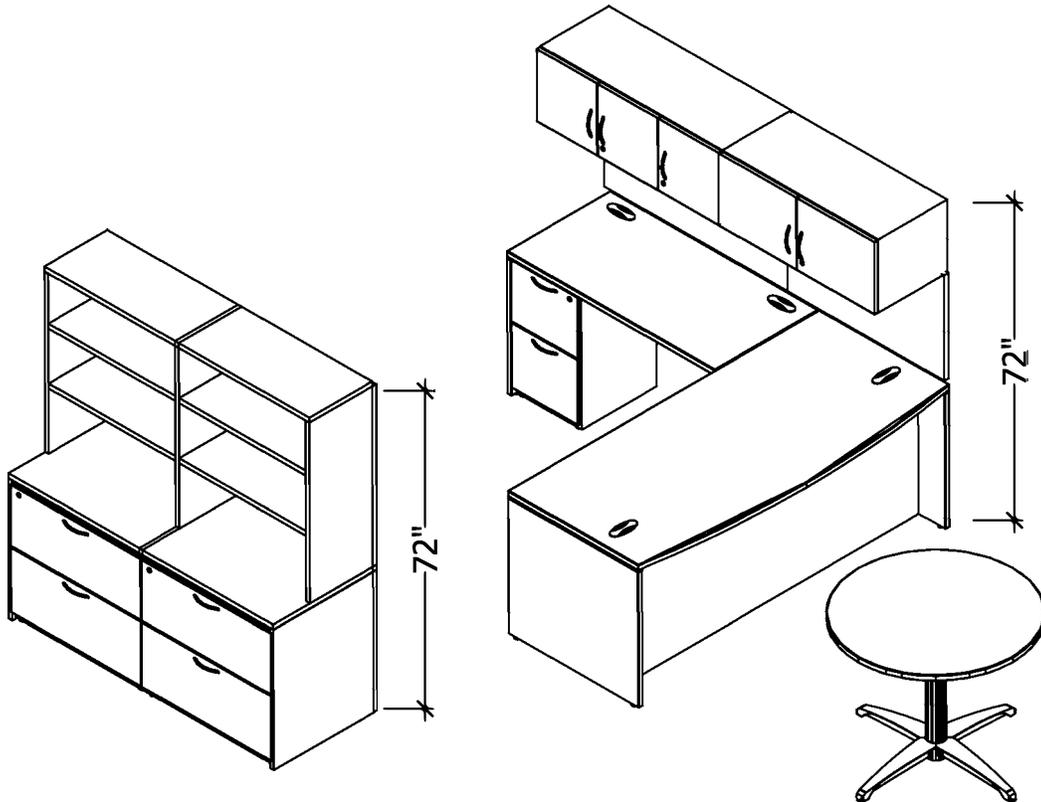
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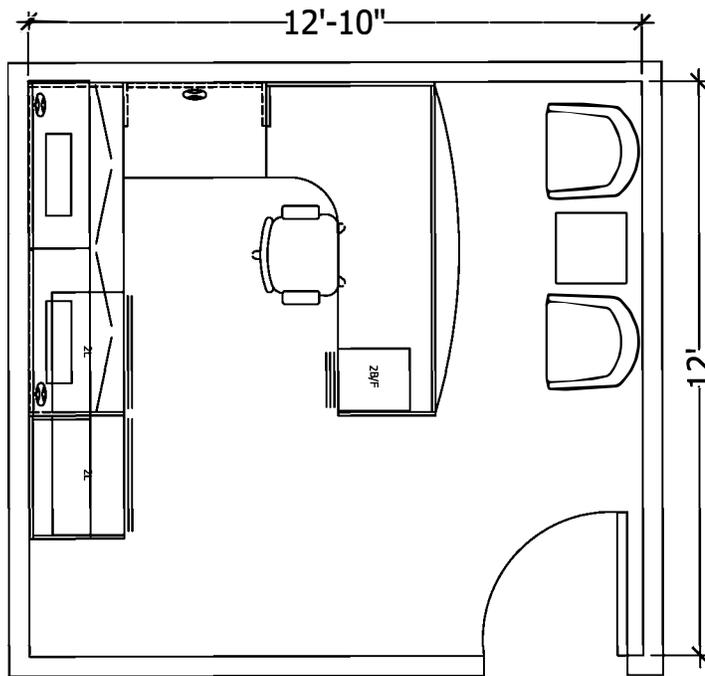
S3  
Option 1  
150 sqft



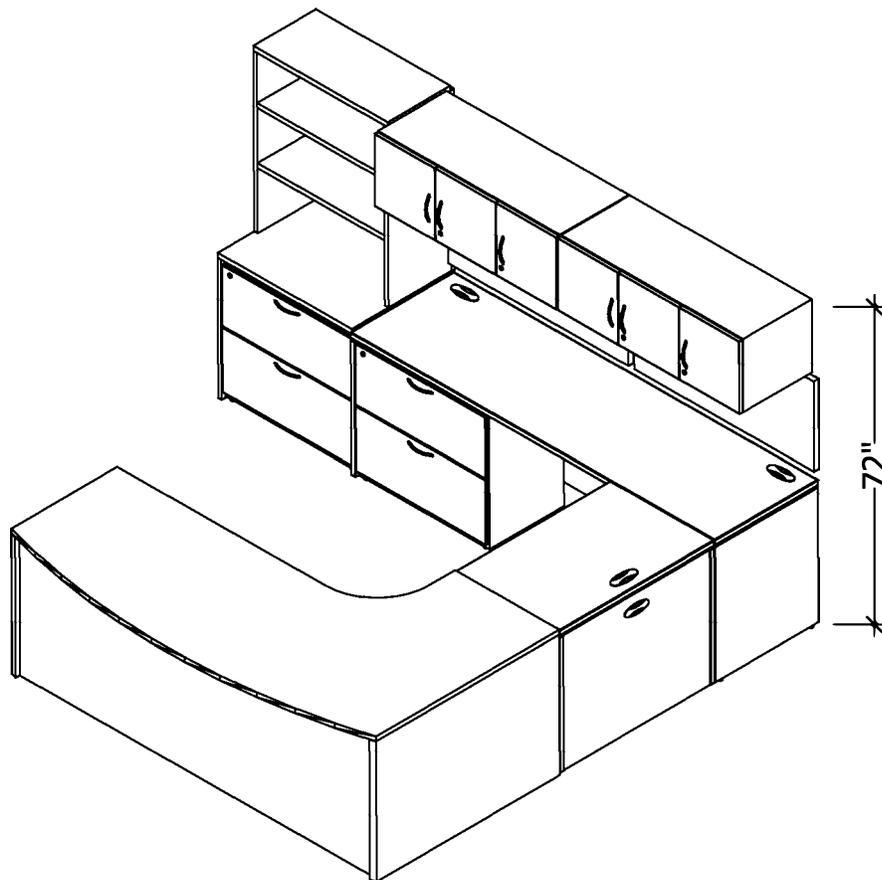
S3

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BY JOG  
SCALE NTS



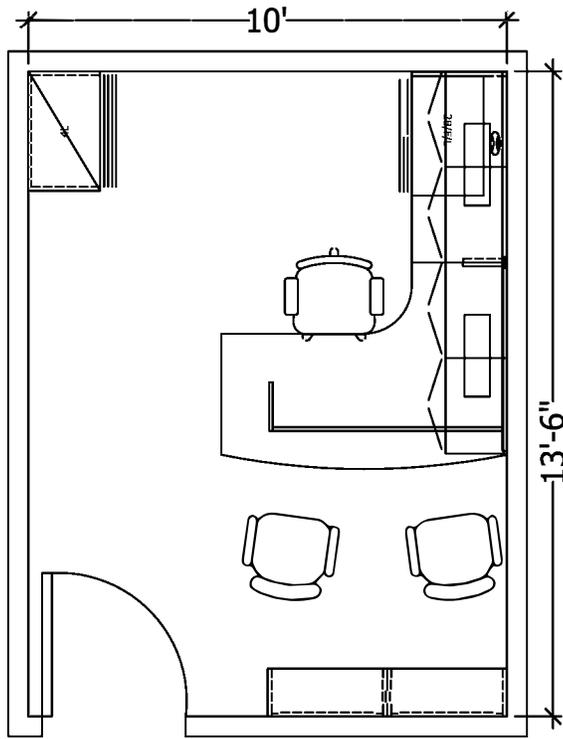
S3  
Option 2  
150 sqft



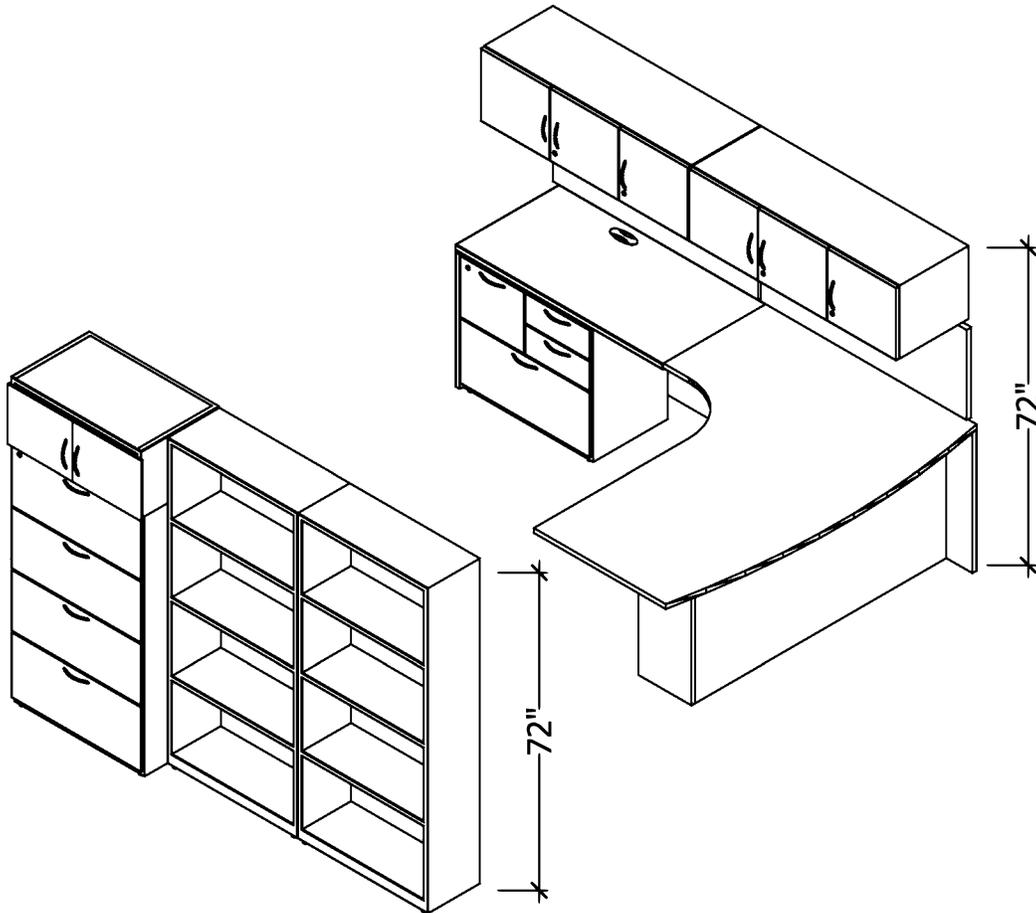
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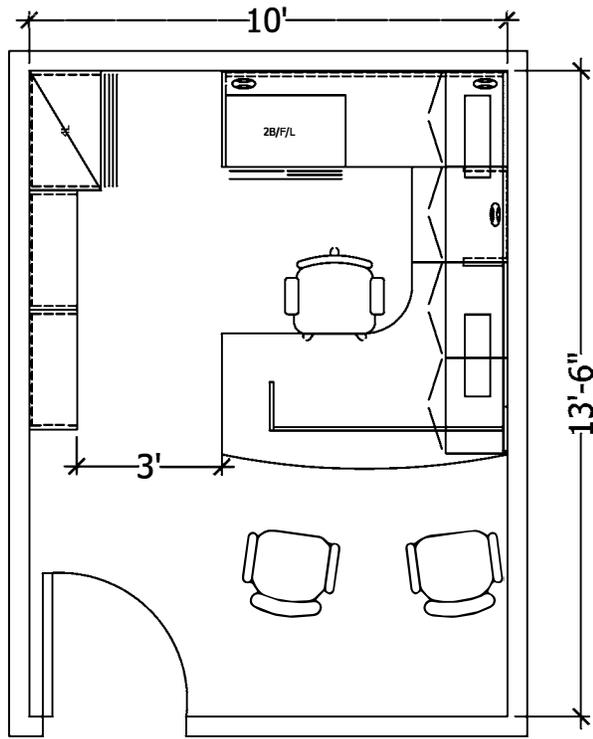
S4  
 Option 1  
 135 sqft



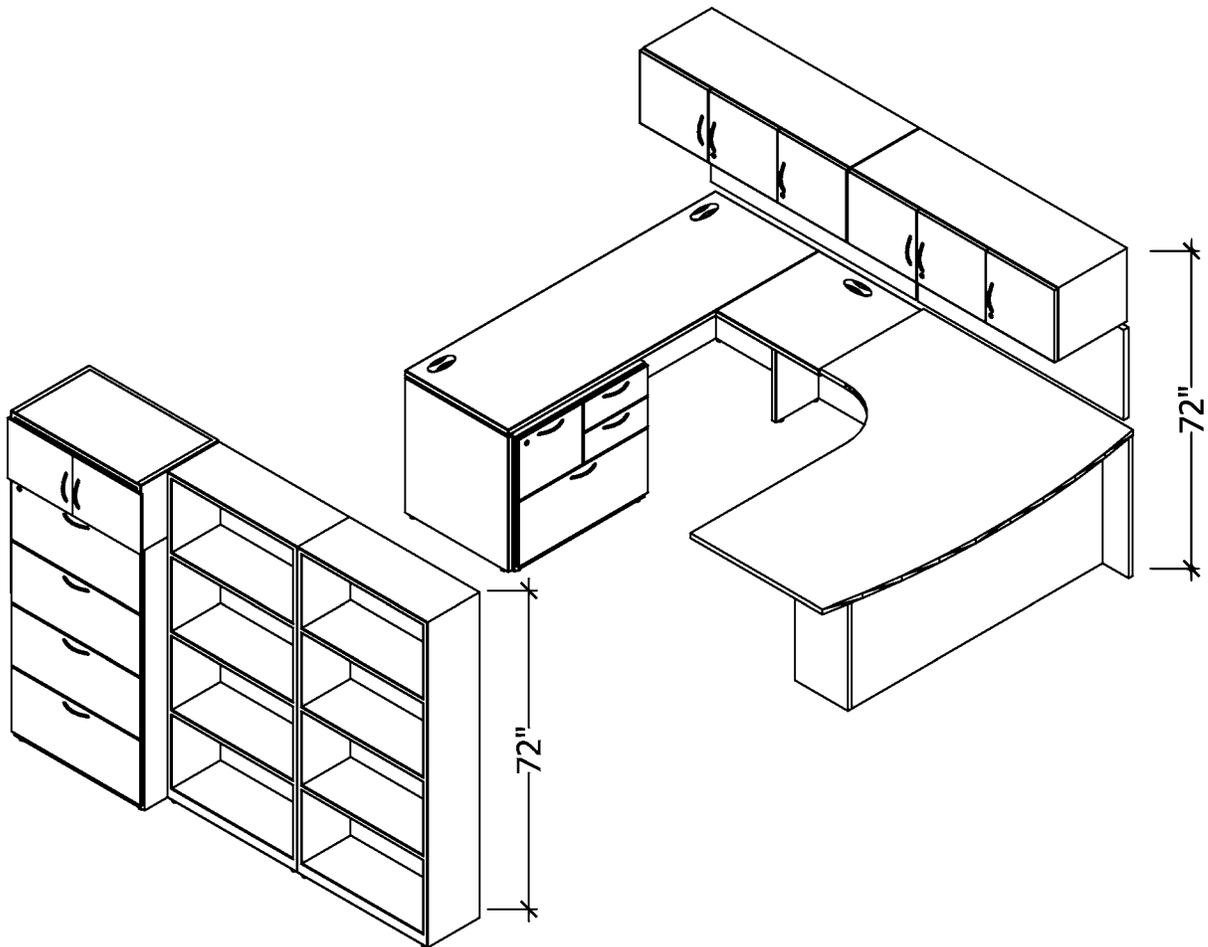
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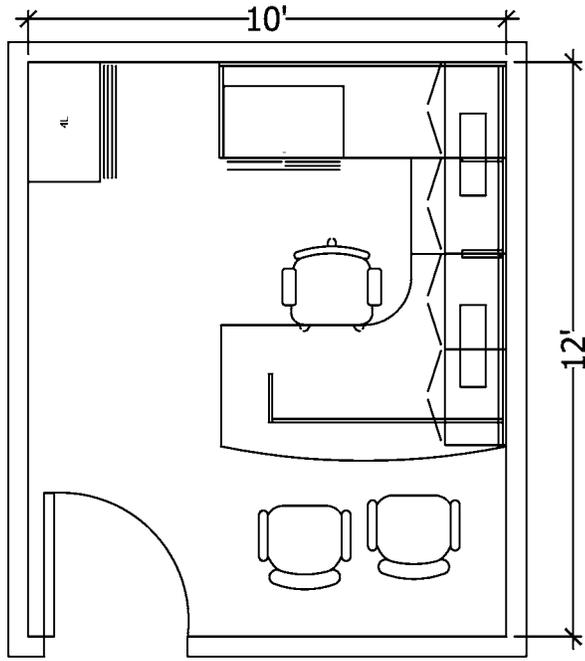
S4  
Option 2  
135 sqft



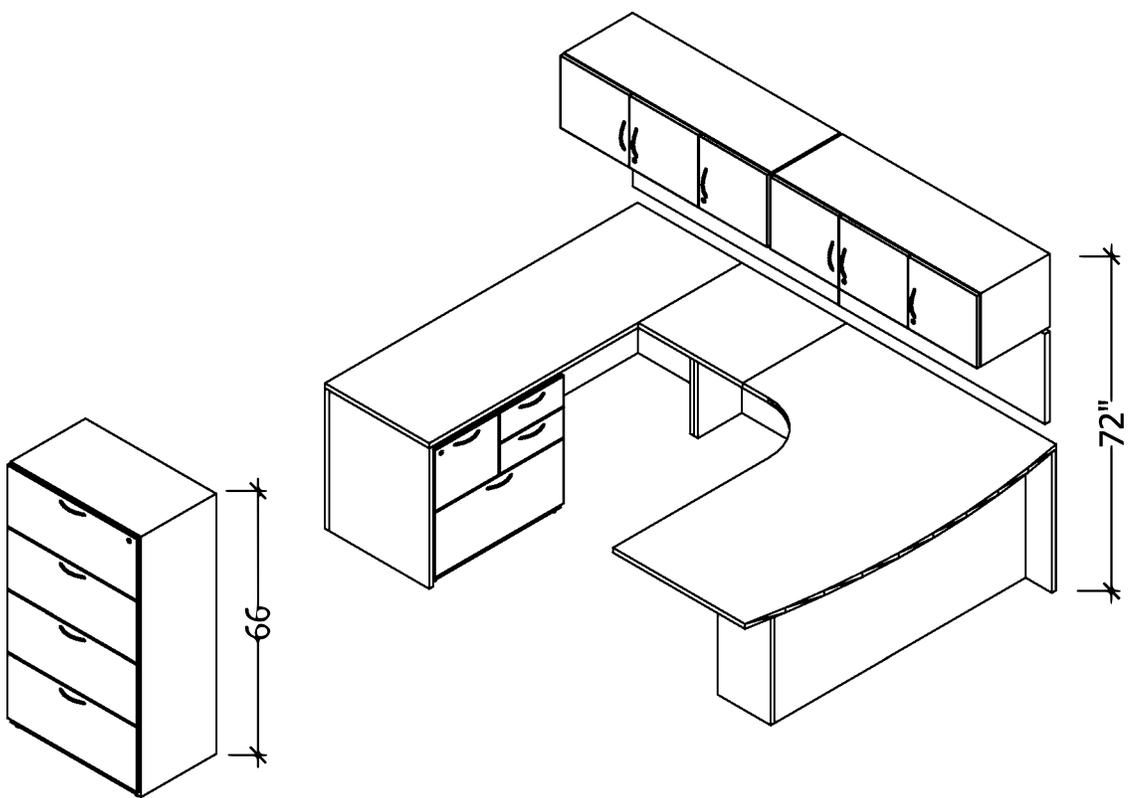
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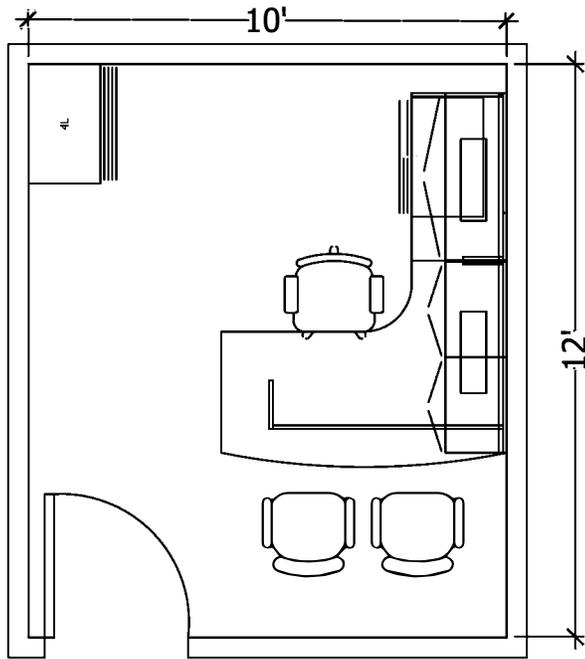
S5  
Option 1  
120 sqft



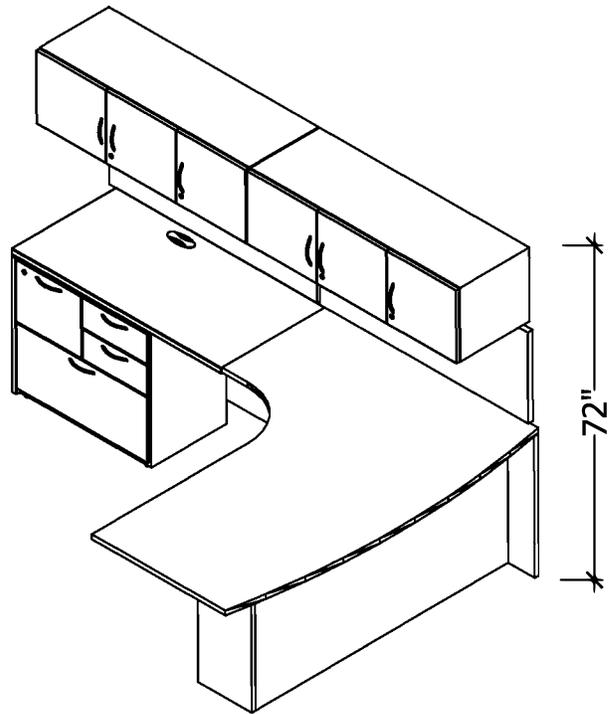
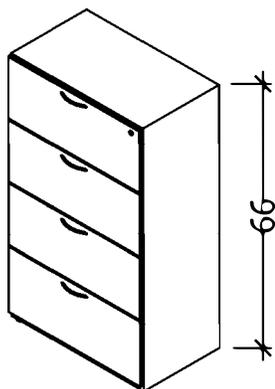
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SCALE NTS



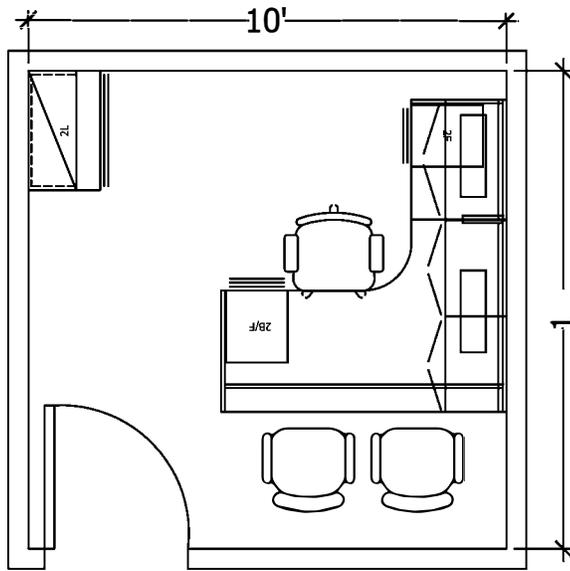
S5  
Option 2  
120 sqft



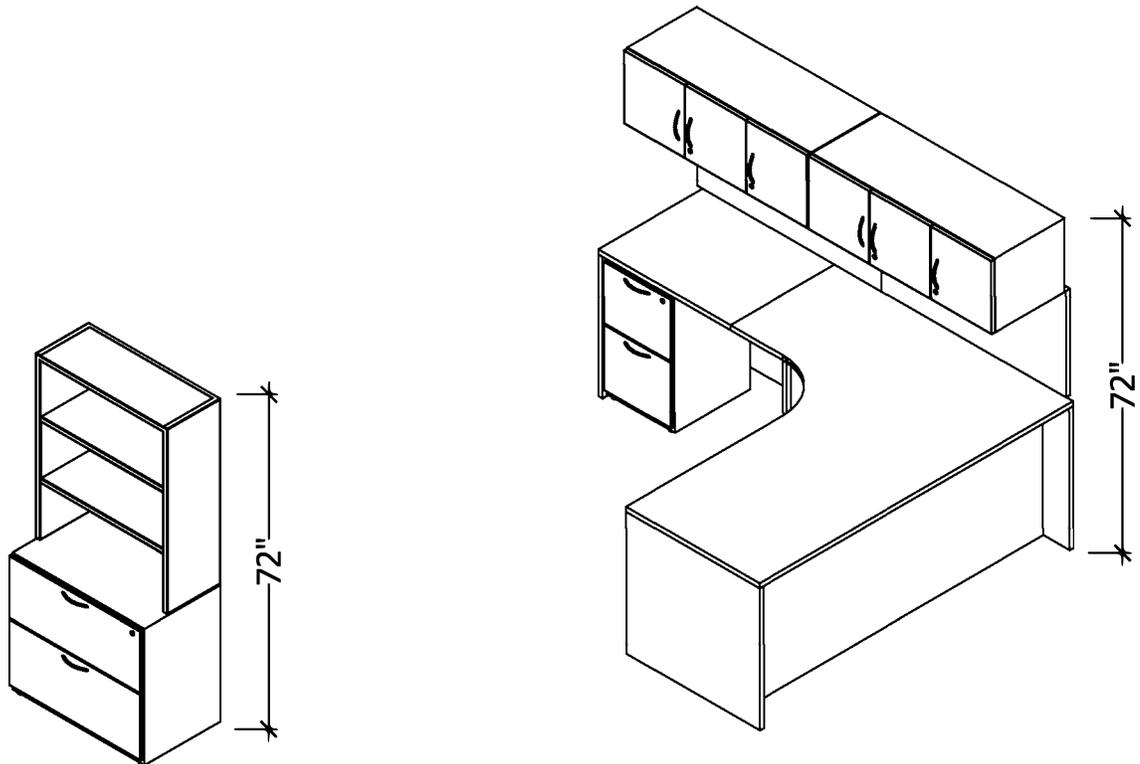
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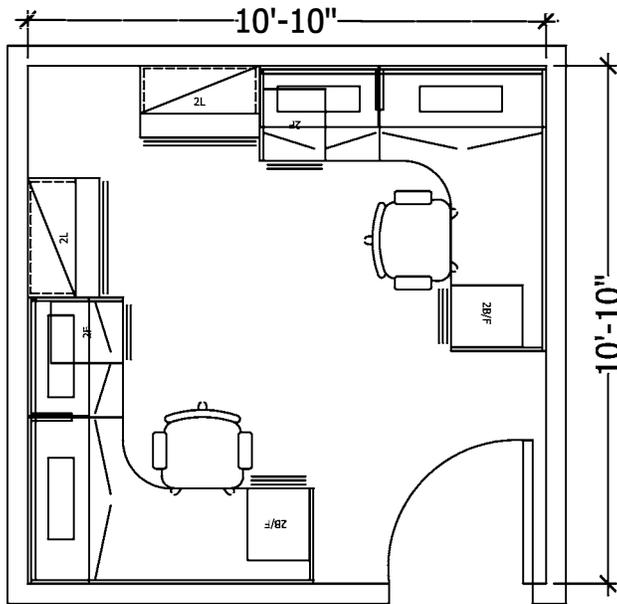
S6  
100 sqft



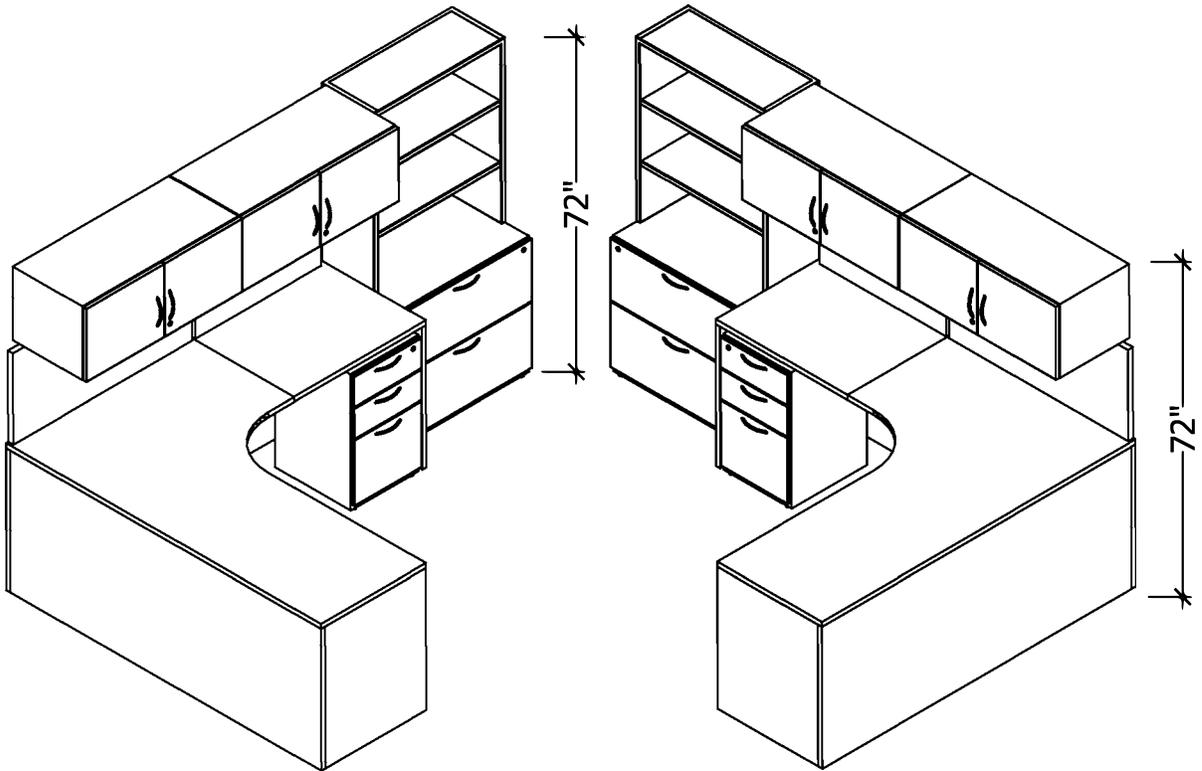
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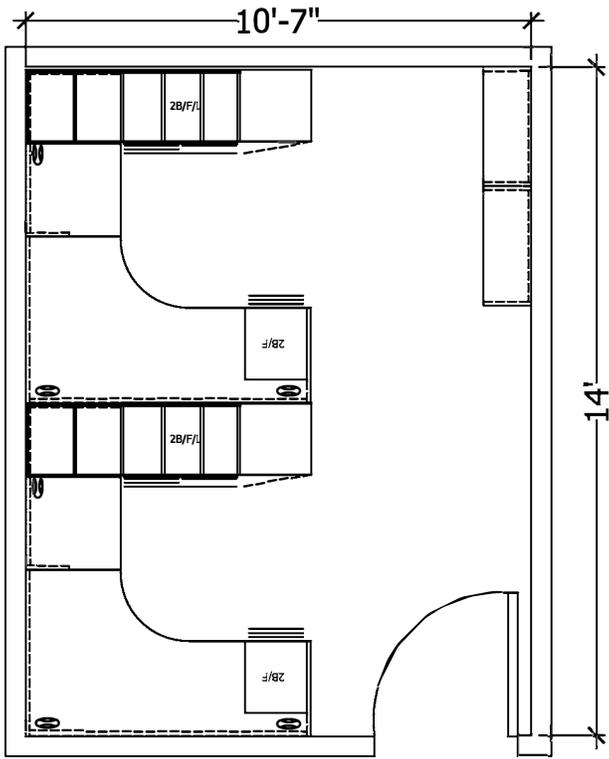
DATE 1/11/12  
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BY JOG  
SCALE NTS



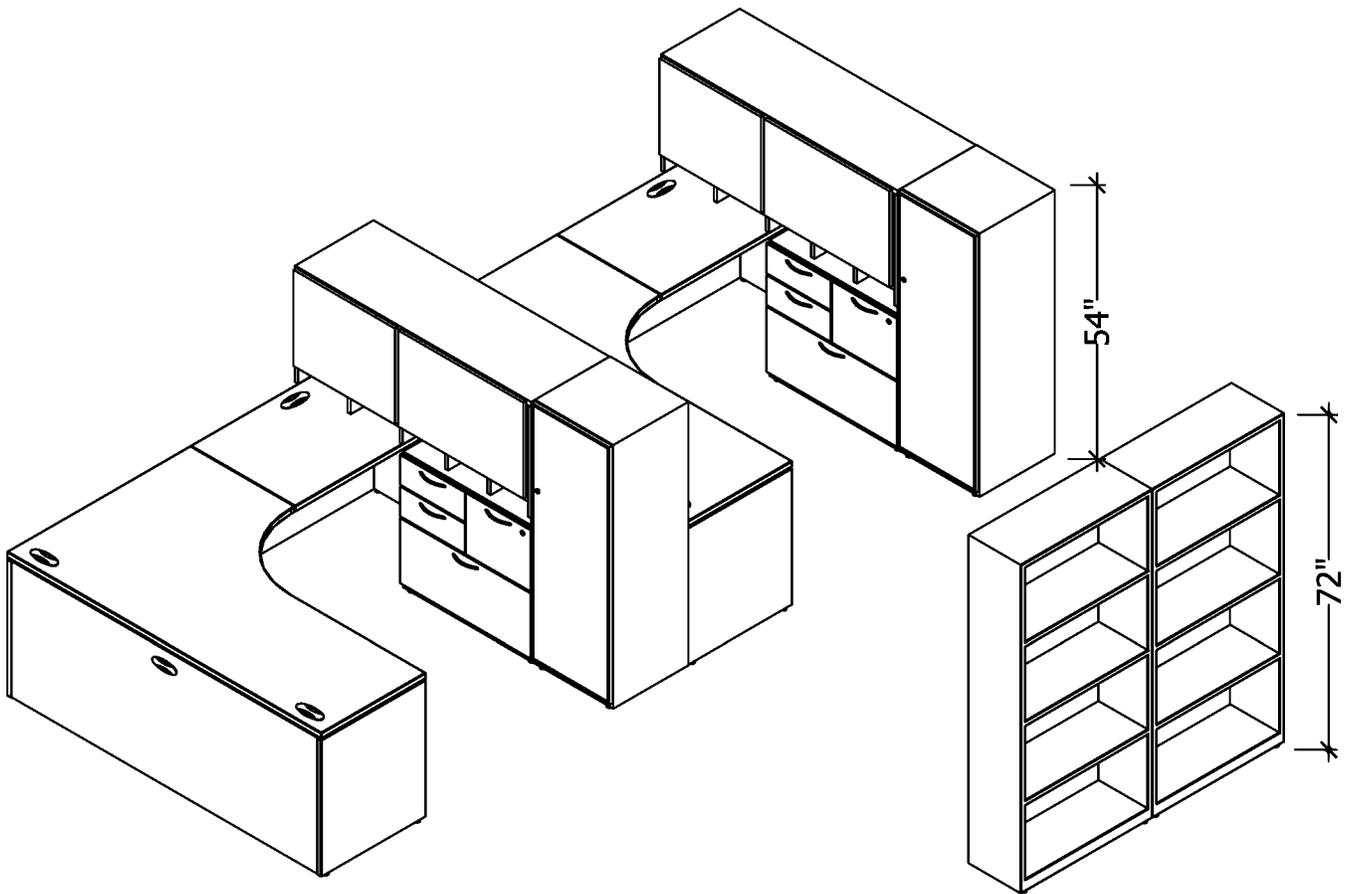
S6  
 Shared Space  
 Option 1  
 120 sqft



S6



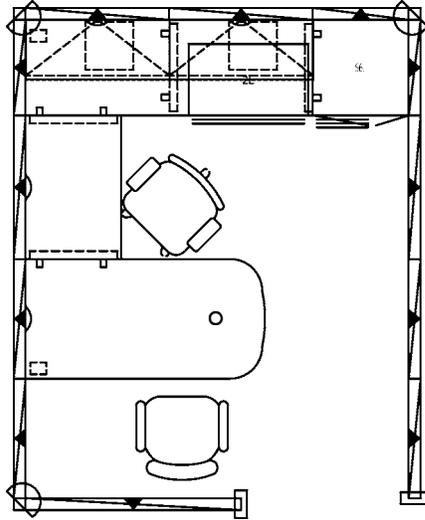
**S6**  
**Shared Space**  
**Option 2**  
**150 sqft**



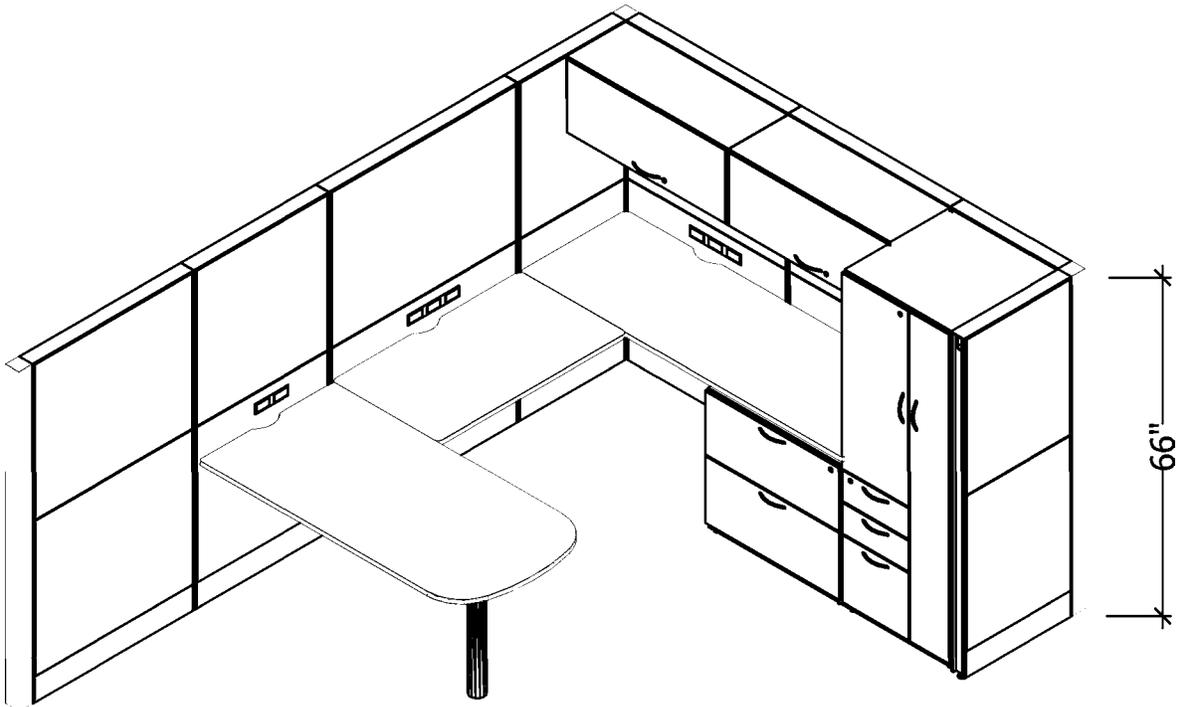
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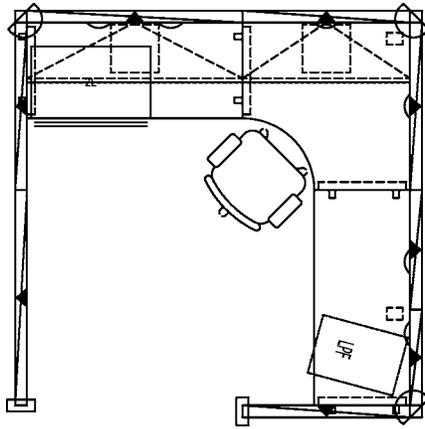
S7  
8x10



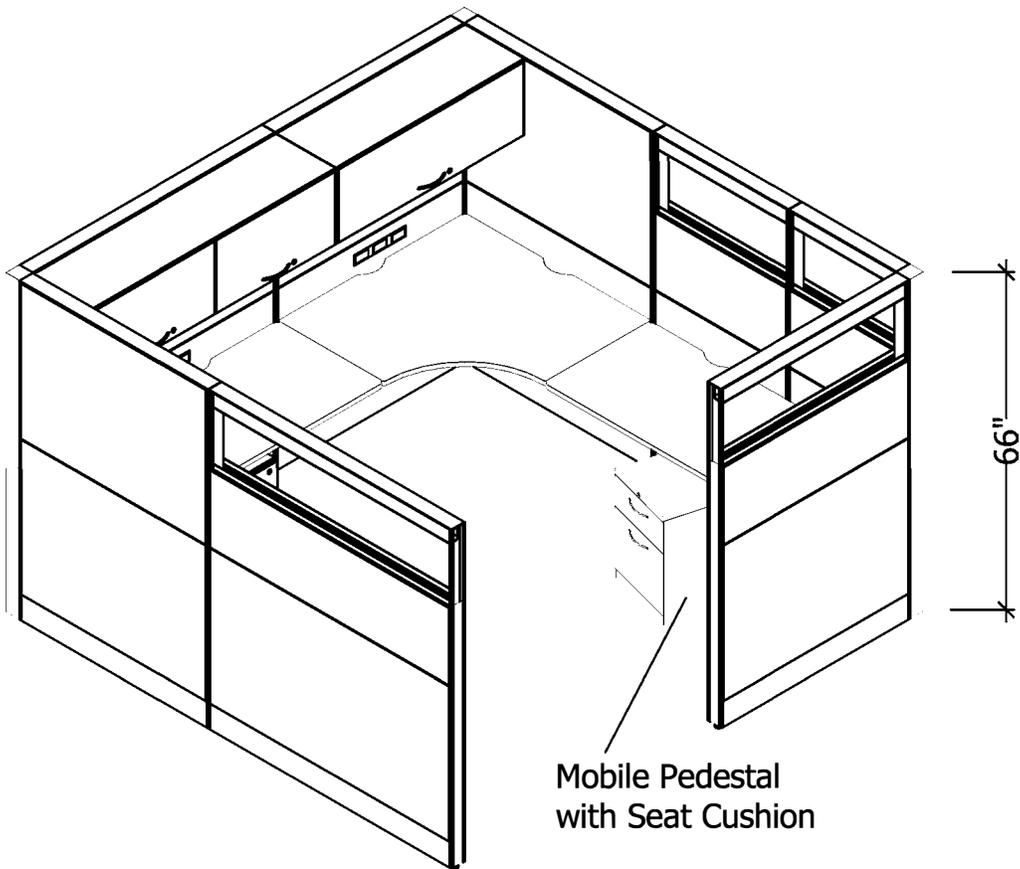
S7

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BY JOG  
SCALE NTS



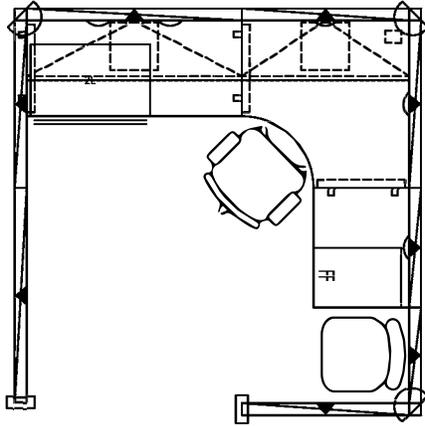
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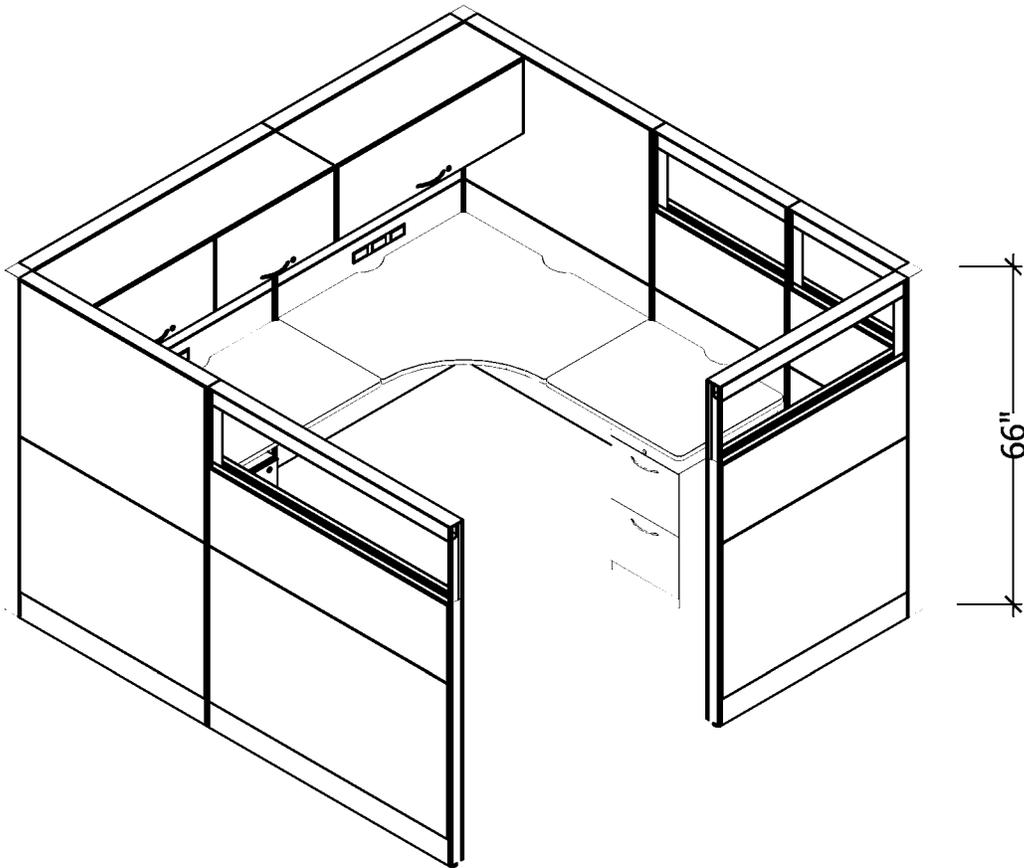
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KSU Staff Office/Furniture Standards  
Appendix C

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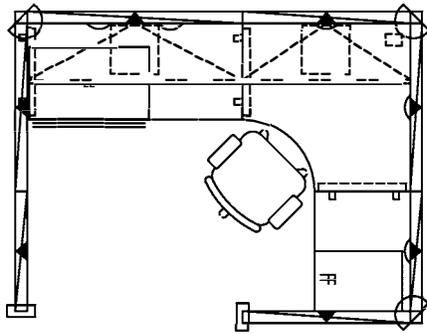
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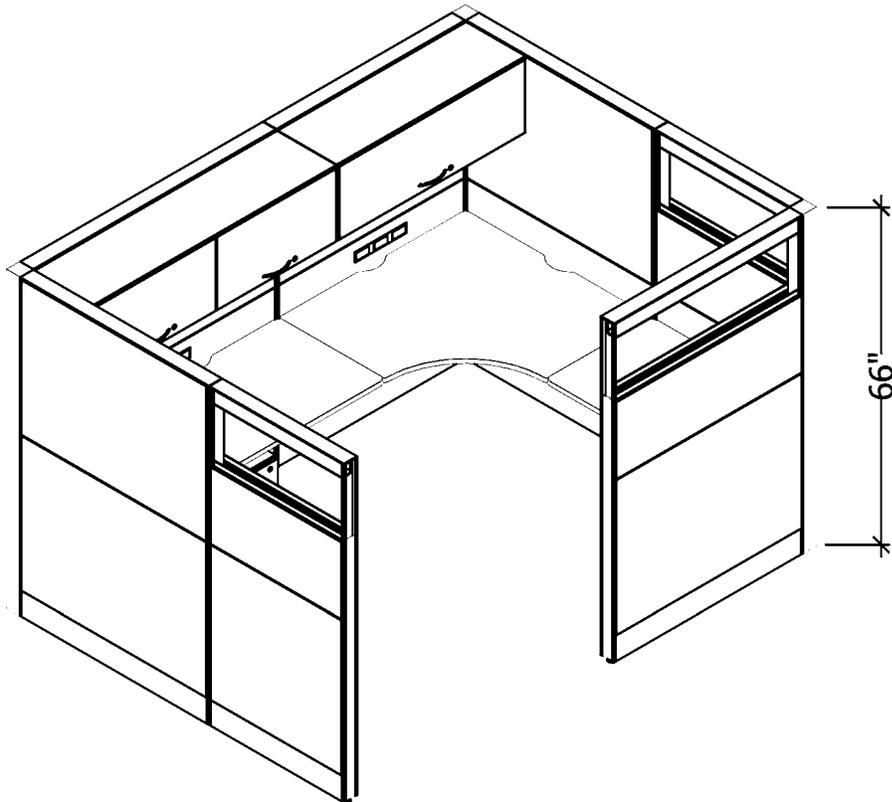
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**APPENDIX 02 – PROTOTYPICAL ROOM DESIGN CRITERIA – PLANS/ELEVATIONS**  
**(UNDER DEVELOPMENT)**

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**APPENDIX 03 – TELECOM/DATA INFRASTRUCTURE SPECIFICATIONS**

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# **Telecom/Data/Networking Infrastructure Specifications**

**For**

**“Building”**

**“Date”**

(REVISED 4/26/2017)

**For Additional Information  
Please Contact**

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## A. Project Summary and Administrative Procedures

- 1. IMPORTANT NOTICE: These “Telecom/Data Infrastructure Specifications” MUST be incorporated into the initial Architect’s Project Manual and the Construction Project Manual under “Division 16000-Electrical” as “Section 16200-Communications & Protection”.**

2. Description

The project will involve the installation of a complete cabling infrastructure system as described within these specifications and drawings.

3. Scheduling

The construction schedule, as approved by the KSU Project Manager, shall be an integral part of the Contract and shall establish interim contract completion dates for the various activities. The schedule must remain adjustable and flexible throughout the length of the project with the completion of the Voice/Data Equipment rooms a top priority.

4. Ceiling Space Coordination

The General Contractor shall coordinate and schedule the installation of work above ceiling with the KSU Telecom cabling technicians and other trades so as to avoid installation conflicts. The KSU Telecom cabling staff/technicians shall participate in special project meetings (if requested) for the purpose of ceiling space coordination. Such coordination shall include, but is not limited to, the following work:

- a) Ceiling Grid and Ceiling Tile Installation
- b) Ductwork, HVAC Piping, and Conduits
- c) Electrical Wiring
- d) Telephone/Data Wiring

5. Inspection Requirements

The contractor shall be solely responsible for determining, verifying and complying with inspection requirements relative to the scope of work.

END OF SECTION

**B. Building Voice and Data Cable-  
Outside Plant Entrance Conduit must be provided for all new Building Projects to allow for the installation of Copper and Fiber into the building. Design must be coordinated with Telecommunications & Networking.**

1. Buried Entrance Conduit

Buried building entrance conduit shall extend into undisturbed earth to prevent shearing (24-inch [60 cm.] minimum depth) and will be run in a conduit trench back filled with appropriate material.

An Orange detectable plastic warning tape shall also be placed in the trench a minimum of eighteen (18) inches above the conduit to provide additional detection measures.

The conduit shall further be encased with 2500 psi minimum strength concrete where:

- a. The recommended minimum depth cannot be attained.
- b. The conduit(s) pass under roads or driveways.
- c. Conduit bend points are subject to movement.

When boring under roadways or railways, corrosion-resistant steel pipe can be used as a substitute for concrete encasement.

2. Connecting Conduit

The connecting conduit run shall be limited to a maximum of two (2) 90-degree bends (or an equivalent number of sweeps and/or radiused bends). Conduit runs installed by the Contractor should not exceed 350 feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull boxes. Pull box sizes will be determined by KSU Telecom personnel during the construction project.

The radius of a conduit bend must be at least 6 to 10 times the diameter of the conduit, depending on its size. If the conduit has an internal diameter of 2 inch or less, the bend radius must be at least 6 times the internal conduit diameter. If the conduit has an internal diameter of more than 2 inches, the bend radius must be at least 10 times the internal conduit diameter.

3. Quantity of Conduits/Innerducts

Contractor shall verify exact termination point of service with the utility prior to roughing.

There shall be a minimum of four (4) – four (4) inch voice/data cable conduits used to provide cable ingress into the Main Equipment Room (MDF).

All cable conduits shall extend four (4) inches beyond the surface from which it emanates.

The ends of all metallic data/voice conduits should be reamed, bushed, and grounded according to the National Electrical Code.

All conduits and/or innerduct shall contain Kevlar pull strings with a minimum test rating of 200 lb. pulling tension.

Two conduits to be utilized for voice are to be void of innerduct. One of these conduits shall contain a continuous true tape from end to end.

Two conduits to be utilized for data (fiber optic), shall contain innerducts. Each data conduit shall contain four (4) - 3/4 inch innerducts.

4. True/Prove of Conduits

All conduits must be true to ensure that the interior of the conduit does not change to less than 3-1/2" from end to end. KSU Personnel must be present to ensure verification.

5. Conduits Entering Building

Outside plant (nonfire-rated) entrance cable must be terminated within fifty (50) feet upon exiting the conduit inside the building.

If the termination point is greater than fifty (50) feet from the entrance point, the cable must be run in rigid metallic conduit to within fifty (50) feet of the termination point and the conduit shall be grounded.

The inside-the-building end of the voice/data cable conduit(s) shall be sealed to prevent vermin and environmental elements from entering the building.

END OF SECTION

**C. Building Voice and Data Cable-Entrance Termination MDF (Main Distribution Frame and Backbone Riser System IDF (Intermediate Distribution Frame)**

**MDF must be completed in early stages of the building project using both KSU and AT&T specifications. This will allow KSU and AT&T to install entrance copper and fiber cables necessary to provide dial tone/data required for certifications, i.e. elevator, fire alarm, HVAC, etc.**

The building entrance cable shall be terminated at the Voice/Data Main Distribution Frame (MDF).

The MDF/IDF Telecommunications rooms shall include the following:

1. MDF/IDF Locations:

The Voice/Data shall be co-located in a single room, with a minimum of one room per floor. Telecom rooms should be directly accessible from the hallway or other common area. Telecom rooms should have only one door and not used as a passage way to other rooms.

The MDF/IDF rooms shall be stacked vertically wherever possible so that the backbone riser is accessible in each Telecommunications room.

The MDF/IDF rooms shall be centrally located so that network access can be provided with IEEE 802.3 100BaseT horizontal cabling distribution specifications, thus retaining the 295 ft, (excluding the patch cable length) maximum cable distance requirement, from MDF to each telecommunications workstation outlet box.

2. Wall, Floor, Ceiling, and Door Requirements

The room sizes should be determined by KSU Telecom personnel during the Space Allocation meetings.

The MDF/IDF room shall be sized appropriately based on occupancy/use and distance. Minimum room sizes should be 10'x15' for MDF's, as BellSouth will also be utilizing the MDF space, and 8'x12' minimum for IDF's. A larger room MDF/IDF may be required if voice/data connectivity exceeds 575 cables per Telecom Room. An example of this would be providing network connectivity in classrooms and labs.

The MDF/IDF rooms shall be painted with campus standard China Doll White paint. **All four walls to be lined with ¾" fire-retardant plywood** painted with minimum of **two coats WHITE** on all sides. If not using fire-retardant plywood, it should be painted on all sides with **two coats WHITE** Intumescent Fire Retardant Paint.

Placement of the plywood shall begin within twelve (12) inches of the entrance door and shall be placed continuously around the room. All ¾" plywood backboards will be 4 feet wide x 8 feet high and will be installed vertically beginning 20" A.F.F., or above electrical outlets. **Plywood must be attached in all four corners to a stud using toggle bolts.** This is to prevent warping or buckling of plywood.

The MDF/IDF room floor shall not have a floor covering other than being sealed or a vinyl covering with base coving. No carpet is to be installed in the MDF/IDF rooms.

The MDF/IDF room shall not have a finished ceiling such as sheetrock or drop construction. Room to be no less than 9' in height to the building structure.

The door to the MDF/IDF room shall be a B18 GA-22 Gauge Stiffners-Honeycomb core steel door, with a (3) hour fire rating. The steel door shall be not less than three (3) feet wide by six (6) feet eight (8) inches high (3'x6'8") and shall **open outward** unless building codes prohibit. Doors swinging in eliminate three feet of usable wall space. In the advent that the door must swing in, the design professional shall add the lost wall space in the design and increase room size to compensate. Do not center door on wall. Entrance door to be located to one side to allow as much wall space as possible.

Card lock must be provided for each MDF/IDF throughout building.

### 3. Electrical Power and Lighting

All electrical outlet locations in MDF/IDF to be determined by KSU Telecom personnel at time of installation. Additional electrical outlets will be required to data racks upon build-out of data room. Each outlet should be labeled such that the panel and breaker location is easily identifiable.\*

\*All Network data racks to have one (1) dedicated twenty (20) ampere, 120-volt independently breakered and grounded quad outlet. Installation of these outlets to be coordinated with KSU Networking personnel upon installation of data racks in each MDF/IDF.

The MDF/IDF room shall be properly powered with a minimum of three (3) dedicated twenty (20) ampere, 120-volt independently breakered and grounded quad outlets.

REQUIREMENT FOR THIS TO BE DETERMINED BY NETWORKING PER EACH PROJECT. Please confirm before adding:

Two (2) dedicated thirty (30) ampere, 208-volt independently breakered and grounded (NEMA L6/30 Twist Lock) outlet in MDF only.

Electrical outlets shall be flush with the plywood backboards, or located below installed backboards. No surface mounted electrical to be installed on backboards. All electrical outlets in the MDF/IDF shall also be connected to the emergency power circuits or facility generator in case of utility power outages.

Lighting of the MDF/IDF shall be provided with illumination to approximately 50 foot-candles (540 lux). Power for the lighting should not feed from the same circuits as the duplex wall outlets. The lighting circuits shall not be on the building master switch.

4. Environmental Control (HVAC)

The MDF/IDF rooms must have independent dedicated AC (air conditioning) equipment 24 hours per day, 365 day per year. No heat is to be supplied to these rooms. Utilizing the building AC will not be adequate, due to air handlers being reduced or turned off for energy savings on evenings, weekend, holidays and campus closings. The AC system must be connected to the emergency power circuits or facility generator, if available, in case of utility power outages. The system must be fitted with manual controls located in the MDF/IDF rooms.

The AC control systems for the MDF/IDF shall meet or exceed the standards shown below:

Environmental Factor	Requirement
• Temperature	64 to 75 Degree F.
• Relative Humidity	30 to 55 Percent
• Heat Dissipation:	

**MDF to accommodate approximately 25,000 BTUs/hr  
IDF's to accommodate approximately 10,000 BTUs/hr**

Location of the AC unit and relief duct must be coordinated with KSU ITS-Telecom to **avoid locating above data racks**, which could cause possible water damage from malfunctioning units or drainage. If possible, **locate above or near door**.

5. Shafts and Raceways

Riser shafts and raceways shall be located and designed to provide adequate space for the amount of cable to be installed, meet structural loading requirements, and enable cable to be routed within distance limitations.

6. Sleeves

Sleeves shall be used to all floors for cable riser distribution within the building. All sleeves from floor to floor shall be four (4) inches in diameter. There shall be a minimum of four (4) – four (4) inch sleeves between all MDF/IDF rooms.

In locations where the MDF/IDF rooms are not constructed in a stacked fashion, all sleeves will be connected with rigid metallic conduit. Conduit runs from the MDF to each IDF to be installed by the contractor shall not exceed

100 feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull boxes.

In addition, all MDF/IDF rigid conduit specified for data usage shall be filled with innerduct (3 - 1.00") – this to be coordinated with KSU ITS-Telecom.

Sleeves shall be located adjacent to a wall on which the backbone cables can be supported without obstructing the wall termination space. Sleeves shall be designed to conform to the NEC and local fire codes and must be fire stopped as part of the installation procedure following the pulling of the cable.

Sleeves shall extend four (4) inches above/below the entrance into the MDF/IDF room. The ends of all metallic data/voice conduits should be reamed, bushed, and grounded according to the National Electrical Code.

## 7. Horizontal Distribution Pathways

The layout and capacity of the data cable pathway shall have the following characteristics:

Meet ANSI/EIA/TIA-569 and ANSI/NFPA 70 (Clearance from EMI sources) requirements. For special or heavy EMI/RFI environment installation situations, the home run conduit method shall be considered.

Conduit runs installed by the contractor should not exceed 100 feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull boxes. To avoid electromagnetic interference (EMI), all pathways shall provide clearance of at least:

- (1) Four (4) feet from motors or transformers.
- (2) One (1) foot from conduit and cables used for electrical power distribution.
- (3) Five (5) inches from fluorescent lighting.

Provide for maintenance of the horizontal cabling with minimal disruption of occupant activities through easy access.

The pathway design shall allow for a minimum of four (4) Cat 6 cable runs per individual work area. (2 voice/2data)

All horizontal pathways from classrooms must go back to the same Telco room. This includes all wall and floor box locations within the room.

All horizontal pathways that penetrate fire-rated barriers must be fire-stopped in accordance with applicable codes.

## 8. Cable Trays

Cable tray systems shall be made of straight sections, fittings, and accessories as defined in the NEMA standards publication VE-1. Cable trays shall be UL classified as equipment grounding conductors.

Cable trays shall be used in all horizontal distribution installations. J-Hook distribution shall not be used unless cable tray installation is not feasible due to structure or space accommodation with other trades. J-Hooks must be 2" and installed from ceiling structure with stingers. No wall mounted J-hooks.

Cable trays shall be located in hallways or corridors whenever possible to minimize disruption of occupant activities. Cable trays located in hallways shall be placed off-center to avoid fluorescent lights.

**The distance from the cable termination point in the MDF/IDF room to the telecommunications workstation outlet boxes through the cable tray configuration shall not exceed 295 feet (excluding the patch cable length). Additional IDF MUST be provided if there is any possibility of the cable tray route causing the data cable to exceed the 295' maximum length. This is crucial to cable testing, and providing the proper functionality to any given room.**

The general area for the feeder cable tray to exit the IDF room shall be located to avoid sources of EMI. The cable tray shall not extend into the IDF more than six (6) inches.

The total weight of the cable tray when loaded with cable shall be considered when designing supports to secure the cable tray to the building structure. The working load capacity of a cable tray system shall be determined by both the length of the support span and the static load capacity of the tray.

Materials and Finishes: Straight section and fitting side rails and rungs shall be extruded from aluminum.

Tray Types: Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced nine (9) inches on center. Rung spacing in radiused fittings shall be measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inches with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.

- (1) Tray Size: Trays shall have an overall nominal depth of six (6) inches with a minimum usable loading depth of four (4) inches.
- (2) Straight section side rails shall be I-beam, C rail or Z rails. All straight sections shall be supplied in standard lengths of twelve (12) feet.
- (3) Minimum tray widths shall be twelve (12) inches or as shown on the drawings.

Sweeping or radius bends shall be used. 90-degree corners in the cable tray are not allowed. Fitting radius shall be thirty-six (36) inches. Side rails of straight sections and fittings shall be compatible so that standard splice plates can be used to join straight sections and fittings. Fittings shall have three (3) inch tangents beyond the curved section to accommodate the standard splice

plates. Provide standard radius fittings for turns. Provide standard fittings with required radii for elevation transitions. Provide standard 90-degree down radius at cable tray termination locations.

Splice Plates: Splice plates shall be the bolted type, using either square neck or ribbed-neck carriage bolts and serrated flange lock nuts. The resistance of fixed splice connections between an adjacent section of tray shall not exceed .00033 ohm. The cable tray shall be designed so that a splice plate located anywhere along the span shall not decrease the strength of the cable tray system. Splice plates shall be furnished with straight sections and fittings, and shall be included in unit prices.

Accessories: Covers and other special accessories shall be furnished as required to protect, support, and install a cable tray system.

Cable tray shall meet NEMA class 12A. Cable tray shall be made to manufacturing tolerances as specified by NEMA VE1-2.03 and VE1-2.04.

Support: Provide trapeze-type support system consisting of horizontal channel and hanger rod of sizes recommended by NEMA (publication VE-1, latest edition) for ten (10) foot simple spans. Rod shall be threaded at each end or as required for connections. Connection shall be made with fittings and hardware specifically welded. Hanger rods shall not extend more than one (1) inch below bottom of trapeze channel. Support horizontal spans on ten (10) foot intervals. Provide a support within two (2) feet of any termination (end-point of run). Refer to detail on plans for location of supports at elbows and terminations.

Sway-brace shall be one piece channel attached between outside midpoint of elbow radius (or end-point of termination) and nearest building structural component. Make attachments to structure only; do not attach to piping, ductwork, or non-structural walls, floors, etc. Attachments to the structure shall be by one of the following means: 1) toggle bolts on hollow masonry units, 2) expansion anchors on solid masonry, 3) concrete machine screws on steel work, 4) beam clamps on structural steel, or 5) wood screws on wood members.

Penetration of Fire/Smoke Rated Partitions. Provide an eighteen (18) gauge galvanized steel sleeve solidly set in the fire smoke barrier to allow passage of the cable tray through the partition. The sleeve dimensions shall be one (1) inch larger than the cross sectional dimensions of the cable tray. Fill the entire space within the sleeve with Dow Corning TRV foam or #M Barrier compounds (leaving no voids around the cable tray or cables) to maintain the integrity of the partition fire or smoke rating.

## 9. Grounding

In MDF: Provide a four (4) lug #6 ground buss bar(3M 4140 copper ground buss bar or equivalent) with AWG #6 insulated wire terminated on a ground bar 20" A.F.F. for telephone dial tone provider (BellSouth). Must be located near the building entrance conduits. Ground bar shall be connected to the approved building ground. Leave a minimum of 8 ft. slack of ground wire.

In each IDF: Provide a four (4) lug #6 ground buss bar(3M 4140 copper ground buss bar or equivalent) with AWG #6 insulated wire terminated on a ground bar 20" A.F.F. – exact location to be determined by KSU Telecom personnel at time of installation. Ground bar shall be connected to the approved building ground. Leave a minimum of 8 ft. slack of ground wire.

10. Utilization of MDF/IDF Space

**ALL** wall space in MDF's and IDF's is to be utilized by KSU equipment only. There shall be no other equipment installed either on the walls or within the room without the prior approval of KSU Telecom personnel. These are secured rooms and access is limited to IT personnel.

**PROHIBITED:** Locating other non-OIT resources in Telecommunications rooms.

**PROHIBITED:** Using Telecommunications rooms as a route for other facilities to pass through or utilize, including but not limited to air handler units, fire or security alarm systems, A/V infrastructure.

**PROHIBITED:** Using boiler rooms, air exchange rooms, janitorial closets, Electrical distribution closets or areas with water, and/or sinks for Communications is prohibited. It is essential that these spaces be dedicated to Telecommunications.

END OF SECTION

## D. Workstation Communication Outlets

When the individual work area is 100 square feet or less, a single 2-square box with a single-gang mud ring is required.

An individual work area larger than 100 square feet shall have at least two (2) 2-square boxes, each with a single-gang mud ring, and are to be located on opposite sides of the work environment.

Each back box shall have an individual 1" conduit terminated as close as possible, using the shortest most direct route, to the nearest cable tray on that floor. If cable tray is not provided, each conduit to stub up a **minimum of 6 inches above wall cap and piped out into common area**. 2" J-hooks must be provided every 5-6 feet, to manage cable to be taken back to nearest cable tray. J-hooks must be installed from ceiling structure with stingers. No wall mounted J-hooks.

All conduits shall be fitted with a minimum 200 TS polyline pull string to run the length of each conduit. **NO FLEX CONDUIT WITHOUT PRIOR CONSENT OF TELECOMMUNICATIONS FOR ALL INSTALLS.**

All workstation communication outlet boxes shall be placed in close proximity to standard electrical outlets. Outlet boxes shall be mounted at either standard electrical outlet height or above counters.

All voice/data outlets and floor boxes must go back to the appropriate telco room **keeping within the 295' maximum cable distance requirement for network connectivity.**

## D. ELECTRONIC CLASSROOM and LAB SPECIFICATIONS

### DATA OUTLETS

All horizontal pathways from classrooms must go back to the same Telco room. This includes all wall and floor box locations within the room.

Provide at minimal, (1) 2 square single gang outlet in each classroom & lab with a single-gang mud ring. One outlet to be centrally located on wall at the front of each room, to accommodate voice/data cable.

Provide one 2 square single gang back box with a single-gang mud ring for every four workstations. Outlet to be located approximately mid-way between the four workstations. Each back box shall have an individual 1" conduit terminated as close as possible, using the shortest most direct route, to the nearest cable tray on that floor. If cable tray is not provided, each conduit to stub up a minimum of 6 inches above wall cap and out of room with an appropriate sized J-hook provided every 5-6 feet, to manage cable to be taken back to nearest cable tray. **NO FLEX CONDUIT WITHOUT PRIOR CONSENT OF TELECOMMUNICATIONS FOR ALL INSTALLS.**

When tables are set up in rows, adequate power must be provided on the walls to allow for an electrical whip from the wall to powered table top.

All computer labs must have a location designated during design to allow for a print release station and PC. Provide one 4 square double gang outlet with 2-gang mud ring at each printer location.

Provide one dedicated electrical quad outlet at each printer station location

1-1" Conduit to be provided for data cable to floor box at Instructor's Station in each classroom & lab. This conduit to be stubbed up and out to nearest cable tray. Data cable will co-exist with AV cable in floor box. . **NO FLEX CONDUIT WITHOUT PRIOR CONSENT OF TELECOMMUNICATIONS FOR ALL INSTALLS.**

## **ROOM LAYOUT**

### **Electronic Classrooms: Tables to be arranged in horseshoe shape, unless otherwise specified by the Dean or Department Chair.**

The room layout in electronic labs should be arranged in horseshoe shape around the perimeter of the room.

The room should allow for tables to be a minimum of 72" long and 24" deep allowing a minimum of 36" of spacing between workstations.

All electronic classrooms must provide wall space for a printer table. Allow space for a table to be a minimum of 48" long x 30" wide and ADA height requirements must be met. The placement of this table must be in an accessible area for all students to access, without interrupting instructor. Table must also be placed in a location that will not interfere with a pull down screen.

The room must provide for a minimum of 2% of classroom seating for wheelchairs as required by ADA.

### **Computer Labs: Tables to be arranged in rows, unless otherwise specified by the Dean or Department Chair.**

The room layout in computer labs should allow for a minimum of 4 feet between each row of tables. This allows sufficient room for walking and for moving chairs in and out of position.

The room layout should allow for a 4-5 foot center aisle, if tables are to be arranged in rows.

The room should allow for tables to be a minimum of 72" long and 24" deep allowing a minimum of 36" of spacing between workstations.

The room must provide for a minimum of 2% of classroom seating for wheelchairs as required by ADA.

## **POWER**

Electronic classrooms must be provided with surge protection at the electrical panel.

Power must be adequate at electrical panel to accommodate the scheduled number of seats per row.

When tables are arranged around perimeter of room in a horseshoe shape, adequate power must be provided on the walls to accommodate a PC & monitor for each seat.

## **FURNITURE**

The room should allow for tables to be a minimum of 72" long and 24" deep allowing a minimum of 36" of spacing between workstations for all electronic classrooms and computer labs.

### **For Electronic Classrooms:**

Tables should be arranged around the perimeter of the room, unless otherwise specified by the Dean or Department Chair. Tables will need to provide a separate wire management system for power and data. These can not be combined.

### **For Computer Labs:**

Tables should be arranged in rows, unless otherwise specified by the Dean or Department Chair. These tables must be wired for electrical and powered to accommodate an electrical whip from wall to table top. A separate wire management system must be provided for power and data. These can not be combined.

ADA seating must be provided with tables which are either 31" in height or adjustable. A minimum of 2% must be furnished for wheelchair bound students.

One printer table must be provided to accommodate a printer and a PC Work Release Station. The printer table must be a minimum of 48" long x 30" wide and must be ADA compliant.

Movable seating with tablet arm should have an oversized arm for note taking. Approximately 10% of tablet arm chairs should be for left-handed students.

END OF SECTION

## **F. Elevator Lines, Alarm Circuits, Emergency and Courtesy Phones**

A written request must be sent to KSU Telecom, requesting appropriate number of voice and data cable that will be required, as well as giving locations where cable is

to be pulled and terminated. Voice and data cable **will not** be terminated and active until MDF and IDF Telco closets have been completed by KSU personnel.

Conduit must be provided for all elevator lines and alarm circuits, from appropriate mechanical room to nearest cable tray on that floor, using the shortest most direct route, or to nearest Telco closet. **Telco rooms are to house only building entrance conduits and pathways to multiple floors. All other conduit should be taken back to nearest cable tray or have prior approval by UITS to be located in MDF/IDS's.**

Conduit or appropriate pathway must be provided for emergency and courtesy phones, from outlet to nearest cable tray or Telecommunications room. These outlets must comply with ADA requirements.

END OF SECTION

## **G. Grounding and Bonding Labeling**

- Telecommunications Main Grounding Busbar (TMGB).
- The telecommunications main grounding busbar must be labeled "TMGB" to comply with standard requirements.
- Telecommunications Grounding Busbar (TGB).
- Telecommunications grounding busbars located in each equipment room must bear the prefix "TGB". The room numbers in which the TGBs are installed must be labeled accordingly.
- TGB-1-A through TGB-1-D on the first floor.
- (Example: TGB-1-A is the Telecommunications Grounding Busbar on the first floor, cable A)
- Telecommunications Backbone Bonding Conductor (TBBC).
- The telecommunications backbone-bonding conductor shall be labeled with the prefix "TBBC".
- Grounding Electrode Conductor (GEC).
- The grounding electrode conductor shall carry the prefix of "GEC" followed by the type of electrode to which it is grounded.
- Telecommunications Equipment Bonding Conductor (TEBC).
- The telecommunications equipment-bonding conductor shall have a prefix of "TEBC". In installations with more than one (1) equipment rack, the suffix shall indicate the rack in which the TEBC terminates. The TEBC shall also be labeled at both ends. (Example: TEBC-1 would be bonding conductor #1)

END OF SECTION

## H. Equipment and Racks

Equipment racks shall be 7-ft. high floor mounted standard racks with a minimum load rating of 600 pounds. Racks shall be black powder coat finish and shall comply with EIA310-D. Racks shall be UL listed, self-supporting, with horizontal and vertical wire management systems to facilitate the proper termination of cabling, and allow neat and orderly cross-connect administration, labeling, and move/add/change (MAC) management. Horizontal cable channels shall intersect seamlessly with vertical cable channels. Provide covers for all cable management channels.

Because every location is unique, final placement of:

1. Rack and Ladder
2. Cable Management
3. UPS equipment
4. Network switches
5. Other equipment

This will need to be coordinated with KSU UITS Cabling, Infrastructure, and Networking.

In general, spacing should be 3' in the front of the rack, and 5' in back.

The Ladder should connect to both walls and directly connected to the top of the racks using the top plate and "J" bolts.

END OF SECTION

## I. Wi-Fi Installation

KSU has standardized on Cisco AP3800 series access points. A Cisco AP2800 series access point can be utilized in rare cases and must be approved by a KSU network engineer prior to purchase. Mounting the Cisco Access points must follow the guidelines provided by Cisco in the "Cisco Aironet Series 2800/3800 Access point Deployment Guide".

AP location information:

A Wireless site survey should be performed to determine AP locations using an access point with an internal antenna or a simulation tool such as AirMagnet Planner. Both A and G antennas should be set to diversity mode. Transmit Power levels should be set to 6mW for 2.4GHz and 12mW for 5GHz unless otherwise noted. The locations identified by the survey should be additional APs to the KSU UITS Network specified locations which will be provided.

Survey Grade as defined by the following Specifications: DATA

Minimum Cell Boundary (2.4 GHz / 5 GHz)	-73dBm
Minimum Data Rate	12 Mbps
Minimum SNR	25 dB
Cell Overlap (2.4 GHz / 5 GHz)	15%
Adjacent Channel Separation	-86 dBm
2.4 GHz Channels	1, 6, 11
5 GHz Channels	UNII-1 & UNII-3
AP power Levels	Set to match Client or 6/12mW

END OF SECTION

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**APPENDIX 04 – AUDIO VISUAL DESIGN CRITERIA**

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# **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

## **Introduction**

An enterprise-wide technical architecture (EWTA) is an operational statement of the current technologies utilized and supported by the central computing organization.

## **The elements of the EWTA are:**

1. Desktop Client Platforms
2. Desktop Applications
3. Email/GroupWare
4. Servers
5. Network and Communications Protocols
6. Operational Software
7. Database, Data Interfaces
8. Security
9. Middleware
10. Application Development Tools
11. Mobile/Remote Platforms
12. Voice Communication
13. E-Commerce
14. Transaction Security
15. ADA Compliance
16. Interfaces to ERP Data
17. Learning Management System
18. Content Management System
19. Software as a Service

## ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

### 1. Desktop Client Platforms

The client-server desktop platform is described by IT Services' hardware, operating system and client software.

#### Hardware

The supported client desktop is Dell Optiplex, Dell Precision, and Apple iMac. The University's preferred vendor is Dell and Apple. Current purchases are:

<p><b>Dell OptiPlex 9020 MT Desktop:</b></p> <p>Intel® Core™ i7-4790 Processor (Quad Core, 8MB, 3.60GHz w/HD4600 Graphics)              8GB 1600MHz DDR3 Memory              500GB Hard Drive              AMD Radeon™ R2 240, 1GB DDR3, FH, 1 DP 1 DVI              19-inch Flat Panel Monitor</p>	<p><b>Dell OptiPlex 9020 ( High-End) MT Desktop:</b></p> <p>Intel® Core™ i7-4790 Processor (Quad Core, 8MB, 3.60GHz w/HD4600 Graphics)              16GB 1600MHz DDR3 Memory              1TB Hard Drive              AMD Radeon™ R2 240, 1GB DDR3, FH, 1 DP 1 DVI              19-inch Flat Panel Monitor</p>
<p><b>Dell Precision T1700 MT CTO Base ( High-End Desktop)</b></p> <p>Intel Core I7-4790 (Quad Core HT, 3.60GHz Turbo)              Nvidia Quadro K620 2GB (DP, DL-DVI-I)              500GB 3.5inch Serial ATA (7,200 Rpm)              16GB (2x8GB) 1600MHz Memory              19-inch Flat Panel Monitor</p>	<p><b>Apple iMac 21.5-inch Desktop:</b></p> <p>2.9Ghz Quad-Core Intel Core i5, Turbo Boost up to 3.6GHz              NiVidia GeForce GT 750M 1GB GDDR5              8GB 1600MHz DDR3 SDRAM              1TB Hard Drive              Apple Mouse              Apple Keyboard with numeric keypad (English)</p>

The supported client laptops are the Dell Latitude E5000 and E7000 series, Apple MacBook Air and Macbook Pro, and Lenovo ThinkPads. Complete a Tech Purchases webform found at <http://uits.kennesaw.edu/support/formspurchases.php> for specific laptop configurations.

Kennesaw State University leverages Virtual Desktop Infrastructure (VDI) as a preferred solution utilizing PCoIP monitors as the preferred lab interface. All VDI images are based on the campus standard image.

# ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

## **Operating System (OS)**

Enterprise-wide client-server applications will be required to be compatible with Microsoft Windows 7 Enterprise Edition 64-Bit Service Pack 1 and/or OSX 10.10

## **Client Applications**

A client application is a software program that connects the desktop computer to its corresponding server based component. Client applications by themselves provide no or minimal functionality. They require a connection to their “application server”. The server and client components must be in sync (i.e. compatible versions) for all functions to work correctly. The table below is an alphabetical list of supported clients. Additional version information is available upon request.

<b>Client Application</b>	<b>Function</b>
ADP Ev5	HR/Payroll
AIM	Facilities and Asset Management
Banner INB & Web Self-Service 8.x	Student Information System
Blackbaud Financial Edge	Accounting and Fundraising System
Blackbaud Raiser’s Edge	Alumni & Development System
Bomgar	Remote Assistance
ChangeGear	Service Request and Change Mgt
Crystal Reports	IT-Centric Reporting Tool
DegreeWorks	Degree Auditing System
Digital Measures Course Response and Activity Insight	Electronic Course Evaluation System and Faculty Activity and Portfolio Portal
Endeavor	Library System
Events Management System (EMS)	Client for accessing EMS Enterprise
Firefox	Web Browser
Higher One	Refunds
Hobsons	Customer Relationship Management
Internet Explorer	Web Browser
<u>IronKey</u>	<u>Encrypted Hard-Drives</u>
Lenel	Door/gate access
Microsoft Application Virtualization	Virtual application delivery

## ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

Missouri Book Systems	Bookstore POS System
Nelnet	e-Cashier flexible payment portal
Nolij Transfer	Data Load System
Nolij Web	Document Imaging System
OnityTesa	Door/gate access
Oracle Application Server/ Portal 10giAS	ESS Development, report & application deployment
Oracle Java Version 6/7	Oracle Forms Client Access
Oracle Networking	Oracle Database Access
Oracle SQL*Net	Oracle Database Access
PeopleSoft Financials 8.9	Purchasing/Accounting/GL
Pharos Gold	Network Print Mgmt
Remote Assistance	Remote Server Access
SALTO	Door/gate access
SAS Enterprise Guide and Web Report Studio 9.2	Reporting and Analytics Tool
Smart Grants	Grants Management
StarRez	Student Housing Management
Team Dynamix	Project Management Portal
Touchnet	Payment Portal
VMware Fusion	Desktop Virtualization
Zimbra 7.1.1	Email & Calendar

### 2. Desktop Applications

A desktop application can be completely installed on the desktop computer's hard drive and does not require a network connection to a corresponding "server application" to provide its functionality. This is in sharp contrast to client applications, which provide no functionality unless connected to its corresponding server component (see "Section 1, Desktop Client Platforms").

Desktop applications do, like client applications, depend upon the underlying desktop operating system. Currently, Windows and Apple applications are supported.

Below are the specific products for which both technical and user support is available.

<i>Type</i>	<i>Software Application</i>	<i>Version</i>	<i>Description</i>
General Productivity	MS Office Suite	2011/2013	Includes a word processor (Word), spreadsheet (Excel),

## ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

			database (Access), presentation tool (PowerPoint)
	MS Visio	2010/2013	Flowchart creation tool
	Adobe	Creative Cloud	Document, Multimedia and graphic creation/editing
Utilities	Microsoft	System Center 2012 Endpoint Protection	Anti-virus, firewall, IDS, & proactive threat protection
	Microsoft System Center Endpoint Protection	Client Version 4.5	Anti-virus and proactive threat protection
	Adobe Acrobat Pro	11	PDF file editor

### 3. Email/Zimbra

Zimbra is a genre of software that facilitates collaboration through integrated functions and shared resources. Zimbra products integrate email, contacts, and calendars.

KSU uses Zimbra messaging, which is IMAP compliant. KSU does not support POP.

The table below shows the supported solutions and their respective components.

<i>Category</i>	<i>Protocol</i>	<i>Platform</i>	<i>Client</i>
Email	IMAP	Microsoft	Outlook
	IMAP	OSX	Mail
	HTTP	Zimbra	Web Browser
Calendar	IMAP	Microsoft	Outlook
	IMAP	OSX	iCalendar
	HTTP	Zimbra	Web Browser

### 4. Servers

Servers are categorized by the following:

- Administrative servers, generally housing enterprise-wide administrative applications
- Research Servers are used to support academic research conducted on the High Performance Computing Cluster managed by UITS.

## ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

- File/print servers, used for desktop application delivery and “infrastructure applications” such as e-mail. Infrastructure applications are defined as applications that are primarily used as data transport.
- Web servers, both Internal (Intranet) and External
- Enterprise servers, generally housing, technical applications that affect the operation of the entire network; including functions such as DNS/DHCP and firewalls.
- Small application servers, generally housing single, tactical applications
- Servers must be located and managed in accordance with USG and KSU policy requirements.

The standards for these servers include both the hardware and operating system:

<b><i>Server Category</i></b>	<b><i>Vendor &amp; Hardware</i></b>	<b><i>Operating System</i></b>
Administrative Servers	HP Blade Center	Redhat Linux 5.x
Research Servers	IBM 3650, 3850, Flex Chassis	Redhat Linux 5.x, CentOS
File/Print Servers	IBM Xseries and HP Blade Center Technologies leveraging VMWare 5.x	Windows 2008 R2/2012
Operational servers	Sun SPARC	Solaris / Apache
Small Application Servers	Dell Intel-based, HP Blade Center technologies, & IBM Intel-based Servers	Windows 2008 R2/2012
Web Servers – Internet or Extranet	Sun SPARC HP 9000, HP Integrity	Solaris / Apache HP-UX 11.x, Apache, Oracle 10giAS, and Oracle Weblogic FMW 11g, Linux
Enterprise Servers	IBM Blades and Xseries, Dell Intel based, and HP Blade Center technologies	Linux, Windows 2008 R2/2012, VMWare VSphere 5.x

Clearly, applications often drive hardware and operating system choices. The table above represents “best attempt” guidelines. Deviation from the standards should be for clear necessity, not simply for optimization.

# ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

## **5. Network and Communications Protocols**

Network hardware, as well as communications protocols, is included in this section.

### **Physical Equipment**

Any purchases of equipment, routers, hubs, switches must be compatible with the existing Cisco, Enterasys, and Aptran infrastructure, as well as IPv6 compliant.

### **Wiring (Physical layer)**

Currently installed campus network wiring is “Category 6” as well as “Category 5e” to the desktop, and fiber between wiring closets and buildings.

### **Wireless**

Wireless utilizes WPA2enterprise and WPA2 with a AES cipher. These connections are authenticated via the Identity Management System. Full access to all network resources will require authentication via 802.1x.

### **Network (Network layer)**

The network is switched Ethernet for all on-campus connections. POE is available to 98% of all data ports around campus.

### **Protocol (Internet layer)**

Although many protocols will work successfully within a single subnet, the only ones that will be “routed” or passed between buildings or subnets, are IP (Internet Protocol). **We do not route non-IP protocols.**

## **6. Operational Software**

Operational software is software that is used, primarily, by computing personnel as adjuncts to the operating system to provide a comprehensive computing framework.

The following software is preferred:

<b>Category</b>	<b>Preferred Solution</b>
Backups (Windows)	CommVault Simpana 10
Backups (Unix)	CommVault Simpana 10
Batch scheduler	UC4/Appworx and IBM Platform Computing LSF Scheduler
DNS/DHCP	ISC Bind, DNCPd, Bluecat
Email list management	Listserv, Joomla, Sympa
Firewall	PaloAlto

## ENTERPRISE-WIDE TECHNICAL ARCHITECTURE

Print management	Windows 2012
Web server	Apache, Oracle 10giAS Portal, Oracle WebLogic FMW 11g, and IIS
LDAP Authentication (administrative, Oracle users)	Oracle Internet Directory (OID) 10.x
Identity Management (centralized Username Password)	<b>IBM Directory Services (LDAP)</b> – Preferred Authentication Method for Applications; <b>Active Directory</b> – Preferred Authentication Method for Desktops and Infrastructure

### 7. Database, Data Interfaces

A Data Base Management System (DBMS) consists of a collection of programs that enables you to store, modify, and extract information from a database. From a technical standpoint, DBMSs can differ widely. The terms relational (RDBMS), network, flat, and hierarchical all refer to the way a DBMS organizes information internally.

*The three supported enterprise level DBMSs are:*

- Oracle 10g Enterprise Edition (10.x) & Oracle 11g Enterprise Edition (11.x)
- Microsoft SQL Server 2008, 2012
- MySQL

Desktop and shared, small database needs can be met via Microsoft's Access RDBMS and its Open Data Base Connectivity (ODBC) standard. Client and technical support is available for Access, ODBC, and the middleware listed Section 9. Direct Oracle connectivity is available through Oracle Networking 10g/11g or SQL\*Net as well as JDBC thin client.

### 8. Security

#### **Organization**

While information security is the responsibility of all KSU employees, it is managed centrally by University Information Technology Services. System and application administrators are a critical component of information security on campus and work closely with IT Services to ensure the confidentiality, availability, and integrity of data at KSU.

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

Life safety and emergency planning are managed centrally by the Department of Strategic Security and Safety and KSU Public Safety.

### **Network/System Security**

Network Firewall security for all of campus is maintained with an enterprise Firewall at the demarcation point to the Internet. Individual servers are scanned prior to production status and maintain local security through a variety of technologies including; local firewalls/IDS, IP filtering rules, IPSec, etc. Scheduled scans of the KSU network ensure that systems are cataloged and remain hardened as services evolve.

### **Identity and Access Control**

As previously mentioned, user accounts at KSU are managed via enterprise directory services, with authentication available via LDAP, Active Directory, and CAS. ***All proposed systems are strongly encouraged to conform to this standard.*** Accounts are audited for use and password age regularly based on user classification and service access. The maximum age of the password of any NetID account is 365 days; passwords expire and accounts lock after that time period.

Enterprise Information Technology is the sole provider of Two-Factor Authentication for University resources.

### **Proximity Authentication**

Usage of RFID technologies on campus that support a changeable key are centrally managed and stored by the Information Security Office. The primary technology for Proximity Authentication is MIFARE. The cards supported are MIFARE Classic 4k. Changes to sectors or keys must be coordinated to ensure that compatibility is maintained. A complete list of sectors that can be utilized can be obtained by request from the Information Security Office.

### **IP Surveillance Cameras**

Purchase and installation of IP Video Cameras must be approved by the Department of Public Safety. Contact information can be found at <http://www.kennesaw.edu/police/>.

### **Disaster Recovery**

Disaster Recovery is another component of a complete security infrastructure. In terms of disaster recovery:

- All KSU critical servers are backed up at a consistent point in time
- Full backups are done weekly; incremental backups are done daily
- We have 7x24 coverage on all critical servers/components

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

- Off-site storage is used for all “mission critical” information. Proposed systems are evaluated for disaster recovery intersections during their implementation, and safeguards introduced as necessary. Server Disaster Recovery documents are maintained as part of KSU Business Continuity Documentation.

### **9. Middleware**

Middleware is the software between the application programs we use and the operating system of our computers. Kennesaw State adheres to the National Middleware Initiative – Enterprise Desktop Integration Technologies (NMI-EDIT) standards for academic side processes.

Middleware products that are currently supported:

- Oracle Networking and/or SQL\*Net provides applications the interfaces needed to communicate with Oracle databases, i.e. native database drivers
- OLE DB/ODBC provides applications with standard interfaces to communicate with databases from many vendors, i.e. non-native database drivers
- Oracle HTTP Server (i.e., Apache) included with Oracle 10giAS and Oracle WebLogic FMW 11g are being used as the application server. Application delivery is done with MODPLSQL module (for PL/SQL) and the Oracle Components for Java (OC4J) for JSP, Java applets, and Java Servlets.
- Oracle10g iAS Portal is employed for application development including reporting as well as a deployment and delivery platform to end-users.
- Oracle Internet Directory (OID) 10.x is being used for LDAP authentication for Oracle 10.x Portal and network names resolution.
- SAS Data Integration Studio is employed as a middleware ETL tool for data integration and secure movement of data between databases.
- Enterprise directory functionality provides authentication, authorization, and auditing for all user accounts including Banner, Oracle/PeopleSoft Financials, and ADP Ev5.

### **10. Application Development Tools**

#### **Application Development**

The following application development languages/tools are supported to develop and/or modify enterprise-wide systems including Banner and PeopleSoft:

- SQL
- PL/SQL
- Java

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

- PHP
- SAS
- JQuery
- XML
- Classic ASP
- Java Script

Production of SQL and PL/SQL is done via Dell Software's SQL Navigator and TOAD.

### **Data, Information, and Analytics Reporting**

SAS Business Intelligence Platform

(including Web Report Studio, Enterprise Guide, and Enterprise Miner), Crystal Reports, and Oracle BI technologies (Oracle Portal) are supported tools for reporting from enterprise-wide systems.

### **Web Application Development**

The following application development tools are supported to develop/modify enterprise-wide web applications:

- Java
- JavaScript
- Java Server Pages (JSP)
- HTML5
- SQL
- PL/SQL
- Perl
- PHP
- AJAX
- ASP
- VBScript
- MS .NET Platform
- T-SQL
- CSS

### **11. Mobile/Remote Platforms**

Kennesaw State University uses both mobile and remote access for its computing needs. This ranges from mobile device and laptops in terms of hardware and Wide Area Networked file storage (WebDAV based) and web based access to groupware in terms of software. Secure Roaming Wireless (802.11) access is deployed across the campus. In addition, synchronization software for handhels is supported.

### **Remote Computing**

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

Virtual Private Networking (VPN) is in use for secure off site access to internal services. VPN access, or equivalent secure tunneling technology, is required for remote administration.

### **12. Voice Communication**

The following telecommunications vendors provide voice communication services:

- Primary dial tone to KSU is provided by the Unify Enterprise VoIP system. Life Safety devices will retain the Analog 5ESS Centrex line services as provided under state contract with AT&T.
- Long Distance, int'l and toll-free services are provided through Unify Enterprise VoIP system. Long distance and int'l are billable at a per minute/per country rate and will be charged back to the respective department based on the ext utilized to place the call.
- The voice mail system is provided as part of the Unify Enterprise VoIP system.
- Cellular Telephone services are tailored per departmental needs.
- KSU Central IT provides secondary support for Residential Student Services
- UITS supports the following headsets and connection cabling for use with the Unify Enterprise VoIP system:

Plantronics Savi W740 Convertible Headset 83542-01 Plantronics APS-11 EHS cable Savi/CS500 37818-11
Plantronics CS540 Convertible Headset 84693-01 Plantronics APS-11 EHS cable Savi/CS500 37818-11
Plantronics HW251N NC Mono Headset 64338-31 Plantronics A10-16 Direct Connect Cable 66268-02
Plantronics EncorePro HW710 Mono Headset 78712-01 Plantronics A10-16 Direct Connect Cable 66268-02
Plantronics EncorePro HW720 Stereo Headset 78714-101 Plantronics A10-16 Direct Connect Cable 66268-02

### **13. E-Commerce**

Our preferred solution is that all personal financial information be requested and processed by Touchnet (a Board of Regents chosen vendor).

The following requirements must be met by e-commerce systems:

- Must be compliant over SSL version3, Secure FTP or SSH.  
NOTE: Telnet and FTP protocols are not used on campus and are blocked at the firewall.

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- Must be compliant with Industry, Federal, State, BOR, and KSU policies regarding credit card transactions and security.

### **14. Transaction Security**

KSU requires all applications which allow transactions to be routed on public networks (including the university backbone) meet or exceed all applicable government and industry standards for security including, but not limited to,:

- All Federal, State, and Local Laws
- Family Educational Rights and Privacy Act (FERPA)
- Payment Card Industry (PCI)
- Health Insurance Portability and Accountability Act (HIPAA)

### **15. ADA Compliance**

KSU prefers that systems deployed for campus users meet ADA Tier-1 Compliance. The purpose of this requirement is to ensure that the needs of system users are met through reasonable accommodation in the IT products and services provided.

### **16. Interfaces to ERP Data**

KSU maintains information on the campus community (students, faculty, staff, visitors, etc.) including education records and courses and finances in supported ERP systems. Any ancillary system implemented for campus that requires data maintained in any operational enterprise system, must be able to synchronize data with the source ERP system(s). The preferred synchronization method is via an ancillary system function that processes updates from the ERP system(s). Occasionally, ancillary systems are granted read-only access to operational ERP systems.

### **17. Learning Management System**

The campus standard Learning Management System (LMS) is Desire2Learn Brightspace (D2L). The D2L system is hosted by the University System of Georgia and administered by local KSU personnel, with authentication provided by KSU systems. Any systems that communicate directly with, or extend, the standard LMS must go through an approval and testing process that involves both KSU and the University System.

### **18. Content Management System**

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

The campus standard Content Management System for web sites is OmniUpdate OU Campus. KSU operates OU Campus as Software as a Service through the vendor OmniUpdate with users authenticating into the system through CAS. All production websites are hosted on a high-availability Linux cluster. The system is configured to allow for multiple websites, varying level of user permissions, and user workflows. OU Campus allows for web forms with submissions being stored in a back-end database that is accessible to internal users through the system. While KSU still has websites in Drupal, those sites will be migrated into OmniUpdate by January 2016.

### **19. Software as a Service**

All Software as a Service (SaaS) purchases must conform to the Technology Purchasing, Relocation, and Surplus Policy found at [policy.kenneaw.edu](http://policy.kenneaw.edu).

## **ENTERPRISE-WIDE TECHNICAL ARCHITECTURE**

### **20. Presentation Audio/Visual**

A/V equipment and infrastructure for classrooms and conference spaces is included in this section.

#### **Hardware**

The following campus standards are maintained for presentation hardware. Deviations from this list should only be made when the specific application requires a capability not available via the standard:

<b><i>Equipment Type</i></b>	<b><i>Manufacturer</i></b>
A/V switchers, controllers, processors, DSPs, touch pads/panels, scalars, converters, transmitters/receivers	Extron
Amplifiers	Extron, Crown, QSC
Speakers	Project specific
Microphones	Shure, Audio-Technica
Projection	Epson
Displays	Samsung
Interactive products	Smart, Panasonic, Samsung
Projection Screens	Da-Lite / Draper
PTZ Cameras	Sony
Document Cameras	WolfVision
Blu-Ray players	Sony
Wireless presentation	WePresent
Mounting hardware	Chief, Peerless
Lecterns	MDI
Racks/cabinets/furniture	Middle Atlantic

#### **I/O Standards**

The following standard I/O protocols and delivery methods are employed for presentation A/V:

<b><i>Distribution Type</i></b>	<b><i>Technology</i></b>
Digital Video	HDMI, HDBase-T, Display Port
Analog video	VGA
Audio	Analog, sized as appropriate
USB	Cat 5e extenders
Serial	Low voltage 22 AWG

#### **Wiring**

All UTP cabling must be Category 5e/6, plenum rated for in-wall/ceiling applications

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**APPENDIX 05 – ENVIRONMENTAL, HEALTH & SAFETY**

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## **1. Purpose**

The purpose of the document is to provide general procedure and requirement for Baseline IEQ assessment to ensure acceptable indoor air quality prior to occupancy of a new or refurbished facility at Kennesaw State University (KSU).

## **2. Scope**

These guidelines apply to new or significantly refurbished building facilities at KSU campus.

## **3. Scheduling**

Scheduling of IAQ testing should be done well in advance to ensure the work is performed and completed after the construction activities, but prior to occupancy.

## **4. Procedures**

### **A. HVAC System Verification**

To assure compliance with recognized standards for indoor air quality including ASHRAE Standard 62 latest version, the contractor's independent testing and balancing agency shall verify the performance of each HVAC system including space temperature and space humidity uniformity, outside air quantity, filter installation, drain pan operation, and any obvious contamination sources.

### **B. Flush-Out Procedures**

#### **1) Option 1**

After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 ° F and relative humidity no higher than 60%.

### **C. Baseline IAQ Assessment**

- Contractor shall hire an independent IAQ consultant/contractor, with a minimum of 5 years experience in performing IAQ assessment, to test levels of indoor air contaminants in compliance with these guidelines, subject to approval by the KSU's EHS department.



- IAQ testing shall be performed following the completion of all interior construction activities and prior to occupancy. The building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Perform testing prior to installation of furniture, workstation components, and casework.
- IAQ testing shall be conducted using testing protocols consistent with the EPA's Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- The independent IAQ contractor shall prepare a sampling plan for the approval of by KSU EHS Department. The plan shall specify sampling locations, instrumentation, sampling methods and quality control procedures.

**1) Sampling Procedure**

1. Air samples shall be collected during normal occupied hours (prior to occupancy) with the building ventilation system starting at the daily normal start times and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
2. IAQ samples shall be taken for each portion of the building served by a separate ventilation system.
3. The number of sampling points shall not be less than one per 25,000 sq. ft., or for each contiguous floor area, whichever is larger. Verify areas to be tested with the KSU's representative.
4. Samples shall be collected within the breathing zone, between 3'-0" and 6'-0" above the finished floor and over a minimum 4-hour period.
5. For formaldehyde and TVOC, at least one outdoor air samples, for each contaminant, shall be collected simultaneously with indoor sampling at appropriate outside locations for comparison.



2) Evaluation Criteria

- Maximum concentrations for monitored IAQ pollutants shall not exceed the limits listed in the most current LEED standard.

Contaminant	Maximum Concentration
Formaldehyde	27 ppb
Particulates (PM10)	50 µg m <sup>-3</sup>
total volatile organic compounds (tvoCs)	500 µg m <sup>-3</sup>
4-Phenylcyclohexene (4-PCH)	6.5 µg m <sup>-3</sup>
Carbon monoxide (Co)	9 ppm

D. Reports and Submittals

- IAQ consultant shall prepare assessment reports showing the results and location of each test, a summary of the HVAC operating conditions, and a listing of any discrepancies and recommendations for corrective actions, if required.
- In the event that any non-compliant test results occur, Contractor must provide a written report to KSU describing the source(s) of the non-compliant condition(s) and the corrective action(s) implemented.
- For each sampling point where the maximum concentration limits are exceeded, the Contractor is responsible for conducting additional flush-out with outside air and retesting the specific parameter(s) exceeded to indicate the requirements are achieved.

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TYPE: ENVIRONMENTAL, HEALTH & SAFETY STANDARD	ISSUED BY: EHS&RM DEPARTMENT	
DOCUMENT TITLE: <b>Guideline for Protecting IEQ during Construction and Renovation projects</b>		

Approved By:	
Director of Environmental Health, Safety & Risk Management	

### 1. Purpose

The purpose of the document is to provide KSU's Project Managers with guidance on how to minimize the negative impact of construction process on indoor environmental quality (IEQ) during construction and renovation projects.

### 2. Scope

These guidelines apply to all construction, demolition and renovation projects on KSU campus.

### 3. Definitions

- IEQ – Indoor Environmental Quality
- HVAC – Heating Ventilation and Air Conditioning System
- Project personnel- Persons engaged in construction activities either as employees of the University or as Contractors/third party acting on behalf of KSU.

### 4. Procedure

Construction process can have a significant negative impact on indoor environmental quality (IEQ) through the introduction of pollutants such as particulates, offensive odors, toxic chemical vapors, microbial, and combustion products. These pollutants may be as a result of both the construction activities and the use of products that may emit significant levels of contaminants. Once in the building, the contaminants may be entrained into the building's HVAC systems and be transported to contiguous areas, subsequently affect populations beyond the immediate project area. In addition, building elements may become wet from rain or snow, thus increasing the potential for mold contamination.

Proper pre-planning efforts that anticipate potential impacts on IEQ and specify adequate control strategies prior to commencing work should be viewed as an essential step to "on-time", "within budget", project completion. As part of these efforts, the KSU's Project Managers should take a comprehensive and integrated approach to IEQ during the entire construction process – from design, construction, commissioning and operation. In this regard, the Project Managers should seek to develop an Indoor Environmental Quality Management Plan which spells out appropriate project specification for maintaining

occupant comfort during and after construction; ensure review and selection of appropriate materials; adapt a proactive communication strategy to allay concerns; and implement commissioning procedures, at project completion, that specifies re-occupancy criteria.

## 5. Guidelines

The following components of project management should be considered to minimize negative impacts of construction on IEQ:

### A. Pre-Planning

Proper advance planning by Project Managers can lead to successfully control of potential pollutant, allay concerns, and maintain occupant comfort during and after construction activities. During pre-planning, some key factors to assess include:

- Types of dusts or odors produced from:
  - Material being demolished
  - Products used in construction
  - Equipment used in construction
- Presence of pollutants that are a recognized hazard, as evidenced by the Material Safety Data Sheet (MSDS).
- Times and locations where occupants are most likely to encounter airborne pollutants.
- The expected amount and duration of exposure occupants may have to the pollutants.
- General safety and hygiene; for example, keeping hallways and exits unobstructed.

As specific details of the project become clear, pollutant control methods can be tailored to the project. Specific control measures may involve:

- Protection of the heating, ventilating, and air conditioning (HVAC) system
- Control of the pollutant source
- Interruption of the pollutant pathway (plastic sheeting barriers, etc.)
- Housekeeping
- Scheduling considerations

### B. Occupant Notification

Notifying area occupants of the proposed work, work schedule, and a description of the type of inconvenience it may cause is critical to the success of most projects. Specifically occupants should be advised of potential odors, noise, dust generation, etc., well in advance of work so that individuals with pre-existing medical conditions can make alternate arrangements or go on a modified work schedule.

## 6. Pollution Control

Prior to commencement of work, project personnel should be made familiar with KSU's emergency procedures, and other safety regulations. Project personnel should wear appropriate personal protective equipment.

### A. Control Strategies

#### 1) HVAC Protection

- Where feasible, the HVAC system should be shut down for the duration of the demolition project.
- All return air (RA) openings within the designated work area should be sealed with 6-mil polyethylene sheeting and secured with duct tape.
- When total HVAC isolation is not feasible, filter media with MERV of 8 should be used at each return grill. The filters should be frequently inspected during the course of the project and replaced as needed.
- The mechanical room must not be used to store construction or waste materials.

#### 2) Source Control

- All surfaces to be disturbed should be misted with water to minimize airborne dust.
- When possible, products emitting lower amounts of odor or volatile organic compounds (VOC's) should be used.
- If feasible, electric-powered equipment should be used in lieu of gasoline-powered equipment.

#### 3) Pollutants Pathway Interruption

- All return air (RA) openings within the designated work area should be sealed with 6-mil fire resistant polyethylene sheeting and duct tape to ensure contaminants do not enter the HVAC system.
- Establish a complete physical isolation of the construction zone polyethylene sheeting of appropriate thickness.
- The floor within the enclosure should be covered with one layer of 6-mil polyethylene sheeting. Each layer should be taped at all edges. All carpeting must be protected from contamination during construction, unless new carpeting will be installed.
- Adequate exhaust ventilation should be established to maintain a negative pressure differential between the work area and adjacent areas of the building (0.02 to 0.04 w.g). The established negative pressure should be monitored to ensure the containment remains under negative pressure. EHS&RM may be contacted to provide this service.
- As far as practicable, negative pressure ventilation units should be exhausted to the outside of the building. Careful installation and daily

inspections should be performed to ensure exhausted contaminants do not re-enter the building through open windows or the air intake of the HVAC system and the ducts do not release construction debris into uncontaminated areas of the building.

- The negative pressure systems should continuously operate while work is in progress. Damage and defects in the enclosure system are to be repaired immediately upon discovery.
- Maintain the occupied spaces under positive pressure relative to the outside

#### 4) **Housekeeping**

- After completion of the work, the entire work area (including walls, ceilings, floors, and other work surfaces) should be cleaned and vacuumed. All surfaces should be free from visible construction debris and dust.

#### 5) **Scheduling**

- Depending on the expected impact, some projects should be scheduled off-hours. If this is not feasible, a buffer zone should be established around the work area where no building occupants are permitted. Building occupants should not be allowed to remain in the area where construction activities are in progress.

### **7. Commissioning and Re-occupancy Criteria**

- Prior to reoccupation of the project area, the worksite should be cleaned until there is no visible haze in the air and no settled dust is found on surfaces.
- There should be low to no detectable odors upon re-occupancy.
- The HVAC system should be restored to good operating conditions when odors and visible emissions have dissipated or otherwise been eliminated.

*Section 13850 Special Construction*

**Integrated Life Safety System**

**Kennesaw State University**

## **PART 1 General**

### **1.1 Summary**

#### **1.1.1 Summary - Fire - Security - Access Control**

This performance specification provides the minimum requirements for the Integrated Life Safety, Security, Access and Video Surveillance System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

Fire detection and alarm system  
Access control system  
Security system  
Video surveillance interface

#### **1.1.2 Manufacturer**

Acceptable fire alarm system manufacturers include:  
Edwards Systems Technology, Inc.

All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system <access control> <security>, and smoke control system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

### **1.2 References**

#### **1.2.1 Codes**

##### **1.2.1.1 Codes - Fire - Security - Access Control**

The equipment and installation shall comply with the current provisions of the following codes and standards:

NFPA 70 - 2002 National Electric Code®  
NFPA 72 - 1999 National Fire Alarm Code®  
NFPA 90A - 1999 Air Conditioning Systems  
NFPA 92A - 2000 Smoke Control Systems  
NFPA 92B - 2000 Smoke Management Systems in Malls, Atria, and Large Areas  
NFPA 101- 2000 Life Safety Code®  
UL 864 - Control Units for Fire Protective Signaling Systems.  
UL 268 - Smoke Detectors for Fire Protective Signaling Systems.  
UL 268A - Smoke Detectors for Duct Applications.  
UL 217 - Single and Multiple Station Smoke Alarms  
UL 521 - Heat Detectors for Fire Protective Signaling Systems.  
UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.  
UL 464 - Audible Signaling Appliances.  
UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling

Systems

UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.  
UL 1971 - Signaling Devices for the Hearing-Impaired.  
UL 1481 - Power Supplies for Fire Protective Signaling Systems.  
UL 1711 - Amplifiers for Fire Protective Signaling Systems.  
UL 1635 - Digital Alarm Communicator System Units  
UL 294 - Access Control System Units  
UL 1610 - Central Station Burglar Alarm Units  
UL 609 - Local Burglar Alarm Units and Systems

City of Kennesaw AHJ

Local codes/standards such as: Georgia State Accessibility Code

Federal Codes and Regulations

Americans with Disabilities Act (ADA)

Factory Mutual (FM) approval

International Standards Organization (ISO)  
ISO-9000  
ISO-9001

### 1.3 System Description

#### 1.3.1 General

##### 1.3.1.1 General Fire - Security - Access Control

The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional integrated life safety fire, security, access control system (System). The System shall comply in all respects with all pertinent codes, rules, regulations and laws of the local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

It is further intended that upon completion of this work, the Owner be provided with:

Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.

Complete documentation of system(s) testing.

Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Contractor shall use "Fire Alarm System Certification and Description" as required by Section 1-6.2 of NFPA 72 - 1999 edition.

#### 1.3.2 Description

**1.3.2.1 Description - Fire - Security - Access Control**

<Note: The following section needs to be specifically tailored to the specific project. The intent of this section is to describe the project scope, describe location of equipment and any additional details.>

Provide and install a new fire detection and alarm system consisting of:

Fire command center shall be located as shown on the drawings.

LCD Annunciator shall be located as shown on the drawings.

Provide a multi-channel one-way voice communication system.

Provide a color graphic workstation and printer, as shown on the drawings.

Remote control panel(s) shall be located every five (5) floors, as shown on the drawings..

Manual pull stations shall be located as shown on the drawings.

Area smoke detection shall be provided as shown on drawings.

Area heat detection shall be provided as shown on drawings.

Beam smoke detection shall be located as shown on the drawings

Duct smoke detection shall be provided as shown on the drawings.

Monitor the sprinkler system Waterflow(s) and valve supervisory switch(s).

Monitor the stand alone suppression systems as shown on the drawings.

Provide audible appliances located throughout the building, as shown on the drawings.

Provide synchronized visual appliances located throughout the building, as shown on the drawings.

Provide a Two- way communication system <remote telephone> <phone jack> located at elevator lobby(s), within exit stairwell(s), elevator car(s), the fire pump room, as shown on drawings.

Magnetic door holders shall be located as shown on drawings.

Provide fan shutdown controls as shown on drawings.

Provide direct interface to the building automation system.

Provide elevator recall functions for primary and alternate floors and elevator power shunt trip activation.

Provide access control card readers and controllers and required accessories at the doors shown on the drawings.

Provide electrically controlled door locks, type and location as shown on the drawings.

Provide 1 set of access control card management software for installation on owner's

computers

Provide intrusion detection sensors, type and location as shown on the drawings.

Provide security keypads as shown on the drawings.

Provide connection to a central station. The owner shall arrange for two dedicated phone lines to be terminated as directed by the installing contractor.

Remove the existing fire detection and alarm system(s).

### **1.3.3 Operations**

#### **1.3.3.1 Sequence of Operations**

##### **1.3.3.1.1 General**

<The following representative tasks should be customized for each project>

Upon the alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler Waterflow, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

Display the alarm event on the graphical workstation.

The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local Annunciator LCD/LED's associated with the alarm zone shall be illuminated.

Activate notification audible appliances on the fire floors (zones) immediately above and below (adjacent to) the fire floor (zone) <general alarm evacuation>.

Activate visual strobes notification appliances on the fire floors (zones) immediately above and below (adjacent to) the fire floor (zone) <general alarm evacuation>. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.

Transmit signal to the building automation system.

Transmit signal to the central station with point identification.

Activate automatic smoke control sequences.

All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

All stairwell/exit doors shall unlock throughout the building.

All self-closing fire/smoke doors held open shall be released.

Direct the closed circuit TV cameras to the alarm event and start video recording.

Transmit alarm text messages to "alpha-numerical" display pagers.

##### **1.3.3.1.2 Duct Smoke Activation - Supervisory**

<The following representative tasks should be customized for each project>

The supervisory activation of any duct smoke detector, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

Display the event on the graphical workstation and display a pictorial image.

The LCD display shall indicate all applicable information associated with the

supervisory condition including; zone, device type, device location and time/date.  
All system activity/events shall be documented on the system printer.  
Any remote or local Annunciator LED's associated with the alarm zone shall be illuminated.  
Transmit signals to remote Annunciator located in building security desk, the engineer's office and the building management office.  
Transmit signal to the building automation system.  
Transmit signal to the central station with point identification.  
Shutdown the local air handling unit.  
Transmit alarm text messages to "alpha-numerical" display pagers.  
All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

#### **1.3.3.1.3 Supervisory Operation**

Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.  
Display the event on the graphical workstation and display a pictorial image.  
The LCDXL display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.  
All system activity/events shall be documented on the system printer.  
Any remote or local Annunciator LCD/LED's associated with the supervisory zone shall be illuminated.  
Transmit signal to the central station with point identification.

#### **1.3.3.1.4 Trouble Operation**

Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.  
Display the event on the graphical workstation and display a pictorial image.  
The LCDXL keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.  
All system activity/events shall be documented on the system printer.  
Any remote or local Annunciator LCD/LED's associated with the trouble zone shall be illuminated.  
Transmit signal to the central station with point identification.

#### **1.3.3.1.5 Monitor Activation**

<The following representative tasks should be customized for each project>

Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

<The internal audible device shall sound at the control panel or command center >  
<Display the event on the graphical workstation and display a pictorial image.  
<The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.>  
<All system activity/events shall be documented on the system printer.>

Any remote or local Annunciator LCD/LED's associated with the status zone shall be illuminated.

### 1.3.3.2 Graphic Workstation

#### 1.3.3.2.1 Graphic Workstation - Fire - Security - Access Control

##### Graphic Workstation Functions

##### All Events

Display the address of the alarm or off normal point with type and description and time of the event in a prioritized color-coded event list. Highlighting an event in the event list shall automatically cause the other three quadrants (described below) to display information relating to the highlighted event.

Display color graphical representation of the area in which the alarm or off normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered equal.

Display a set of written operator instructions for each event, site programmability of the message must be provided allowing modification by the end user to suit occupancies and emergency plans. The Workstation must provide simple control via a two button mouse.

Display a preset CCTV video or stored image of the device

Log operator's comments for each event to history with time and date.

Log all events and operator actions to history for future review.

##### Fire alarms

Shall be capable of acknowledging, silencing, and resetting fire alarm functions.

Shall be capable of manually activating, deactivating, enabling, and disabling individual fire alarm points.

Shall be capable of generating status, maintenance and sensitivity reports for all fire alarm components.

Receipt of a fire alarm shall activate an audio WAV file over the workstation speakers alerting the operator to a fire alarm, and providing audible instructions.

##### Security Events

Shall be capable of acknowledging and silencing security event functions.

Shall be capable of manually activating, deactivating, arming, disarming, enabling, and disabling individual security points and /or partitions.

Shall be capable of generating status reports for all security devices.

Receipt of a security event shall activate an audio WAV file over the workstation speakers alerting the operator to a security event.

##### Access Control Events

Shall be capable of acknowledging access control event functions.

Shall be capable of manually activating, deactivating, arming, disarming, enabling, disabling, opening, unlocking, closing, and locking individual doors.

Shall be capable of manually enabling and disabling card readers.

Shall be capable of generating status reports for all card reader controllers.

Receipt of an access control event activate an audio WAV file over the workstation speakers alerting the operator to a security event.

##### Closed Circuit Television (CCTV)

Shall provide a video display on one quadrant of the workstation as received from

the CCTV switcher-multiplexer.  
Shall command the switcher-multiplexer to direct the appropriate camera to the preset azimuth and elevation for each event, and sent this image to the workstation.  
Shall provide manual pan, tilt, and zoom control signals to the switcher-multiplexer.

Maintenance and Control Functions  
Control capability  
Reports: status, sensitivity.

### 1.3.3.3 Security

#### 1.3.3.3.1 Perimeter Security

Perimeter Security - Activation of any armed perimeter security device shall perform the following operations:

Show the location and type of alarm sensor on the keypad display.  
Notify the remote central monitoring station(s) with the group, system location, and device location of the alarm event.  
Activate local sounders or voice communication system.  
Notify the building command center with the group, system location, and device location of the alarm event.  
Display a graphic representation of the alarm location, device type, operator instructions and video call-up on the event driven graphic workstation.  
Send a digital message to an alphanumeric pager(s) for designated employees.  
Send a digital signal to the video controller, enabling alarm call-up and VCR recording of the alarm event.  
Log and record the alarm event.

#### 1.3.3.3.2 Interior Security

Interior Security - Activation of any armed interior security device shall perform the following operations;

Notify the location and type of alarm sensor on the keypad display.  
Notify the remote central monitoring station(s) with the group, system location, and device location of the alarm event.  
Activate local sounders or voice communication system.  
Notify the building command center with the group, system location, and device location of the alarm event.  
Display a graphic representation of the alarm location, device type, operator instructions and video call-up on the event driven graphic workstation.  
Send a digital message to an alphanumeric pager(s) for designated employees.  
Send a digital signal to the video controller, enabling alarm call-up and VCR recording of the alarm event.  
Log and record the alarm event.

#### 1.3.3.3.3 Opening and Closing

Opening and Closing Operation - When a group(s) of security protection are closed (secured) and opened (unsecured) the following shall occur:

The entry reader by the employee entrance door will open the door and deactivate the perimeter and interior security groups for the facility.  
Upon securing the group(s) for the facility, the LCD keypad display will indicated the status of the security group(s) and the related devices. If the security group(s) are

secure, an authorized user will put the security code into the LCD keypad display and activate or secure the security groups authorized. An internal adjustable exit timer will activate shunting the employee entrance door until the entrance door is closed or the timer expires.

#### **1.3.3.3.4 Hold up and Duress**

Hold Up or Duress - Activation of any duress security device shall perform the following operations;

Notify the remote central monitoring station(s) with the group, system location, and device location of the alarm event.

Notify the building command center with the group, system location, and device location of the alarm event.

Display a graphic representation of the alarm location, device type, operator instructions and video call-up on the event driven graphic workstation.

Send a digital message to an alphanumeric pager(s) for designated employees.

Send a digital signal to the video controller, enabling alarm call-up and VCR recording of the alarm event.

Log and record the alarm event.

### **1.3.3.4 Access Control**

#### **1.3.3.4.1 Card Access Database Program**

Card Access Database Application Program

The card access database (CAD) application program shall be designed to administer the functions necessary for access control. The program shall operate under Windows® 2000 with intuitive, easy to operate capabilities for any novice PC user. The CAD can be installed on a single PC or on a server allowing multiple users full access to the database. The CAD shall support multi-tenant applications, segregating databases for each tenant. The CAD shall employ an ODBC database engine that stores cardholder and system configuration information. The CAD shall enable the user to add, change or delete cardholder information, schedules, access levels, etc. The CAD shall contain the ability to retrieve, filter and generate reports uploaded from the card reader controllers. The CAD shall archive and log system activity and create history logs that will enable a user with the ability to retrieve the information as required.

#### **1.3.3.4.2 Parking Gate**

Parking Gate Operator - The following will occur when a parking gate operator is equipped with a card reader, gate arm, request to exit device and loop detector;

The card reader controller (CRC) shall read the credential code presented to the card reader and either deny or grant permission to the gate controller depending on the authorization permissions of the credential holder.

When a valid credential is presented, the green LED shall light continuous for a period determined by the reader capabilities or until another credential is presented.

When an invalid credential is presented, the red LED shall flash continuous for a period determined by the reader capabilities or until another credential is presented.

The parking gate reader shall have a read range of 3 feet minimum.

When a vehicle passes through and clears the gate and clears the vehicle detection device, the gate controller shall close the gate arm.

On egress, a vehicle detection device will activate the gate controller and lift the gate

arm to allow the vehicle clearance. When the vehicle clears the vehicle detection device on the other side, the gate controller will close the gate arm.

### **1.3.4 System Configuration**

#### **1.3.4.1 General - Fire - Security - Access Control**

The system supplied under this specification shall utilize node to node, direct wired, multi-priority peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors, input/output modules, intrusion detection and card reader controllers as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional member of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

All integrated life safety system equipment shall be arranged and programmed to provide an integrated system for the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants. In all operating modes, the processing of fire alarms shall have the highest priority.

Devices shall be listed for both fire and security applications. System performance shall not be degraded if fire and security devices are installed in the same system. Fire alarm, intrusion, access control and video functions shall be partitioned to permit virtual-independent operation.

All integrated system operation shall be based on application programming in order to provide the greatest flexibility in integrating fire, intrusion, access control and video functions, and assure compliance with all required codes and standards.

#### **1.3.4.2 Power Supply**

Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for <insert 24 or 60> hours and capable of operating the system for <5> minutes in the alarm mode at 100% load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

#### **1.3.4.3 Display**

The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermix to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.

#### **1.3.4.4 Initiating Device Circuits**

Initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, Waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be <Class A (Style "D" or "E")>< Class B (Style "A" or "B").> Initiating device circuits monitoring magnetic security contacts, motion detectors, duress station, glass break and intrusion type devices, shall be Class B (Style "A" or "B").

#### 1.3.4.5 Notification Appliance Circuits

All notification appliance circuits shall be <Class A (Style "Z")><Class B (Style "Y")>. All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc; 50 watts @ 25V audio, and 35 watts @ 70V audio. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

#### 1.3.4.6 Signaling Line Circuits

When a signaling line circuit covers more than one fire/smoke compartment, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments. The signaling line circuit connecting network panel/nodes, Annunciator, command centers, shall be <Class A (style 7)>< Class B (style 4).> The media shall be copper except where fiber optic cable is specified on the drawings.

The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be <Class A (style 6 or 7)>< Class B (style 4).>

The signaling line circuit connecting to the audio communications (pre-amp signal), amplifiers, and nodes shall be <Class A (style 6)>< Class B (style 4).> The circuit shall be power limited.

The signaling line circuit connecting to the two-way communications circuit (riser) shall be <Class A (style 6)>< Class B (style 4).>

The signaling line circuit connecting to access control card reader controller and keypads/displays shall be <Class A (style 6)>< Class B (style 4).>

#### 1.3.4.7 Network Wiring

The system supplied under this specification shall utilize node to node, direct wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules <intrusion detection> as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

#### 1.3.4.8 Network Nodes

The remote control panel(s) (network nodes) shall meet the same requirements as described in control panel section and shall contain the following;  
<Common control switches with 168 character LCD display, as required.>  
Integral power supply(s) with secondary stand-by power.

Signaling line circuits for communications with analog/addressable devices, as required.  
Audio amplification, as required.  
Notification appliance circuits, as required.  
Auxiliary function circuits and operations, as required.

#### **1.3.4.9 DACT**

The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols. The system shall provide an individual CMS account for each tenant, and send the required signals to the one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

<The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system of the owner's choice, using TAP Pager protocol.>

#### **1.3.4.10 Security**

All intrusion detection system equipment shall be arranged and programmed to provide an integrated system for the intrusion detection, local notification on premises, the notification of a UL listed central monitoring center, and the activation of other auxiliary systems required to annunciate and notify the proper authorities.

Intrusion detection devices shall be connected using intelligent distributed devices wired to a panel. Devices such as motions detectors, door position switches, dry-contact monitoring devices, glass break detectors, photoelectric beams, etc., shall be supported by intelligent monitoring devices or contain integral intelligent circuits required for monitoring. Security functions provided by the system shall include; partitioning, interior security, perimeter security, day security, bypassing, entry/exit delays, audible notification, bi-lingual support, international language support, and annunciation.

The one-way voice messaging system equipment shall be configured and programmed to provide a command and response messages related to access control and/or intrusion detection systems under normal or abnormal conditions.

#### **1.3.4.11 Access Control**

All access control equipment shall be configured and programmed to provide a distributed integrated system for the processing of credentials presented for ingress or egress of protected entry or exit areas and the activation of other auxiliary systems required to annunciate and manage the system on or off premise.

The card reader controller (CRC) shall be designed to accommodate complete information for up to 36,000 individuals and will process egress or ingress decisions based on the CRC database and permissions granted by each individual. The CRC shall be programmed to allow or disable event reporting to the network panel/node and shall have event storage capacity for up to 20,000 events.

Individual personnel information shall be programmed into the CRC using the node/panel network from an application program designed to administer and manage the access control system. The application program shall be Windows® 2000 or XP based and be able to operate on commercial off the shelf Intel based computers. The application program shall be able to operate as a single program or with other program applications operating on the computer. The computer shall connect through a direct RS-232 connection, fiber optic cable connection or IP connection. The application program shall

be able to store, report and manage event activities related to access control functions.

## 1.4 Submittals

### 1.4.1 Project

The contractor shall purchase no equipment for the system specified herein until the owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order.

Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.

All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials

#### Product Data

Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Architect/Engineer.

#### Shop Drawings

A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

Control panel wiring and interconnection schematics.

Complete point to point wiring diagrams.

Riser diagrams.

Complete floor plan drawing locating all system devices and 1/4" = 1'-0" scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.

Complete system bill of material.

All drawings shall be reviewed and signed off by an individual having a minimum of a NICETIII certification in fire protection engineering technology, subfield of fire alarm systems.

#### Samples

A sample of each smoke detector, intelligent modules, horn, strobes, card reader controller, card reader, and door locking mechanism shall be provided to the contractor for their familiarization.

#### Quality Assurance/Control Submittals

##### Installer's Certification

The engineered systems distributor must be licensed in the state of project location and have been recognized or incorporated in the business in the state of Georgia for a minimum of 10

years. The distributor must be a registered MBE. The distributor must be registered as ISO 9001. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.

#### System Calculations

Complete calculations shall be provided which show the electrical load on the following system components:

Each system power supply, including stand alone booster supplies.

Each standby power supply (batteries).

Each notification appliance circuit.

Each auxiliary control circuit that draws power from any system power s

### 1.4.2 Close Out

Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:

Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.

The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).

Provide the name, address and telephone of the authorized factory representative.

A filled out Record of Completion similar to NFPA 72, 1999 edition figure 1-6.2.1.

## 1.5 Quality Assurance

### 1.5.1 Qualifications of Contractor

#### 1.5.1.1 Fire - Security - Access Control

The contractor shall have successfully installed similar system <fire detection, evacuation voice and visual signaling control components; access control, card readers; security detectors and controls, video surveillance equipment> on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.

The contractor shall be licensed in the state of project location and have been recognized or incorporated in the business in the state of Georgia for a minimum of 10 years. The contractor shall be a registered MBE. The contractor shall be registered as ISO 9001. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.

The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

## **1.5.2 Pre-installation Meetings**

### **1.5.2.1 Pre-Installation Requirements**

The provider shall submit a detailed project plan that will describe in detail how the provider will approach the project, from inception to finalization. The plan must include at a minimum the following information:

- Project Staging
- Project Management
- Equipment Schedules
- Installation Time Lines
- Other Trade Requirements
- Final Acceptance Testing
- Personnel Resumes
- Progress Report Sample

All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the manufacturer's riser/connection diagram and details for all specific system installation/termination/wiring data.

### **1.5.2.2 Start and Completion Dates**

The starting and completion dates for this work will be established at the pre-bid meeting.

### **1.5.2.3 Submission of Bid**

Bids will be due at or before 3:00 P.M., local time, on <Insert Date> at: <Insert Name & Address>

Copies to: <Insert Name & Address>

Bids shall be submitted on the bid form. Four (4) copies of the bid form shall be

submitted and one copy retained by the bidder for his records. All blank spaces for bid prices shall be filled using ink or typewritten. Any exceptions to the bid documents or qualification of the bidder's bid shall be fully explained where indicated on the bid form.

## 1.6 Project Conditions

### 1.6.1 Project Conditions

It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Inspection of the building may be made by appointment with the Owner. Contractors are requested to inspect the building prior to the pre-bid meeting.

A pre-bid meeting will be held to familiarize the Contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the Contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.

All work, except for <INSERT>, may be conducted during normal working hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, by properly coordinating the work with the Owner. Noise restrictions do apply. The core drilling, testing of evacuation signals and other work disruptive to occupants will be prohibited between 6:00 a.m. and 6:00 p.m., Monday through Friday, and will be explained at the pre-bid meeting. <NOTE: Add exclusion as needed for kitchens and other areas>. <OPTIONAL all system switch over shall be done during unoccupied hours or over weekends. Contractor is to include, in his base bid, all overtime necessary to complete his work.

The Contractor shall be responsible for prior coordination of all work and demolition with the Owner.

## 1.7 Warranty and Maintenance

### 1.7.1 Spare Parts

#### 1.7.1.1 Spare Parts - Fire - Security - Access Control

The Contractor shall supply the following spare parts:

Automatic detection devices - Two (2) percent of the installed quantity of each type.

Manual fire alarm stations - Two (2) percent of the installed quantity of each type.

Glass rods or panels for break glass manual fire alarm stations (if used) - Ten (10) percent of the installed quantity, but no less than two devices.

Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.

Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

Ten (10) Access control cards

### 1.7.2 Warranty

The contractor shall warranty all materials, installation and workmanship for one (1) year

from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals.

The System Supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.

## **1.8 Training**

### **1.8.1 Training**

The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.

The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

## **PART 2 Products**

### **2.1 Manufacturer**

#### **2.1.1 Fire - Security - Access Control**

The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

Edwards Systems Technology, Inc. products constitute the minimum type and quality of equipment to be installed.

All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based, direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, intrusion detection sensors, modules, and card reader controllers as described in this specification.

### **2.2 Panel Components & Functions**

#### **2.2.1 General**

##### **2.2.1.1 General - Fire - Security - Access Control**

The control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control, <extinguishing agent releasing system>, guard patrol, security and access control applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section.

The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any application can be configured, and modified using software provided by a single supplier. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

The control panel shall include the following capacities:

Support up to 2500 analog/addressable points.

Support up to 124 reader controllers.

Support up to 124 keypad displays

Support network connections up to 63 other control panels and Annunciator.

Support multiple digital dialers and modems

Support multiple communication ports and protocols

Support up to 1740 chronological events.

The network of control panels shall include the following features:

Ability to download all network applications and firmware from the configuration computer from the configuration computer from a single location on the system.

Provide electronic addressing of analog/addressable devices.

Provide an operator interface control/display that shall annunciate command and control system functions.

Provide an internal audible signal with different programmable patters to distinguish between alarm, supervisory, trouble and monitor conditions.

Provide a discreet system control switch provided for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details switch.

Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.

Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.

Provide an authorized operator to perform test functions within the installed system.

The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

## **2.2.2 Operator's Interface**

## **2.2.2 Operator's Interface**

### **2.2.2.1 Annunciation - Audio**

The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Standard LED Annunciator may be combined in common enclosures provided that the groups of LED's comprising each of the required Annunciator are separated from one another (Detection, Supervisory, Status, and Security) and clearly labeled.

Manufacturers' standard control switches shall be acceptable if they provide the required

operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Owner is required.

Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet. The Annunciator shall contain the following system status indicators:

- 960 character Backlit Liquid Crystal Display
- System Normal Indicator
- System Common Alarm Indicator
- System Common Trouble Indicator
- System Common Supervisory Indicator
- System Ground Fault Indicator
- System Common Security Indicator
- System Disabled Point(s) Indicator
- System Reset Switch with Indicator
- System Alarm Silence Switch with Indicator
- System Trouble Silence Switch with Indicator
- System Message Queue Scroll Switches.
- 10-Digit Keypad to Enable/Disable System and Functions.

The LED Annunciator rows shall contain the following format:

Provide one row of red (alarm) and yellow (trouble) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

Provide one row of red (alarm) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

Provide one row of yellow (supervisory) LED's. LED's in each row shall be arranged in columns, one column per type of supervisory type device, and shall illuminate upon receipt of an supervisory signal from the associated device(s) (i.e., 2nd floor sprinkler valve supervisory switch)

The LED Annunciator shall be provided with <25>% spare LED's minimum. Each pair of LED's shall be labeled "Spare".

The LED Annunciator shall contain the following switches:

Provide two-position switch to manually unlock all stairwell doors.

Provide eight (8) two position switches for system by-pass functions. Actual switch function shall be determined by the owner.

Provide a one-way emergency voice communication system Annunciator with the following design:

This standard LED Annunciator shall incorporate the microphone for the one-way and telephone handset for the two-way voice communication systems, including all required zone select and manual override control switches and the following LED indicators:

3-Position Switch

Provide 3-position switch for each evacuation signaling zone, with "Voice," "Auto" and "Evacuate" positions identified and two LED status indicators for each audio visual evacuation signaling "zone", one red and one yellow. These LED's shall illuminate to indicate respectively: 1) Evacuation signals activated (red), 2) Trouble in audio (speaker)

or visual (strobe) circuit(s) (yellow).

#### 2-Position Switch

Provide 2-position switch for each evacuation signaling zone, with "Voice" and "Auto" positions identified and two LED status indicators for each audio visual evacuation signaling "zone", one red and one yellow. These LED's shall illuminate to indicate respectively: 1) Evacuation signals activated (red), 2) Trouble in audio (speaker) or visual (strobe) circuit(s) (yellow).

#### All Call Switch 2- Position

Provide 2-position switch for "All-Call" to activate all the evacuation signaling zones, with "Voice" and "Auto" positions identified and two LED status indicators for each audio visual evacuation signaling "zone", one red and one yellow. These LED's shall illuminate to indicate respectively: 1) Evacuation signals activated (red), 2) Trouble in audio (speaker) or visual (strobe) circuit(s) (yellow).

#### All Call Switch 3-Position

Provide 3-position switch for "All-Call" to activate all the evacuation signaling zones, with "Voice", "Off" and "Auto" positions identified and two LED status indicators for each audio visual evacuation signaling "zone", one red and one yellow. These LED's shall illuminate to indicate respectively: 1) Evacuation signals activated (red), 2) Trouble in audio (speaker) or visual (strobe) circuit(s) (yellow).

#### Emergency Two-Way Voice Communication

Provide two LED status indicators for each two telephone zone, one red and one yellow. These LED's shall illuminate to indicate respectively: 1) Telephone calling-in and call connected (red), 2) Trouble in circuit(s) (yellow).

### 2.2.3 Audio

The system shall be capable of delivering 8 channel audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits.

The one-way emergency audio control shall provide control switches to direct paging messages as follows:

"All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.

"Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.

"Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones..

"Page to Balance Building" to direct page messages to the areas) in the facility NOT receiving either the evacuation area or alert area messages.

"Page by Phone" switch to select the firefighter's telephone system as the source for paging.

The system shall be capable of delivering multiple audio messages simultaneously over copper and / or fiber media. All audio messages and live pages shall originate at the one-way emergency audio control unit. The one-way emergency audio control unit shall store pre-recorded audio messages digitally. These messages shall automatically direct to various areas in a facility under program control. The system shall support remote panels with zoned amplifiers to receive, amplify and distribute messages through speakers over supervised circuits.

The two-way voice communications control unit shall provide two-way communications between remotely located phones and the command center. The control unit shall provide the ability to individually select and display each two-way voice communication circuit support up to five (5) remote telephones in simultaneous two-way voice communications.

#### Audio Amplifiers (Multi-Channel)

Provide as minimum one twenty (20) watt audio amplifier per paging zone. The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000 Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall include a dedicated, selectable 25/70 Vrms output. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

### 2.2.3 DACT Dialer

The system shall provide off premise communications capability using a digital alarm communications transmitter (DACT) for sending system events to multiple central monitoring station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols. <The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system of the owners choice, using TAP Pager protocol.> The system shall provide an individual CMS account for each tenant, and send the required signals to the one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

### 2.2.4 Power Supply

System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.

Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.

Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply affected.

All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72 - The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

### 2.2.5 Reports

The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.

The system shall provide a report that gives a chronological listing of up to the last 1740 system events.

The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

### **2.2.6 System Printer**

The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. The printer shall be capable of serial or parallel communications protocol. The communications speed for RS-232 communications protocol shall be adjustable from 300 to 9600 Baud. The printer shall list the time, date, type and user defined message for each event printed.

## **2.3 Graphic Command Workstation**

### **2.3.1 Fire - Security - Access Control**

#### **2.3.1.1 General**

The command center shall function as the center point for all operational and administration functions required for the systems provided within the specification. The command center shall contain a console that will display and house any equipment necessary for system operation. Console space shall be provided for other equipment provided under other sections of the specifications. A single graphical command workstation shall be provided that will enable primary control of the systems provided by this specification. An operator shall not have to operate multiple workstations to receive, view, process and record system events for each system provided. Equipment included in the command center shall be:

System annunciation and controls for.

Fire detection.

Fire suppression.

Fire pump status

Firefighters smoke control.

Intrusion detection.

Access control monitoring and administration.

Video surveillance.

Door unlocking system controls.

Emergency one-way voice communications.

Video imaging and badging.

<Standby generator status indication and controls.>

<Automatic transfer switch status indication and controls.>

<Radio communications>

<Public intercom>  
<Public telephone>  
<Video event recording>  
<Elevator monitor, status and controls>

### 2.3.1.2 Graphical Command Workstation

The graphical command workstation(s) shall display a different color text for each message type and color graphic diagrams/floor plans. The graphical command workstation shall simultaneously display the following system event views; system event display, graphical diagram display, event video, detailed event message/instructions, and user event log. The workstation shall be an IBM-compatible personal computer listed for UL Standards 864 (Control Units for Fire-Protective Signaling Systems) under categories UOJZ, APOU, and UUKL; UL 1076, (Proprietary Burglar Alarm Units and Systems) under category APOU as applicable; and UL 294 (Access Control System Units). The workstation(s) shall be capable of annunciation and control of all fire detection, smoke control, intrusion detection and access control points.

The computer shall be minimum of a Pentium Grade Processor 2.4 GHz, with a 533MHz front side bus, 512 MB RAM, 80 GB Hard Drive, and 18" LCD monitor. Installation of the computer or monitor can be either desk top or floor mounting or rack/panel mounting.

The software shall provide multitasking type environment that allows the user to run several applications simultaneously. The operating program shall run within a 32-bit operating system such as Windows® XP. These Windows applications shall run simultaneously with other programs. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel and other Windows based software packages, while concurrently annunciating on-line alarms and monitoring functions.

#### Graphic Workstation Operations

The graphic display screen shall be displayed into four areas. When any event occurs:

The "list of events area" shall display the address of the alarm or off normal point with type and description and time of the event in a prioritized color-coded event list. Highlighting an event in the event list area shall automatically cause the display of a graphical map and other three panels areas (described below) to display information relating to the highlighted event.

The "map area" shall display color graphical representation of the area location in which the alarm or off normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered equal.

The "event action area" shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator's log shall record operator's comments for each event in system history with time and date.

The "image area" shall display a <preset CCTV video> and/or <stored image of the device> relating to the event highlighted in the event list area.

When processing fire alarm events the graphic workstation:  
Shall be capable of acknowledging, silencing, and resetting all fire alarm functions.

Shall be capable of manually activating, deactivating, enabling, and disabling individual fire alarm points.

Shall be capable of generating status, maintenance and sensitivity reports for fire alarm components.

Receipt of a fire alarm shall activate an audio WAV file over the workstation speakers alerting the operator to a fire alarm<, and providing audible instructions.>

When processing security events, the graphic workstation:

Shall be capable of acknowledging and silencing security event functions.

Shall be capable of manually activating, deactivating, arming, disarming, enabling, and disabling individual security points.

Shall be capable of generating status reports for all security devices.

Receipt of a security event shall activate an audio WAV file over the workstation speakers alerting the operator to a security event.

When processing access control events, the graphic workstation:

Shall be capable of acknowledging access control event functions.

Shall be capable of manually activating, deactivating, arming, disarming, enabling, disabling, opening, unlocking, closing, and locking individual doors.

Shall be capable of manually enabling and disabling card readers.

Shall be capable of generating status reports for all card reader controllers.

Receipt of an access control event activate an audio WAV file over the workstation speakers alerting the operator to a security/access event.

Upon receipt of any event, the workstation:

Shall command the CCTV switcher-multiplexer to direct the appropriate camera to the preset azimuth and elevation for each specific event, and sent send this image to the workstation.

Shall display the video image on one area of the workstation as received from the CCTV switcher-multiplexer.

Shall provide manual pan, tilt, and zoom control signals to the switcher-multiplexer.

## **2.4 Access Control**

### **2.4.1 Access Control Database Program**

The access control database application program shall be designed to administer the functions necessary for management of the access control services. The program shall operate under Windows®, 98, ME and 2000 with intuitive, easy to operate capabilities for any novice PC user. The program can be installed on a single PC or on a server allowing multiple users full access to the database over commercial LAN/WAN infrastructures. The program shall support multi-tenant applications, segregating databases for each tenant. The program shall employ an ODBC database engine that stores cardholder, system configuration information and assuring standard connectivity with other database applications. The program shall enable the user to add, change or delete cardholder information, schedules and access levels. The program shall contain the ability to retrieve, filter and generate reports uploaded from the card reader controllers. The program shall archive and log system activity and create history logs that will enable a user with the ability to retrieve the information as required.

### **2.4.2 Access Cards**

A quantity of <xx> proximity access cards shall be provided. The card shall use passive

technology for transmitting its encoded badge number to the reader. For security purposes, the card's internal data storage format shall be unique to the system supplier, and not be available from third party vendors. Cards must be compatible with the card readers supplied for the project.

The card shall be the approximate size and weight of a standard credit card, 2.125" x 3.375", (540mm x 857mm).

The card shall be suitable for direct printing with a video badging system.

The card shall accept a slot for either horizontal or vertical hanging, without affecting card operation.

#### **2.4.3 Badging System**

A video badging system shall be provided for the capture, storage, and attachment of photographic images for each cardholder profile and printable to a badge. The system shall operate in using a Windows® 98, ME or 2000 operating platform and contain an ODBC compliant database. The video badging system shall interface with the Access Control Database Program to extract cardholder information for each cardholder. The video badging system shall contain management and storage functions for each card holder profile, image and badge background(s) for the creation of a photo identification badge.

Badge graphic design content and cardholder information shall be the responsibility of the owner.

#### **2.4.4 Badge Printer**

A color dye sublimation badge printer shall be provided as the output device from the video badging software. The printer shall contain current Windows® software drivers capable of communicating to Windows® 98, ME and 2000 operating systems.

A color resin thermal transfer badge printer shall be provided as the output device from the video badging software. . The printer shall contain current Windows® software drivers capable of communicating to Windows® 98, ME and 2000 operating systems.

The printer shall be capable of printing on one <two> card sides.

### **2.5 Field Mounted System Components**

#### **2.5.1 Fire Initiating Devices**

##### **2.5.1.1 Smoke Detectors & Accessories**

###### **2.5.1.1.1 Analog Addressable Smoke -- General**

Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive. In addition to the five sensitivity levels the detector shall provide a prealarm sensitivity setting, which shall be settable in 5% increments of the detector's alarm sensitivity value.

An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event. In addition to the five alternate sensitivity levels the detector shall

provide an alternate prealarm sensitivity setting, which shall be settable in 5% increments of the detector's alternate alarm sensitivity value.

The detector shall be able to differentiate between a long drift above the prealarm threshold and fast rise above the threshold.

The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 75% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% or greater compensation has been used.

The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

#### **2.5.1.1.2 Duct Detector Housing**

Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.

#### **2.5.1.1.3 Smoke Detector - Ionization**

Provide analog/addressable ionization smoke detectors at the locations shown on the drawings. The system shall have the ability to uniquely set the sensitivity and alarm verification values of each detector on a circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting prealarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

#### **2.5.1.1.4 Smoke Detector - Multi-Sensor Ion Photo Thermal**

Provide analog/addressable multisensor photoelectric thermal smoke detectors at the locations shown on the drawings. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements. Separately mounted photoelectric detectors, ionization detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is an acceptable alternative.

The detector shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. It shall be possible to automatically change the

sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting prealarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient "environmental thresholds approximately six times an hour.. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

#### **2.5.1.1.5 Smoke Detector - Multi-Sensor Photo Thermal**

Provide analog/addressable multisensor smoke detectors at the locations shown on the drawings. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements. Separately mounted photoelectric detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is an acceptable alternative. The detector shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. It shall be possible to automatically set the sensitivity of individual analog/addressable detectors for the day and night periods.

Each smoke detector shall be capable of transmitting prealarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

#### **2.5.1.1.6 Smoke Detector - Photoelectric**

Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings. The detector shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

#### **2.5.1.1.7 Smoke Detector Guards**

Smoke detector guards shall be installed at the locations shown on the drawings. The guards shall be Underwriters Laboratories tested and listed by for use with the smoke detectors they protect. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing. The guards shall be constructed of 16-gauge steel with a baked white finish to match the detectors. Tamperproof mounting hardware shall be provided.

### **2.5.1.2 Detector Bases**

#### **2.5.1.2.1 Detector Base - Standard**

Provide standard detector mounting bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box. The base shall, contain no electronics and support all series detector types.

### **2.5.1.3 Manual Stations**

#### **2.5.1.3.1 Manual Station - Double Action Single Stage**

Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers.

## **2.5.2 Notification Appliances**

### **2.5.2.1 Speakers**

#### **2.5.2.1.1 Low Profile Speaker**

Provide low profile wall mount speakers at the locations shown on the drawings. The low profile speaker shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings.

The low profile wall mount speaker shall be EST Genesis G4 series.

#### **2.5.2.1.2 Speaker-Ceiling Mount-8in**

Provide 8" ceiling mounted speakers at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square steel with white finish as required. Provide square surface mount boxes with matching finish where required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft.

#### **2.5.2.1.3 Speaker-Cone-4in**

Provide 4" <white> <red> speakers at the locations shown on the drawings. Speakers shall have a 4" mylar cone, paper cones are not acceptable. The rear of the speakers shall be completely sealed protecting the cone during and after installation. In and

out screw terminals shall be provided for wiring. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 25V or 70V systems. At the 2 watt setting, the speaker shall provide a 90 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480.

#### **2.5.2.1.4 Speaker-Reentrant Surface**

Provide 4" surface re-entrant speakers at the locations shown on the drawings. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable. At the 15 watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480. Weatherproof boxes shall be provided for outdoor mounting.

### **2.5.2.2 Speaker-Strobes**

#### **2.5.2.2.1 Low Profile Speaker-Strobe**

Provide low profile wall mount speaker/strobes at the locations shown on the drawings. The low profile speaker/strobe shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

Strobes shall provide synchronized flash output, which shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings.

The low profile wall mount speaker/strobes shall be EST Genesis G4 series.

#### **2.5.2.2.2 Speaker-Strobe 4in**

Provide 4" <white> <red> speakers/strobes at the locations shown on the drawings. Speakers shall have a 4" mylar cone, paper cones are not acceptable. The rear of the speakers shall be completely sealed protecting the cone during and after installation. In and out screw terminals shall be provided for wiring. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 25V or 70V systems. At the 2 watt setting, the speaker shall provide an 87 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15/75cd, 30cd, & 110cd devices.

#### **2.5.2.2.3 Speaker-Strobe Ceiling 8in**

Provide 8" ceiling mounted speaker/strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft. Strobes shall provide synchronized flash

outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

#### **2.5.2.2.4 Speaker-Strobe Re-entrant**

Provide 4" <white> <red> <surface> <flush> re-entrant speaker/strobes at the locations shown on the drawings. Weatherproof boxes shall be provided for outdoor mounting. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable. At the 15 watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, & 110cd devices.

### **2.5.3 Initiation & Control Modules**

#### **2.5.3.1 Intelligent Modules -- General**

It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

- Temperature: 32°F to 120°F (0°C to 49°C)
- Humidity: 0-93% RH, non-condensing

#### **2.5.3.2 Control Relay Module**

Provide intelligent control relay modules. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

#### **2.5.3.3 Dual Input Module**

Provide intelligent dual input modules. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types:

- Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
- Normally-Open Alarm Delayed Latching (Waterflow Switches)
- Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
- Normally-Open Active Latching (Supervisory, Tamper Switches)

#### **2.5.3.4 Dual Input Signal Module**

Provide intelligent dual input signal modules. The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The dual input signal module shall support the following operation:

- Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio)

#### **2.5.3.5 Isolator Module**

Provide intelligent fault isolators modules. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.

#### **2.5.3.6 Monitor Module**

Provide intelligent monitor modules. The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit. The monitor module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

#### **2.5.3.7 Single Input Module**

Provide intelligent single input modules. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:

- Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
- Normally-Open Alarm Delayed Latching (Waterflow Switches)
- Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
- Normally-Open Active Latching (Supervisory, Tamper Switches)

#### **2.5.3.8 Single Input Signal Module**

Provide intelligent single input signal modules. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The single input signal module shall support the following operations:

- Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
- Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)

#### **2.5.3.9 Universal Class AB Module**

Provide intelligent class A/B modules. The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4"

square boxes with 2-gang covers, or European 100mm square boxes. The universal class A/B module shall support the following circuit types:

- Two (2) supervised Class B Normally-Open Alarm Latching.
- Two (2) supervised Class B Normally-Open Alarm Delayed Latching.
- Two (2) supervised Class B Normally-Open Active Non-Latching.
- Two (2) supervised Class B Normally-Open Active Latching.
- One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc.
- One (1) supervised Class A Normally-Open Alarm Latching.
- One (1) supervised Class A Normally-Open Alarm Delayed Latching.
- One (1) supervised Class A Normally-Open Active Non-Latching.
- One (1) supervised Class A Normally-Open Active Latching.
- One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
- One (1) supervised Class B 2-wire Smoke Alarm Non-Verified.
- One (1) supervised Class A 2-wire Smoke Alarm Verified
- One (1) supervised Class B 2-wire Smoke Alarm Verified
- One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
- One (1) supervised Class B Signal Circuit, 24Vdc @ 2A.

#### **2.5.3.10 Waterflow-Tamper Module**

Provide intelligent Waterflow/tamper modules. The Waterflow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch. The Waterflow/tamper module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

### **2.5.4 Two-Way Audio**

#### **2.5.4.1 Telephone Handsets**

Provide four (4) firefighter's telephone handsets for use with the firefighter's telephone jack stations. The telephone handsets shall be red in color and have a 5 ft (1.3m) coiled cord.

#### **2.5.4.2 Telephone Jacks**

Provide stainless steel firefighter's telephone jack stations at the locations shown on the drawings. The jack station shall be clearly identified with the words "FIRE FIGHTER'S TELEPHONE" for use with portable fire fighter telephone handsets.

#### **2.5.4.3 Warden Stations**

Provide remote firefighter's telephone stations / warden stations at the locations shown on the drawings. The station shall consist of a red telephone handset housed within a locked break glass surface or flush mounted enclosures as shown on the drawings. The enclosure shall have a red finish, and shall be clearly marked "FIRE FIGHTERS TELEPHONE" in large letters for easy identification.

### **2.5.5 Security**

#### **2.5.5.1 Security Keypad**

Provide a keypad display that contains a backlit, 8-line graphic LCD display at the locations specified on the drawings. The keypad shall provide tactile and audible user feedback telephone style 12-key keypad. The keypad shall illustrate all system events

programmed for the display. The keypad shall have UL 864 (Fire), UL 294 (Access Control), UL 609 (Burglary), ULC S527(fire), and ULC S303 (Burglary) listings. The keypad display shall support menu driven applications, bi-lingual operation, bypass functions, arm/disarm security partitions, provides common controls for fire and stores 500 event transactions. A context sensitive help system shall be available to the user at any time.

**2.5.5.2 Door Position Switch-Surface**

Provide hermetically sealed surface mount door position switches at the doors indicated on the drawings. The contact shall be rated for 10 million cycles and shall not exceed a gap tolerance +/- 20%.

**2.5.5.3 Door Position Switch-Concealed**

Provide hermetically sealed concealed mount door position switches at the doors shown on the drawings. The contact shall be rated for 10 million cycles and shall not exceed a gap tolerance +/- 20%.

**2.5.5.4 PIR Motion Detector**

Provide a Passive Infrared (PIR) motion sensor as shown on the drawings. The Passive Infrared Motion Detector shall utilize adaptive signal processing with gliding focus mirror optics to analyze the size, speed and shape to determine the alarm threshold. The unit shall be configurable for up to seven different patterns, have a range of 34 feet and a 90-degree view. The unit shall wire directly to the same intelligent device loop as the intelligent fire detection and control where permitted by the authority having jurisdiction. The unit shall not require power from an external source. The unit addressing shall be electronic, jumpers or DIP switches shall not be considered as equivalent to electronic addressing. Removing the cover shall automatically activate the tamper switch and put the unit in the alignment mode. The unit shall be constructed of thermoplastic housing with integral (removable) cover and integral tamper switch.

**2.5.6 Access Control**

**2.5.6.1 Card Reader-Proximity with Keypad**

At the doors indicated on the plans, provide proximity type card readers that require the access control card be presented in close proximity from the card reader for the card to be read. Insertion of or swiping of the card through the card reader is not acceptable. The encoded data from the access card shall be sent to the card reader controller for processing. The card reader shall provide both audible and visual indication of a properly read card. The LED shall provide a different flash rate when a PIN number, visitor escort or second cardholder is required for access. The card reader shall incorporate an integral, weatherized keypad capable of transmitting personal identification numbers (PINs) to the card reader controller. The card reader output shall utilize the standard Wiegand output protocol and feature a re-present mode to prevent multiple reads from a single card presentation. The reader housing shall be constructed of polycarbonate material, suitable for mounting on a single gang electrical box. The card reader shall be fully weatherized and shall have an operating temperature of -22°F to 150°F (-30°C to 65°C) and shall have an operating range of 5 to 95% humidity, non-condensing.

**2.5.6.2 Card Reader-Proximity-Mullion Mount**

At the doors indicated on the plans, provide proximity type card readers that require only that the access control card be held in close proximity from the card reader for the card to be read. Insertion of or swiping of the card through the card reader is not acceptable.

The encoded data from the access card shall be sent to the card reader controller for processing. The card reader shall provide both audible and visual indication of a properly read card. The LED shall provide a different flash rate when a visitor escort or second cardholder is required for access. The card reader output shall utilize the standard Wiegand output protocol and feature a re-present mode to prevent multiple reads from a single card presentation. The reader housing shall be constructed of polycarbonate material, suitable for mounting on a doorframe or mullion. The card reader shall be fully weatherized and shall have an operating temperature of -22°F to 150°F (-30°C to 65°C) and shall have an operating range of 5 to 95% relative humidity, non-condensing.

#### **2.5.6.3 Card Reader-Proximity-Standard**

At the doors indicated on the plans, provide proximity type card readers that require that the access control card be held in close proximity from the card reader for the card to be read. Insertion of or swiping of the card through the card reader is not acceptable. The encoded data from the access card shall be sent to the card reader controller for processing. The card reader shall provide both audible and visual indication of a properly read card. The LED shall provide a different flash rate when a visitor escort or second cardholder is required for access. The card reader output shall utilize the standard Wiegand output protocol and feature a re-present mode to prevent multiple reads from a single card presentation. The reader housing shall be constructed of polycarbonate material, suitable for mounting on a single gang electrical box. The card reader shall be fully weatherized and shall have an operating temperature of -22°F to 150°F (-30°C to 65°C) and shall have an operating range of 5 to 95% relative humidity, non-condensing.

#### **2.5.6.4 Card Reader Controller**

Provide a card reader controller for each reader-equipped door, as required. The card reader controller shall have UL 864 (Fire), UL 294 (Access Control), UL 609 (Burglary), UL 1610 (Burglary), ULC S527 (fire), and ULC S303 (Burglary) listings. The card reader controller shall provide all the required intelligence to authorize or deny personnel access to the door. The card reader controller shall support a minimum of 8,000 card holders and shall be capable of supporting a maximum of 36,000 card holders. The card reader controller shall hold a minimum of 10,000 event history transactions and shall be capable of supporting a maximum of 20,000 event history transactions. The card reader controller shall support a minimum of one ingress reader/keypad, one egress reader/keypad, one locking device, one request to exit device, one door monitor input, one automatic door opener output and one optional sounder for local door annunciation. The card reader controller shall be capable of supporting standard reader and keypad formats. The card reader controller shall contain the database for all user information including schedules and holidays. The database shall be contained in non-volatile memory. The card reader controller shall not require communication from the host computer to maintain door access functionality.

#### **2.5.6.5 Door Strike**

Provide a heavy duty electric strikes at the doors indicated on the plans. The strike shall contain an internal electrically operated solenoid mechanism having field selectable 12/24VDC operating voltage, and feature built in transient voltage suppression. The strike shall provide 20 lbs. resistance to side load pressure and be designed to accommodate cylindrical or non-deadbolt mortise locksets. The strike shall have a stainless steel housing, and provide horizontal adjustments. The strike shall be UL listed for A Label fire-rated openings and for burglary.

#### **2.5.6.6 Lock-Magnetic-1650 Pound**

Provide a surface mount magnetic locks at the doors indicated on the plans. The magnetic lock shall provide 1650 lbs. of direct holding force. The magnetic lock shall contain no moving parts to wear. The magnetic lock shall be UL listed as auxiliary locks for a 3 hour fire-rated opening and burglary resistance. Input voltage shall be 12 or 24VDC with built in voltage spike suppression.

**2.5.6.7 Lock-Magnetic-650 Pound**

Provide a surface or mortise mount magnetic locks at the doors indicated on the plans. The magnetic lock shall provide 650 lbs. of direct holding force. The magnetic lock shall contain no moving parts to wear. Input voltage shall be 12 or 24VDC with built in voltage spike suppression.

**2.5.6.8 Request-To-Exit Pushbutton**

Provide a heavy-duty push button switch to be used for egress at the doors shown on the plans. The push button shall be configured with either single pole double throw (SPDT) or double pole, double throw (DPDT) contact switches rated at .5 amps at 24V per switch. The heavy-duty switch shall be of standard size that will mount in a single gang box, surface or semi-flush.

**2.5.6.9 Request-To-Exit-PIR**

Provide a request to exit passive infrared (PIR) sensor at the doors indicated on the plans. The sensor shall be capable of being mounted on a wall, doorframe or the ceiling. The sensor shall contain dual relay outputs and have an adjustable range setting. Input voltage shall be either 12 or 24 VDC. The sensor shall be UL rated for the application.

**PART 3 Execution**

**3.1 Field Quality Control**

**3.1.1 Test & Inspection**

All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.

All wiring shall be tested for continuity, shorts, and grounds before the system is activated.

All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.

The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

At the final test and inspection, a factory trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.

All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 1999, Chapter 7.

A letter from the Contractor certifying that the system is installed entirely in accordance with

the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.



## Introduction

Kennesaw State University "KSU" seeks to provide and maintain, so far as is practicable, an environment for its students, faculty, staff, contractors and members of the public, that is safe and without risk to health. As a condition of the contract, KSU requires that Contractors and their subcontractors to perform a service on our campus, exercise all necessary precautions to safeguard the health and safety of all persons including university employers, students, members of the public and contact own employees.

It is the responsibility of the Contractor to inform him/herself of applicable KSU's health and safety policies, procedures implemented by the University. Contractor will comply with the applicable Federal, State, Local and KSU Internal policies, procedures or measures. In the event of any inconsistency, Contractor will comply with the procedures or measures that produce the highest level of health and safety outcome.

## Purpose

The purpose of this document is to describe Environmental Health and Safety requirements for Service Providers (Contractors) while working on Kennesaw State University property/facility. The goal is to ensure safety of KSU's students, employees and visitors and comply with federal, state and local safety and environmental regulations

## Scope:

This program applies to all work performed by Contractors in or on all properties owned, leased or controlled by KSU.

## Definitions

### Contractor

For the purposes of this document, a Contractor is an organization or individual with a contractual agreement with KSU or with a Contractor who have contracted with KSU to provide a specific service or range of services related to the property, facilities or buildings owned or leased by KSU, in accordance with the contract terms and defined scope of work. This includes but is not limited to the following:

- General Contractors
- Sub-Contractors
- Professional Firms
- Service Contractors



## **Roles and Responsibilities**

### **Contractor Responsibilities:**

- The Contractor should have a written Environmental Health and Safety programs in place and is solely responsible for ensuring that such programs comply with federal, state and local regulations.
- Contactor should designate at least one supervisor as the “Competent Person” to be responsible for safety coordination on the job site
- Contractor is responsible for taking all steps necessary to protect the safety and health of KSU’s students, employees, and visitors during the performance of their work by establishing, administering, and enforcing safety rules that meet KSU’s environmental health and safety policies and procedures and federal, state and local EHS laws and regulations.
- The Contractor bears sole responsibility for ensuring the safety of his or her employees.
- It is the responsibility of the contractor to inform their personnel of the hazards associated with specific operations of a project and ensure the necessary controls are in place, including providing employees with the appropriate personal protective equipment (PPE).
- Contractor should ensure that all incidents/injuries relating to the job are promptly investigated.
- Contractor who coordinates the work of Subcontractors shall assure that the Subcontractor abide by the requirements of this document and is responsible for communication of safety-related information and requirements to its’ Subcontractors.
- It’s the contractor’s responsibility to appropriately dispose of all waste materials resulting from the project.

### **Submittals**

- KSU or its representative may elect to require a contractor to submit any or all of the following document/records prior to beginning, in the course of the project or upon completion of work.
  - ✓ Contractors project safety plan including substance abuse control program
  - ✓ Workplace incident and illness records, including Experience Modification Rates (EMRs)
  - ✓ Permits/Licenses certifying knowledge and skills
  - ✓ Safety inspection reports



- ✓ Accident investigation reports
  - ✓ Safety training records
  - ✓ Material Safety Data Sheets (MSDSs)
  - ✓ Copies of waste manifests, disposal documents and any other relevant records
  - ✓ Statutory notifications, including Notice of Intent (NOI) and Notice of Termination (NOT)
  - ✓ Records of noncompliance citations
  - ✓ Record of regulatory agency citations.
- Where submittals are required from the Contractor, they shall be made in writing directly to the University Project Manager/Coordinator or EHS department upon request.
  - Submittals should be made sufficiently in advance to avoid delay of the project. Where review, approval, or coordination of submittals is required, submittals shall be made at least ten (10) working days prior to the start of the project unless prior arrangements have been made.
  - Post-job submittals, where required, shall be made no later than fifteen (15) working days after completion of the project or as specified in the request.

## **Procedures**

### **Worksite Isolation and Access Control**

- The Contractor shall isolate and establish controls of worksite to restrict unauthorized access to the work zone. Requirements for entry should be clearly posted at all access points.
- Wherever necessary, contractor shall erect appropriate barricades and signs to provide protection and alert others of the hazards created by construction activities and shall be used to safely control traffic, both vehicular and pedestrian, through or around the work site. If necessary contractors may engage the services of Police or Parking Services details when pedestrian and/or vehicular traffic is impeded.
- Barricades should meet the requirement of 29 CFR 1926 Subpart G – Signs, Signals, and Barricades and the US DOT Manual on Uniform Traffic Control Devices.
- Signs should clearly indicate required personal protective equipment that must be worn in the restricted area.



- The Contractor must not perform work over the heads of people or leave tools or equipment overhead. The Contractor must abide by all posted signage (i.e. radiation hazard, authorized personnel only, no smoking, chemical hazard, caution, danger, biohazard)
- All portable ladders including but not limited to extension ladders, step ladders, and job made ladders are the Contractor's sole responsibility to maintain and use according to 29 CFR 1910.27.

### **Training:**

- Contractors shall provide and ensure their employees have received the appropriate EHS training in compliance with federal and State regulations and in order for the employee to safely perform their assigned tasks.

### **Hazardous Materials and Hazard Communication:**

#### **Hazardous Material**

- Contractor shall not use solvents, paints, or similar flammable, toxic, or irritating materials in areas occupied by University employees, or students without prior notification to and approval approved by KSU Project manager/Coordinator. Contractor shall provide to KSU with copy of Material Safety Data Sheets (MSDS's) for such materials upon request.
- Contractors shall maintain MSDSs for all hazardous chemicals being handled at the job site.
- The Contractor shall maintain appropriate control, including adequate ventilation to keep exposure levels below applicable OSHA Permissible Exposure Limits (PEL).
- If exposure levels exceed as are expected OSHA PEL, all personnel exposed shall be provided with and required to use appropriate Personal Protective Equipment (PPE), including NIOSH approved respirators, where necessary.
- It is the responsibility of the contractor to ensure the personnel wearing respirators are medically evaluated and fit-tested, as stipulated in the OSHA Respiratory Protection Program (CFR 1910.134).

#### **Hazard Communication:**

- The Contractor shall develop and maintain their own Hazard Communication Plan that complies with OSHA Hazard Communication Program (29 CFR 1910.1200).
- The Contractor shall maintain copies of Safety Data Sheets (SDS's) for all hazardous materials that are brought / used on KSU property on-site and available for review.



- All containers of hazardous materials should be properly labeled and inspected as required by applicable regulations.

### **Personal Protective Equipment**

- All contractors shall ensure their employees have been trained, issued and are wearing the appropriate Personal Protective Equipment (PPE) where required. It is the contractor's responsibility to ensure the correct use of PPE per OSHA standards.

### **Management of Asbestos Containing Materials (ACM)**

- Unless otherwise noted, KSU will have determined, before work starts, the presence, location, and quantity of asbestos containing materials (ACM) or potential ACM that will be specifically impacted by the work under contract..
- KSU is responsible for hiring an Asbestos Abatement Contractor to remove the identified ACM in coordination with the contractor.
- Under no circumstances should the Contractor disturb asbestos-containing materials unless such activities are part of contracted work and the Contractor is specifically licensed in the State of Georgia as Asbestos Abatement Contractor.
- If in the course of work the Contractor discovers material to be suspected of containing asbestos, Contractor should immediately notify KSU EHS Department at 470-578-3321 or the Marietta Campus's EHS Department at 678-915-7256 or the Project Manager. Contractor shall ensure that the suspect material is not disturbed or moved until the material have been evaluated by KSU EHS department and approval to disturb/move the material is granted.
- The Contractor shall not sweep, dust, vacuum or mop dust or debris that is believed to be ACM. The Contractor shall also not pick up or throw away any suspect ACM waste or trash.
- The Contractor shall immediately notify the KSU EHS Office at 470-578-3321 or the Marietta Campus's EHS office at 678-915-7256 or Project Manager if material that is suspected to be ACM is disturbed or becomes airborne.

### **Protecting Indoor Environmental Quality (IEQ)**

- Construction and renovation projects can have a significant negative impact on indoor environmental quality (IEQ) of adjacent occupied spaces.



- Contractors in coordination with KSU project Manager should ensure proper pre-planning efforts that anticipate potential impacts on IEQ and specify adequate control strategies prior to commencing work.
- KSU EHS department has developed procedure to provide Contractors and project managers with guidance on how to minimize the negative impact of construction projects on indoor environmental quality (IEQ) during construction and renovation projects. In this regard, Contractor should:
- Comply with the applicable KSU's IEQ and other health and safety requirements as well as applicable federal, state, and local regulations.
- Implement control strategies, including engineering controls, to eliminate or minimize the impact of contraction activities on IEQ in the building subject to construction work or nearby buildings.
- Maintaining acceptable indoor environmental quality within the space or contiguous spaces where the construction project is occurring.
- Provide all safety and personal protective equipment (PPE) required to complete the contracted scope of work. PPE must meet or exceed the requirements of the appropriate governmental regulatory agency.

## **Fire Protection and Life Safety**

### **Emergency Egress**

- Contractor shall keep all corridors and exit doors clear at all times. In addition all external exit ways, walks, and drives shall be kept free from debris, material, tools and vehicles.
- The Contractor shall not conduct work or operations that obstruct exits or the means of egress from an occupied building without the prior notification and approval of KSU's Project Manager/Coordinator.
- Contractor shall not chock or block open fire-rated doors except temporarily and while maintaining constant supervision. Such chocks/blocks must be immediately removed in the event of a building fire alarm or similar emergency.

### **Fire Protection Equipment:**

- The Contractor shall NOT disable or modify any fire protection equipment or system without prior notification to and approval from KSU's Project Manager/Coordinator.



- Disabling of the fire protection system must follow the Fire Protection Impairment Procedure

### **Building Alarm**

- Contractor personnel shall respond appropriately to all alarms by exiting the building immediately and remaining at least 50 feet from the building to allow for emergency response access. Call KSU emergency number (470)-578-6666 or the Marietta campus's emergency number (678)-915-5555 to report the incident.
- In the event of a fire, contractor personnel should sound the alarm and/or notify other building occupants immediately.

### **Electrical Safety**

- When performing work that involving existing electrical systems and/or equipment, Contractor must be effectively coordinate work with KSU's Project Manager and other involved parties.
- KSU will make reasonable effort to inform Contractors, in advance, if the worksite contains energized electrical systems over 600 volts so that qualified personnel and appropriate protective equipment can be considered in the bidding process.
- KSU Project Manager is responsible for coordinating access to the jobsite, scheduling, pre-planning for outage and coordinating request for shutdowns of existing electrical systems.
- KSU Plan Operation personnel will shut down and start up electrical systems in coordination with Contractor performing work on such systems, unless otherwise specifically directed by KSU.
- When contractor is involved in performing work on or near energized electrical systems or equipment with greater than 50 volts, contractors shall;
  - Ensure all work is being conducted in accordance with applicable OSHA regulations and the National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace.
  - Ensure that only qualified Electricians are permitted to work on electrical systems and equipment that uses or controls electrical power.
  - Ensure the "Limited Approach Boundary" for energized electrical equipment is established and that the area is restricted to authorized personnel only.
  - In the event of a circuit breaker or other protective device "tripping," the Contractor shall ensure that a qualified Electrician examine checks the circuit and equipment and corrects problems before resetting the breaker.



- The Contractor shall not leave electrical boxes, switch gear, cabinets, or electrical rooms open when Contractor personnel are not present at the worksite. Energized parts shall be insulated when covers have been removed or doors are ajar. Cardboard, plywood, or other combustible materials shall not be used to cover energized circuits.
- If a Contractor comes across a potential electrical hazard such as missing protective guards or covers, damaged equipment, etc., Contractor should immediately make reasonable effort to notify KSU Project Manager of such hazard.

### High (Medium) Voltage Power System Safety

- Any current exceeding 600 volts is considered High Voltage.
- The Contractor shall develop, implement and maintain an Electrical Power Transmission and Distribution safety program in accordance with OSHA regulations as it applies to the work of their contract.
- A copy of the program should be maintained at the work site where 29 CFR 1910.269 (OSHA Electric Power Transmission and Distribution Standard) is applicable.
- All applications shall conform to OSHA Standard 1910.269 Electric Power Transmission and Distribution Standard, NFPA 70E Safety Related Work Practices and KSU's Safe Operating Procedures for Medium Voltage Electrical Distribution Equipment.
- New or modified components shall be installed in accordance with design specifications BEFORE energizing equipment related to High Voltage System, Emergency Power Generation Systems, Fire Alarm Systems.

### Lockout/Tag-Out

- The Contractor working on hazardous energy sources shall maintain a Lockout/Tag-out (LO/TO) program in accordance with OSHA regulations (29 CFR 1910.147 – Control of Hazardous Energy Sources (Lockout/Tag-out) and 29 CFR 1910.269 Electric Power Transmission and Distribution Standard) as it applies to the work of their contract.
- The Contractor should maintain a copy of its Lockout/Tag-out Program on-site and readily available for examination by KSU officials before the start of any work where 29 CFR 1910.147 is applicable.
- KSU's Plant Operation Management personnel will shut down and start up utility systems, unless otherwise specifically directed by the university.



- Contractor shall use standard locks and tags, as required to OSHA standards to control the start-up of equipment being serviced or maintained by its employee.
- Whenever the Contractor and KSU personnel must perform a group LO/TO, both LO/TO programs must be coordinated to comply with 29CFR 1910.147 and the KSU's LO/TO program.
- At no time shall a Contractor or its employees override any locks or tags that they encounter during the performance of its work.
- The Contractor shall maintain a log of all machines and equipment that are locked out and/or tagged out during the performance of the work of while under contract.

### **Fall Protection:**

- Contractors must protect their employees from fall hazards and falling objects, in accordance with OSHA Standard on Fall Protection (29 CFR 1926 Subpart M), whenever an affected employee is working 6 feet (1.8 meters) or more above a lower level. Protection shall also be provided workers who are exposed to the hazard of falling into dangerous equipment.
- Contractor shall secure tools and equipment to prevent objects from falling to ground below.
- Contractor shall ensure that all their personnel are trained in accordance with the requirements listed in 29 CFR 1926 Subpart M.
- Where required, the contractor shall provide its employees with personal fall protection equipment or other hazard control measures listed in the fall protection standard and ensure proper usage of the equipment.
- Contractor shall ensure that fall hazards communicated to their employees and that of the Sub-Contractors.
- Any opening from which there is a drop of more than 4 feet where KSU's faculty, staff, students or the public may fall shall be guarded in accordance with "29 CFR 1910 Subpart D – Walking Surfaces".
- Contractor must maintain guardrails, mid rails and toe boards located in KSU buildings or on KSU property unless removal is approved by the KSU Project Manager as part of the work of a contract.
- All open holes, skylights, trenches, or excavations into which KSU's employees may fall shall be covered and/or properly secured.



## **Trenching, Excavation and Utilities Locate**

### **Locating and Protecting Utilities**

- The Contractor is solely responsible for locating all utilities and shall be solely responsible for the protection and the repair of any damage to utilities in connection with the work.
- Contractor shall ensure coordination of trenching, blasting or excavation work with the university Project Manager to facilitate proper coordination of utilities shutdowns, if necessary.
- Contractor shall not commence, perform or engage in blasting, excavation or trenching work, including driving of spikes/stakes into the ground or drilling, until the Contractor has properly submitted a utilities locate request to the Utility Protection Services (UPC) ('Call Before You Dig'), as required by Georgia laws (O.C.G.A § 25-9-6). Contractor should note that UPC WILL NOT locate all utilities on campus and Contractor therefore should make necessary arrangements with a utility location contractor for location and marking of remaining utilities.
- When using mechanized excavating equipment Contractor shall not strike, damage, injure, or loosen any utilities or sewer lateral which has been staked, flagged, or marked.
- When excavating or blasting is to take place within the tolerance zone (2 feet) of utilities, Contractor shall exercise such reasonable care to protect the underground utilities. Such protection shall include, but may not be limited to, hand digging, pot holing, soft digging, vacuum excavation methods, pneumatic hand tools, other mechanical methods with the approval of the KSU Project Manager, or other generally accepted methods.
- In the event a Contractor strikes, damages, injures, or loosens any underground utility or sewer lateral, regardless of whether the utility facility or sewer lateral was marked, Contractor shall immediately cease such blasting or excavating and notify KSU Project Manager and the UPC and IMMEDIATELY make temporary or permanent repair of the damaged utility.
- Should Contractor fail to repair damaged utilities immediately, KSU reserves the right to make the needed repairs and will recover the cost thereof from the payment, then or thereafter, due the Contractor, without limitation to other remedies available to the KSU.
- Contractor shall not engage in excavating or blasting activities that may cause further damage to the utility facility or sewer lateral, until damage previous done has been repaired and approval to proceed has been granted by KSU Project Manager.



### Trenching and Excavation

- All excavation work shall be in compliance with OSHA Standards on excavation (29 CFR 1926 Subpart P).
- Contractor shall designate a Competent Person for every excavation work.
- The Competent Person shall inspect the trench every day before work, after rain and when conditions change. When there is a problem, the competent person shall have the authority to stop work and fix the problem.
- All trenches 5 feet (1.5 meters) or more in depth shall have a protective system. If excavation is less than 5 feet the Competent Person should determine if a protective system is needed or not.
- Trenches 20 feet (6.1 M) deep or greater shall have protective systems designed by a registered professional engineer or based on tabulated data prepared and/or approved by a registered professional engineer.
- Trenches 4 ft or more in depth should be provided with a fixed means of egress.
- The area around the trench/excavation must be kept clear of surface encumbrances.
- Contractor must develop and implement procedures to protect employees from being injured or killed by vehicle traffic.
- Contractor must develop and implement procedures to protect employees from loads or objects falling from lifting or digging equipment.
- Contractor must develop and implement procedures to a warning Systems for mobile equipment to prevent vehicles from accidentally falling into the trench.
- Surface crossing of trenches is discouraged. Such crossings are permitted only under the following conditions:
  - Vehicle crossings have been designed by and installed under the supervision of a registered professional engineer.
  - Walkways or bridges are provided for foot traffic. These structures shall:
    - ✓ have a safety factor of 4;



- ✓ have a minimum clear width of 20 in (0.51 m);
  - ✓ be fitted with standard rails; and
  - ✓ Extend a minimum of 24 in (.61 m) past the surface edge of the trench.
- Contractor must develop and implement procedures for controlling standing water and water accumulation if employees are permitted to work in the excavation.
  - Contractor must conduct atmosphere testing before entry in excavations where hazardous atmospheres have the potential to exist.
  - The excavation must be treated as a permit required confined space if a hazardous atmosphere is found, and managed per confined space requirements in this document.
  - Adjacent structures must be stored in accordance with the design documents to prevent collapse. Where necessary, contractor shall install guardrails or some other means of protecting people from falling into the trench/excavation.

### **Cranes and Rigging:**

- Contractor must ensure that each crane, rigging, or hoist brought onto KSU property have been subject to an annual inspection performed by a certified testing agency.
- Documentation, including a logbook, must be provided to the KSU PM or their designee, upon request.
- All Crane/hoisting equipment operators should be certified and present proof of certification upon request
- Lifting and rigging equipment/components should be inspected by a Competent Person before each use, and as conditions warrant.
- At no time shall loads be hoisted by a non-licensed operator.
- No lifts shall be made over faculty, staff, students and public. Lifts over occupied facilities may only be made after consultation with and approval by the KSU PM.

### **Confined Space Entry**

- Whenever contractor's personnel are required to enter confined spaces on KSU property, Contractor must ensure compliance with OSHA Confined Space Program (29 CFR §§ 1910.146 and 1910.269) and



KSU's Confined Space Entry Program. Contractor shall develop, implement and maintain its own Confined Space Entry Program, including provision for emergency rescue.

- KSU EHS department maintains an inventory of confined spaces on campus and their classifications. All manholes on campus are and should always be considered to be "Permit Required Confined Spaces".
- If in the course of its work, a Contractor encounters a confined space that had not been previously identified by KSU, contractor shall notify KSU's EHS department immediately for an evaluation of the space to determine the appropriate course of action.
- Contractors are required to use their own confined space entry permits when completing confined space entries.
- Contractor should complete and sign a Confined Space Pre-Entry Check before entry into a confined space verifies completion of the required pre-entry procedures. The check list should be maintained at the job site for duration of the job.
- If circumstances dictate an interruption in the work, the space must be re-evaluated and a new check list must be completed.
- Contractors are required to provide their own rescue equipment, air monitors, ventilation fans, personal protective equipment, etc. to safely complete confined space entries.
- When both KSU personnel and Contractor personnel are working in or near confined spaces, the Contractor must coordinate all operations with the affected KSU personnel before entry.

### **Compressed Gas Cylinders:**

- Contactor must ensure that valve protection caps are in place when compressed gas cylinders are being transported, or stored. Close cylinder valves and replace valve covers when work is complete and when cylinders are empty or moved.
- Cylinders must be secured in an upright position while in use or being transported.
- Cylinders must be stored at a safe distance or shielded from welding or cutting operations and should not be placed where they can contact an electrical circuit.
- Oxygen and flammable gas cylinders should be separated by 20 feet or a 5 foot high fireproof barrier.



- If a leak develops in a cylinder and it cannot be immediately corrected, move the cylinder to a safe location outside the building. Contact KSU Public Safety immediately at (470) 578-6666 regarding the leak.
- Compressed gas cylinders must not be taken into or stored in confined spaces, including gang boxes and office/storage trailers. Upon completion of work, Contractor must remove from KSU properties all cylinders belonging to the Contractor.

### **Hot Work**

- Hot work (welding, cutting and brazing) activities must be authorized by a KSU Project/Construction Manager.
- Contractor shall develop, implement and maintain its own Hot work Program in accordance with OSHA regulations.
- The Contractor shall use a hot work permit for each separate work activity and shall ensure that the conditions of the permit are met at all times. This permit should be from the Contractor's Hot Work Program.
- Request for a fire system inspection to determine if the system needs to be shut down or modified, must be made to the Project/Construction Manager at least 24 hours before starting any hot work.

### **Powder-Actuated Tools (Nail Guns)**

- Operators of powder-actuated tools shall be properly trained on their use and have a valid training documentation.
- Powder-actuated tools shall be inspected for obstructions or other defects before use on each workday.
- Operators shall have and use appropriate personal protective equipment such as hard hats, safety goggles, safety shoes and ear protectors.
- The tools should be left unloaded until they are actually ready to be used and should be stored in locked container when not being used.

### **Temporary Structures**

- All tents, stages and temporary structures shall comply with the requirements of the Georgia State Building Code, County ordinances and a permit shall be obtained where required.



## **University Equipment**

- Contractors shall not use university equipment or vehicles nor shall the Contractor allow university employees to use the Contractors' equipment or vehicles without the approval of KSU's Risk Management.
- If an employee of a Contractor needs to use specialized equipment owned by KSU, such as powered industrial trucks, the Contractor must provide suitable documentation that the employee has been trained and certified (if required) to use such equipment.

## **Window Washing:**

- Window washing must be conducted using OSHA compliant method such as suspended scaffold (single or two points or a boatswain's chair).
- Scaffolding apparatus must comply with the requirements of 29 CFR 1910.28.
- Contractor is responsible for inspecting and verifying working condition and suitability of window washing anchors located on any KSU building before use.
- If contractor identify deficiencies on any anchor point, contractor should notify KSU of such deficiencies.

## **Management of Hazardous and Universal Waste**

### **Universal Waste**

- All unbroken fluorescent bulbs, high pressure sodium vapor, and mercury vapor bulbs are "Universal Wastes" and should be treated as such.
- Contractor must ensure proper handling of fluorescent tubes and high pressure metal halide/mercury vapor bulbs must be handled so that they remain unbroken.
- Tubes going to Universal Waste Stream must be stored in cardboard boxes obtainable as they are generated. Boxes of tubes and bulbs must be stored indoors.
- Boxes containing Universal Waste bulbs must be closed at all times except when waste is being added to the container and labeled as "Universal Waste -- Used Bulbs". Bulbs are not permitted to stick out of the boxes.



- Broken fluorescent tubes and high pressure metal halide/mercury vapor bulbs should be treated as “Hazardous Wastes”. Such tubes must be collected, stored and disposed of as hazardous waste. Contact KSU EHS Office your KSU PM if you generate such waste.
- Under no circumstances should Contractor dispose any such fluorescent bulbs, high pressure sodium vapor, and mercury vapor bulbs in regular construction waste.
- Older (pre 1980) light ballasts are regulated waste under the EPA Toxic Substances Control Act (TSCA) due to presence of polychlorinated biphenyls (PCB’s).
- Contractor should not dispose ballasts with the general trash.
- Ballasts manufactured after 1980 do not contain PCBs, however, it is the policy of KSU to collect ballasts and send them off-site for recycling.

### **Hazardous Wastes**

- All chemicals (liquids, solids, gases, etc.) used by Contractors that are characteristic or listed EPA Hazardous Wastes shall be safely stored, managed and disposed.
- Hazardous wastes shall be removed from University property promptly and shall be properly disposed of by a licensed hazardous waste disposal firms off-site when they are no longer usable and have been designated as a waste product.
- Under no circumstances shall a Contractor drain, cause to be spilled/ leaked, deposit or otherwise dispose hazardous waste material on University grounds or any other unauthorized property.
- Contractor is responsible for proper disposal of all unused chemicals and hazardous materials resulting from the project, in accordance with EPA Hazardous Waste Regulations.

### **Accidental Spill and Releases**

- Contractor shall comply with all Federal, State and local requirement for the proper handling of hazardous substances and oil while on KSU property.
- In the event of an accidental release or spill of chemicals or other hazardous materials by the Contractor, the Contractor shall:
  - ✓ Immediately take appropriate actions to contain the spill, without jeopardizing the health or safety of its employees,



- ✓ Call KSU emergency number (470) 578-6666 or the Marietta campus's emergency phone (678) 915-52222, or fire department, or other entities as needed or required,
  - ✓ Contact KSU's EHS Department at 470-578-3321 or the Marietta campus's EHS department at 678-915-7256, and
  - ✓ Notify the university Project Manager/Coordinator
- Contractors shall be responsible for any costs associated with damage and/or cleanup of a hazardous substance and/or oil spill caused by the Contractor or their sub-contractors.
  - This responsibility shall extend to freight carriers who were hired by the Contractor to deliver the commodity or service to the campus.
  - All university costs associated with responding to or remediation of a chemical or hazardous material spill or release may be assessed to the Contractor.

### **Control of Fugitive Dust Emissions**

- The Contractor shall take all reasonable precautions necessary to prevent fugitive dust from becoming airborne from any operation, process, handling, and transportation or storage facility related to the job. The opacity from any fugitive dust source shall not exceed 19%.
- Reasonable precautions which a Contractor should take to prevent fugitive dust emission includes but are not limited to the following:
  - ✓ Use of water to control dust during demolition of existing structure, construction operations, grading or clearing of land.
  - ✓ Application of asphalt, water, or suitable material on dirt road, material, stockpiles and other surfaces that can give rise to airborne dusts,
  - ✓ Installation of engineering control such as hoods, fans and filters to enclose and vent dusty operations,
  - ✓ Covering, at all times when in motion, open-bodied trucks, transporting materials likely to give rise to airborne dust.
  - ✓ Prompt removal of earth or other materials from paved streets onto which such materials have been deposited.

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### 1. Purpose

Hot work is defined as any work that involves burning, welding, using fire- or spark-producing tools, or that produces a source of ignition. Performing hot work activities such as welding, cutting, brazing, soldering, and grinding exposes employees and facilities to the risk of fires from ignition of flammable or combustible materials in the space, and/or from leaks of flammable gas into the space, from the hot work equipment.

This procedure establishes Kennesaw State University (KSU) process for managing Hot Work activities, including conducting risk assessment, authorizing and creating awareness in order to prevent injuries or loss from fire or explosion due to Hot Work activities.

### 2. Scope

This procedure applies to any hot work activities capable of initiating a fire or explosion and covers all KSU employees, students, contractors and other personnel at workplaces under the management or control of KSU.

The procedure does not cover work that produces flames, heat and/or sparks:

- In areas specifically constructed, protected, and arranged to accommodate safe hot work processes e.g. welding shop
- In ongoing work process/environments that are adequately risk assessed and controlled. This may include specific operations in laboratories, workshops and commercial kitchens.

### 3. Definitions

- 1) Hot Work – work involving operations capable of initiating fires or explosions. This includes, but not limited to: welding; burning; grinding; flame cutting; flame heating; brazing; soldering and plasma cutting.
- 2) Hot Work Permit (“Permit”) - A document issued by KSU for the purpose of authorizing performance of a specified hot work activity.
- 3) Permit Authorizing Individual (PAI) - The individual designated by KSU to authorize hot work.

### 4. Role(s) and Responsibilities

#### Environmental Health and Safety (EHS) Department:

- Develop, manage, review and revise the Hot Work safety program.
- Communicate requirement of the program to affected member of the campus community.
- Issue hot work permit and conduct inspection to ensure compliance.
- Responsible for the safe operation of hot work activities.



- Assess the work area where the hot work is to be conducted for site-specific flammable materials, hazardous processes, or other potential fire hazards present or likely to be present and consider the safety of the hot work operator and fire watch.
- Issue the Hot Work Permit prior to work commencing.
- Ensure that fire protection (sprinkler) system is operational and extinguishing equipment is properly located at the site.
- Ensuring that a fire watch is at the site, where a fire watch is required.
- Where a fire watch is not required, conduct a final check after the completion of hot work operations to detect and extinguish smoldering fires.

#### **Project Manager:**

- Communicate KSU Hot Work requirements to all Contractors under their review.
- Make available and distribute Hot Work Permits to KSU personnel and Contractors upon requests.
- Project Managers shall coordinate all Hot Work requests with Contractors.

#### **Hot Work Operator shall:**

- Ensure all hot work equipment is in safe operating condition. Defective equipment should be repaired by qualified personnel prior to use or be withdrawn from service.
- Ensure adequate fire watch is maintained during and after the Hot Work activity as necessary.
- Cease hot work operations if unsafe conditions develop.
- Notify the KSU project manager or EHS of the Hot Work activity.

#### **4.4. Fire Watch shall:**

- Provide required fire extinguishing equipment at torch operation location, and on opposite side of adjacent bulkheads, floors, when the potential of conductive heat transfer exists.
- Guard against a fire starting in their assigned areas of exposure.
- Shall not engage in any activities or task other than that of the Fire Watch.
- Make a complete inspection of the exposed areas for possible hot-spots or fire.
- Remain on site at least 30 minutes after the completion of torch operations to detect and extinguish possible smoldering hot-spots or fires.
- Make an initial inspection of all exposed areas immediately following the completion of torch operations. Such inspection shall be followed up by another final inspection 30 minutes later for the purpose of assessing for any hot-spots, smoldering materials, or fires.



## Procedure

### 6. Hot Work Permit Program Requirements

#### Prior to beginning hot work:

- Hot Work Permit must be initiated by the Hot Work Operator who will be conducting the Hot Work operations, or their on-site supervisor.
- Submit request to EHS by completing the hot work form.
- The Hot Work Operator shall conduct a thorough safety inspection prior to submitting the Hot Work Permit for processing.
- The Hot Work Operator shall submit a request for Hot Work Permit to the EHS Department for processing.
- A Hot Work Permit will be issued for a period of time not to exceed twenty-four (24) hours. Any exception to the twenty-four (24) hour rule must be in writing from the EHS Department.

#### 6.1. Hot Work Permit

- The EHS department shall complete the inspection and issue the Hot Work Permit specific to the hot work activity in the area for the designated time frame. Hot work activities occurring over multiple days will require a new Hot Work Permit each day.
- If hot work activities will extend past the original time frame, the Requestor must contact the EHS department immediately to ensure that the fire alarm system has not been reactivated.
- Upon completion of the hot work activity, the Requestor or Hot Worker must contact the KSU EHS department or stating that the hot work activity is complete, and that the Fire Watch(s) as appropriate is/are now posted and will remain at the location(s) for a duration of 30 minutes.
- Following the minimum 30 minute Fire Watch period, the Requestor or Hot Worker will re-inspect the hot work area(s), and then contact the EHS department reporting all conditions are safe.
- The EHS department will close out the Hot Work Permit by conducting final inspection.

### 7. Permanent HOT WORK AREAS

Designated Hot Work Areas will only be approved by the EHS department. Request for an area to be deemed safe for continuous hot work activity, Permanent Hot Work Area, must be made in writing/email to the department of EHS. The EHS department shall inspect the area upon initial request to be designated as a Permanent Hot Work Area. There will be no combustible materials within the area designated as a Permanent Hot Work Area unless shielded by approved heat shielding material. UV



shields shall be available and maintained at all Permanent Hot Work areas along with approved signs that state that these areas are Permanent Hot Work areas.

## 8. TRAINING

All personnel performing hot work must be trained in proper equipment operation, handling and storage of welding materials, compressed gas safety, chemical hazards, and the Hot Work Program. Additional training may also be necessary in Permit Required Confined Space entry, Control of Hazardous Energy, and the proper selection of use of personal protective equipment before working in such environments and/or conditions.

## 9. DOCUMENT REVISIONS

Each time the document is revised, list the revisions in the table below. This will always be the last section of this document.

REVISION HISTORY			
Revision Number	Revision Date	Description of Revision	Revision Approved By:
1			
2			
3			
4			
5			

**APPENDIX 06 – STRATEGIC SECURITY & SAFETY/ENTERPRISE**  
**RISK MANAGEMENT CRITERIA**

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# KSU Construction Reference Document

## *Surveillance Cameras*

### Minimum Recommended Standards:

- Entrances/Exits: One camera per location. In the event of a wider than usual entry way, such as an area that has a line of 6+ doors or a divider/column that would impede viewing by a single camera, a second camera should be considered
- Stairwells: One camera per floor per stairwell. Cameras are typically located just outside the stairwell unless there is an emergency exit within, in which case the camera needs to be inside the stairwell and able to view the egress point
- Elevators: Cameras inside elevators for new constructions only. Otherwise, they are located one per elevator lobby, per floor. If there is a divider/column that impedes viewing of elevators on both sides of the lobby, a second camera should be considered
- External:
  - Loading Docks: At least one camera per location, unless there are 3+ docking ports or a divider/column that impedes viewing of the entire dock. Number of cameras dependent on visibility challenges and size of loading area
  - Heavy Foot Traffic: One camera per location, dependent on visibility and area being covered
- Others:
  - Parking lots: One camera per vehicle entry/exit point, dependent on lighting and area being covered
  - Cash registers: If KSU owned, one camera per register. If the registers are directly next to each other, one camera can monitor two registers
  - High value physical assets: one camera at entry points (example: computer lab)
  - High value financial instruments: dependent on layout, generally though a minimum of one camera per: transaction point, internal counting/processing point, and storage location (example: Bursar's Office)

### Installation Preparation:

- Ethernet cable should be in conduit anywhere it may be visible
- Exterior conduit should terminate in weatherproof junction box
- Power source required for cameras greater than 300' from any MDF/IDF
- Day/night lighting conditions should be conveyed in project scope

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**APPENDIX 07 – REGISTERED VISITOR & PARKING REQUIREMENTS**

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**Registered Visitor Form**  
(Formerly Non-Paid Affiliate (NPA)/Long-Term Visitor (LTV) Form)

**INSTRUCTIONS**

- The KSU Sponsor should submit this signed form to HR via Ricoh Scan Folder “#LTV” or in person.
- Forms are NOT accepted directly from the visitor.
- All Registered Visitors are required to pay for campus parking.
- Original signatures by the KSU Approver are required and signature stamps are not accepted.
- This form may be used to request review for the need of a background check for current KSU employees involved in Programs Serving Minors
- **PLEASE NOTE:** If access is required for 4 days or less, DO NOT use this form.

**KSU SPONSOR INFORMATION**

<b>First Name:</b>	<b>MI:</b>	<b>Last Name:</b>
<b>Sponsor Email:</b>		<b>Sponsor KSU #:</b>
<b>Department Name:</b>		<b>Department Speed Chart Number:</b> <small>(Background checks will be charged to this account)</small>

**REGISTERED VISITOR INFORMATION**

<b>First Name:</b>	<b>MI:</b>	<b>Last Name:</b>
<b>Date of Birth:</b>	<b>Emergency Contact Name:</b> <b>Emergency Contact Phone:</b>	
<b>Access Start Date:</b>		<b>Access End Date:</b>
<b>Visitor Affiliation or Company/Organization Name:</b>		<b>Visitor Email:</b>
<b>Has this individual ever been a student, employee, or long-term visitor?</b> <b>If “Yes”, please provide the previously issued KSU Number (if known):</b>		Yes      No

**ACCESS SELECTION**

<b>Does this individual require access to Enterprise Systems such as email, Banner, NetID, etc?</b>	Yes	No
<b>Does this individual require access to buildings after normal business hours (after 5pm M-F and holidays)?</b>	Yes	No
<b>Does this individual require key/card access to buildings/rooms/doors?</b> <b>Please note that actual access will need to be requested <u>after</u> you have received Registered Visitor approval at the following link:</b> <a href="http://dooraccess.kennesaw.edu/index.php">http://dooraccess.kennesaw.edu/index.php</a>	Yes	No
<b>Will this individual be in a position/role at KSU that is considered a “position of trust”?</b> (Includes interaction with children, master access to facilities, access to financial resources, delivery of patient care, access to patient information)	Yes	No
<b>Will this individual need access to secure area, information, or services?</b>	Yes	No
<b>Will this individual be involved in a program involving minors?</b> <b>If “Yes” please enter program name:</b>	Yes	No

**APPROVAL**

By signing this request for access to KSU facilities or services, I understand and agree that my department and/or the designated KSU sponsor noted above is responsible for:

- Coordinating the completion of the background investigation form and submitting it to Human Resources
- Covering the costs associated with obtaining a background check
- Ensuring that visitor or sponsor’s department has arranged to pay for campus parking
- Returning the issued KSU ID Card and Parking Pass (if applicable) to card services upon the NPA/LTV’s departure

<b>Dean/Department Head Printed Name:</b>	<b>Dean/Department Head Signature:</b>	<b>Date Signed:</b>
---	--	---------------------

<b>HR Use Only:</b>	LTV	NPA	AI	<b>HR Approval Signature:</b>
Approved?	Yes	No		

Comments:	
-----------	--

<b>Card Services Use Only:</b>	New KSU # (if applicable):
--------------------------------	----------------------------

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## **KSU REGISTERED VISITOR PROCEDURES 6/18/19:**

All contractors and vendors, including their employees/staff and/or subcontractors, who will be working on campus for more than five (5) days is considered a Registered Visitor and must obtain a KSU ID and parking permit to be on campus. To obtain a KSU ID and parking permit each person must complete and submit a Registered Visitor Form. If they are required to have key or key card access to any building or space, work after hours (5pm – 7am) or work weekends/holidays they must get a background check through KSU HR. These forms shall be submitted at least 10 business days prior to the work start date in order to allow KSU adequate time to process, approve and issue KSU ID's and parking permits.

**REGISTERED VISITOR FORM:** Attached is the Registered Visitor Form, which may be filled out on the computer or by hand. The KSU PM completes the following sections; "KSU Sponsor Information", "Access Selection" and "Approval". The Registered Visitor completes the "registered Visitor Information" section. Under "Visitor Affiliation or Company/Organization Name" note the company they work for not who they are subcontracted to. Also make sure to note the access start and end dates, which is limited to a maximum one year period. Once the registered visitor has completed the form it shall be returned to the KSU PM either by e-mail or by hand for the KSU FDCS Director's approval. Once that is done it will be submitted to KSU HR for final approval.

**BACKGROUND CHECK:** KSU HR will determine who needs a background check after receiving the "Registered Visitor Form" and will send an e-mail to the registered visitor with instructions on completing the background check.

Once KSU HR has approved and cleared the registered visitor the KSU PM will be notified by e-mail and will inform the registered visitor that they may pick up their KSU ID and parking permit.

**KSU ID & PARKING PERMIT:** Once the Registered Visitor has been approved and cleared they will go to Talon One, Student Center Kennesaw Campus, 1st floor, Suite 103 to get their KSU photo ID & parking permit. Each person has to pick up their KSU ID since a photo is required. They cannot have someone else pick up their KSU ID. All Registered Visitor's have to get a KSU ID badge in order to be on campus and to get a parking permit. No exceptions. They need to obtain parking permits for each vehicle that needs to be on campus. The parking permits are not transferrable to another vehicle. Parking permits cost \$23/month and must be paid in advance. KSU ID's are only good for up to one year and must be renewed annually, which will require the Registered Visitor and DSI Consent forms to be resubmitted and go through the same process as before.

**PARKING ON CAMPUS:** The parking permit allows access to the faculty/staff parking areas on campus. The following link will provide you campus maps indicating the parking areas on campus, <http://www.kennesaw.edu/maps/>. There are designated "Service Vehicle" parking spaces that are available on a first come basis in the faculty/staff parking areas. If they are occupied you may park in any open faculty/staff parking space. Parking arrangements for specific projects on campus need to be approved by the KSU PM.

**\*\*\*DO NOT PARK IN ANY DEDICATED/RESERVED PARKING SPACES, WHICH ARE CLEARLY MARKED, OR YOUR VEHICLE WILL BE FINED AND TOWED\*\*\***

Contractors and vendors who are on campus less than 5 business days and do not require a KSU ID or parking permit will need to park in the pay-to-park visitor's lots as follows:

**Kennesaw Campus:**

Pay-to-park areas for visitors in Lot V2 outside the Central Deck on Parliament Way and in the Visitor Parking lot on Kennesaw State University Road.

**Marietta Campus:**

Pay-to-park areas for visitors in Lot P2 off of Rossbacher Way and spaces are also available in the P60 parking deck (located on the second level).

**APPENDIX 08 – STANDARD SIGNAGE PROGRAM**

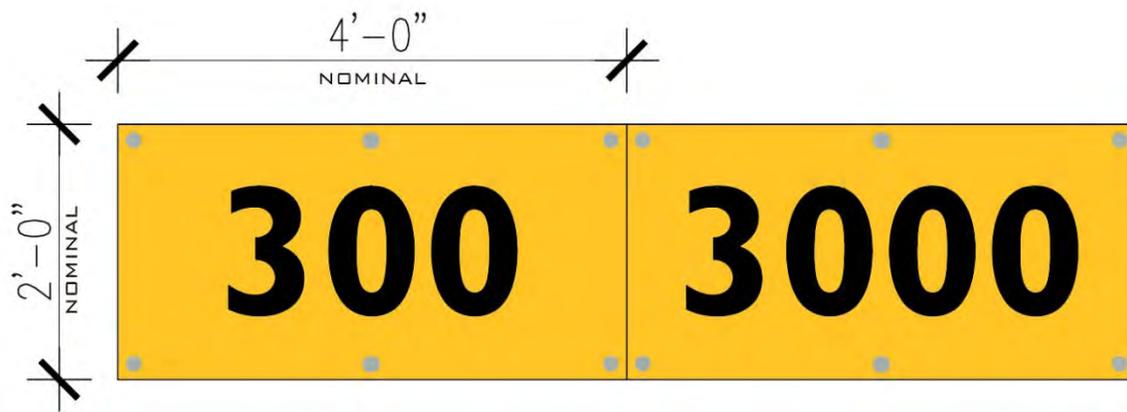
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**Building Address Numbering:**

- Numbers:
  - Font Type: Gil Sans Bold
  - Material: flat cut aluminum
  - Finish: Painted with powder coated, in professional spray booth using architectural grade acrylic polyurethane paints from PPG Industries
  - Finish Color: Black
  - Thickness: ¼-inch
  - Height: 12-inch
  - Mount number with pin support to panel with removal stud mount, ½-inch spacers
- Panel (Mounting Backboard) Material:
  - Polycarbonate with protective coating for scratch-resistance; features:
    - Panel must have highest performance of any engineered resin panel
    - Temperature resistance and impact resistance
    - Extremely tough, allowing for easy fabrication and maximum installed durability
    - Lightweight, reducing structural support requirements
    - Good chemical resistance, deducing potential harm by cleaning agents
  - Panel Face Finish: Standard polish on front and back, matte
  - Panel Edge Finish: Machined or routed as a straight edge, matte
  - Flatness tolerance: Panel shall not have distortion in the form of a wrinkle, twist or scallop along perimeter of the panel. Panel is to be measured when laying horizontally under its own weight on a flat continuous surface.
  - Flammability and Smoke Test Results: Will comply with building code approvals as described in 2009 IBC, for the following:
    - ASTM D 635 Flame Spread
    - ASTM D 1929 Self-ignition Temperature
    - ASTM E84-03 Flame Spread, ½" thickness
    - CAN/ULC 102.2 Flame Spread, ½" thickness
  - Ultraviolet Exposure Performance: Panel to incorporate ultraviolet stabilization technologies to maintain aesthetics and performance. Important characteristic of the material performance is the ability to maintain consistent aesthetics. UV stabilization exhibits excellent performance of impact strength to be 12,000 kJ exposure.
    - Important factor is the ability of the material to maintain its physical integrity after exposure to solar radiation.
  - Size: 2-feet Height x 4-feet Width (nominal)
    - Subject to 3/16" tolerance
  - Finish Color: Pantone PMS 123c (official KSU Gold)
  - Thickness (gauge): ½-inch
  - Warranty: Minimum of five (5) years from date of installation
  - Preferred manufacturer/material: 3form/Koda XT
    - Style: vitamin c + white out / Finish: brushed\_random

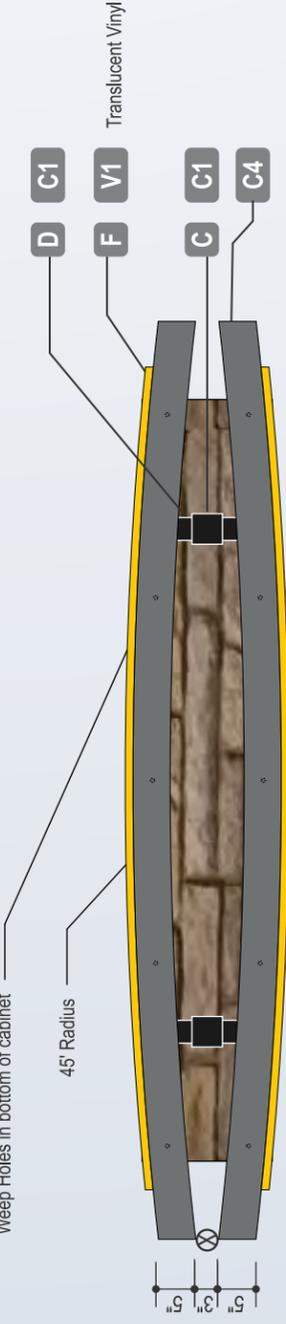
- Mounting Hardware:
  - Hardware designed specifically for exterior conditions, substrates: brick, stone, pre-cast concrete, split-face CMU, and metal cladding
  - Diameter of Standoff Cap and Base: 1 ½-inch diameter
  - Length of Standoff Base: 1-inch
  - Material: Marine grade Stainless Steel 316
    - With vibration-resistant thread tape and panel protecting washers
  - Finish: Brushed stainless
  - Style: Circular with 1 ½-inch diameter
  - Tamper-proof mounting puck, supplied with stainless steel Allen screw
  - Panel Fabrication with hardware: Hole diameter needs to allow the panel to expand/contract.
  - Point support condition per panel:
    - Fixed at points to attach panel to substrate/ exterior wall
    - Point-supports should connect using threaded rod; more rigid and prevents lateral movement of the panel at the support location
    - Quantity per panel, (6) total mounting pucks per panel along perimeter of panel
      - (1) per corner and (1) per middle-edge location = (6) per panel
  - Preferred manufacturer/material: 3form/Hardware XT
    - Approved manufacturer substitution: C.R. Laurence Co., Inc.
- Mounting location:
  - Location adjacent to building entrance:
    - Mounting height between 8-feet to 15-feet, depending on each buildings existing architectural aesthetics
  - Façade building materials throughout campus: Brick, stone, pre-cast concrete, split-face CMU, and metal cladding

\*\*Installation of material and hardware are required to follow manufacturer’s recommendations.\*\*

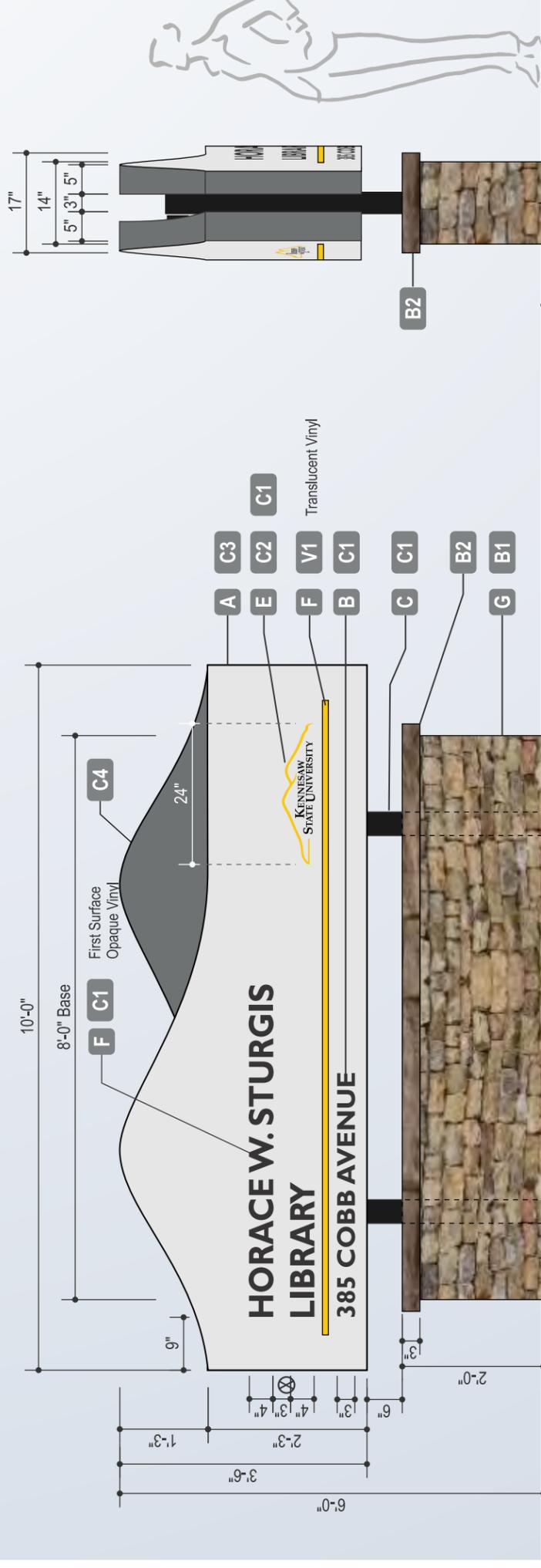


**Colors & Finishes**

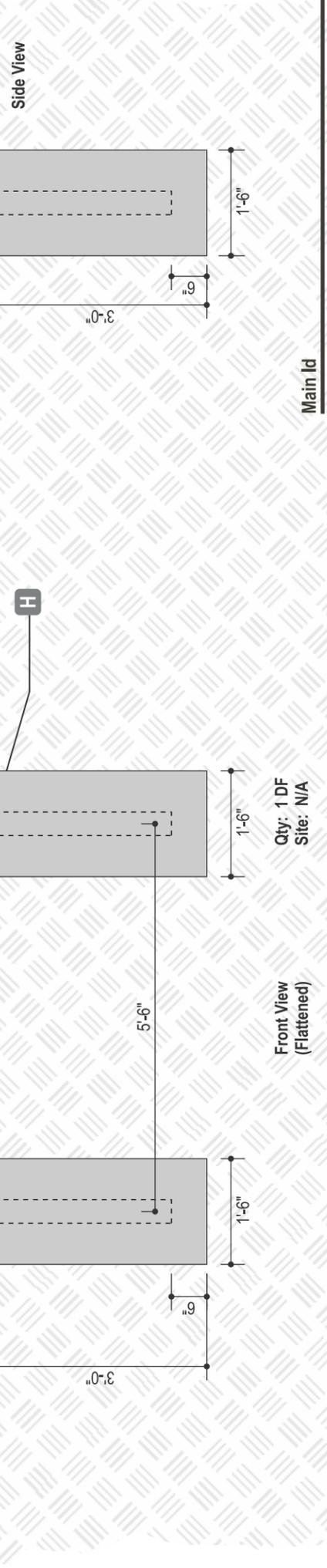
Colors shown here may not exactly match manufacturers color chart swatch or actual sample. Client to either provide samples or specifications for custom colors prior to production or approve DeNyse color samples or color specifications



Plan View



Front View (Flattened)



Side View

Main Id

Scale: 1/2" = 1'-0"

Qty: 1 DF  
Site: N/A

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Management Company  
Kennesaw State University

Property Name & Address  
Kennesaw State University  
KSU Library  
1000 Chastain Rd  
Kennesaw, GA 30144

Opportunity Number  
10721

DeNyse Representative  
Jeff Holley

Designer  
C. Craig

Date  
05.14.2015

Revision Date  
05.22.2015 ccr.raj



Design Time  
2.75

Customer Approval

Filename  
Main Id 2v2

- Concept
- Preliminary
- Production



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**Kennesaw State  
Construction Services**

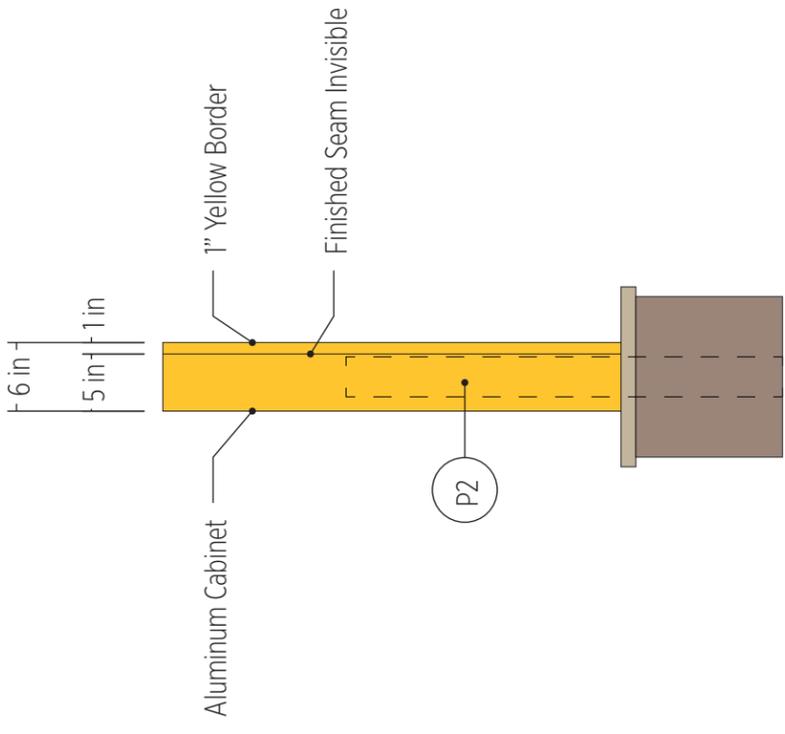
3205 Campus Loop Road,  
Kennesaw, GA 30144

**CLIENT TEAM**

Lead Richard Rhodes  
Phone XXXX  
Email rrhode12@kennesaw.edu  
Site XXXX  
Phone XXXX  
Email XXXX

**41SOUTH TEAM**

Lead Jeff Blankenship  
PM Maddie Richardson  
Design Jeff Blankenship



**2 MONUMENT ELEVATION (SOUTH FACE)**

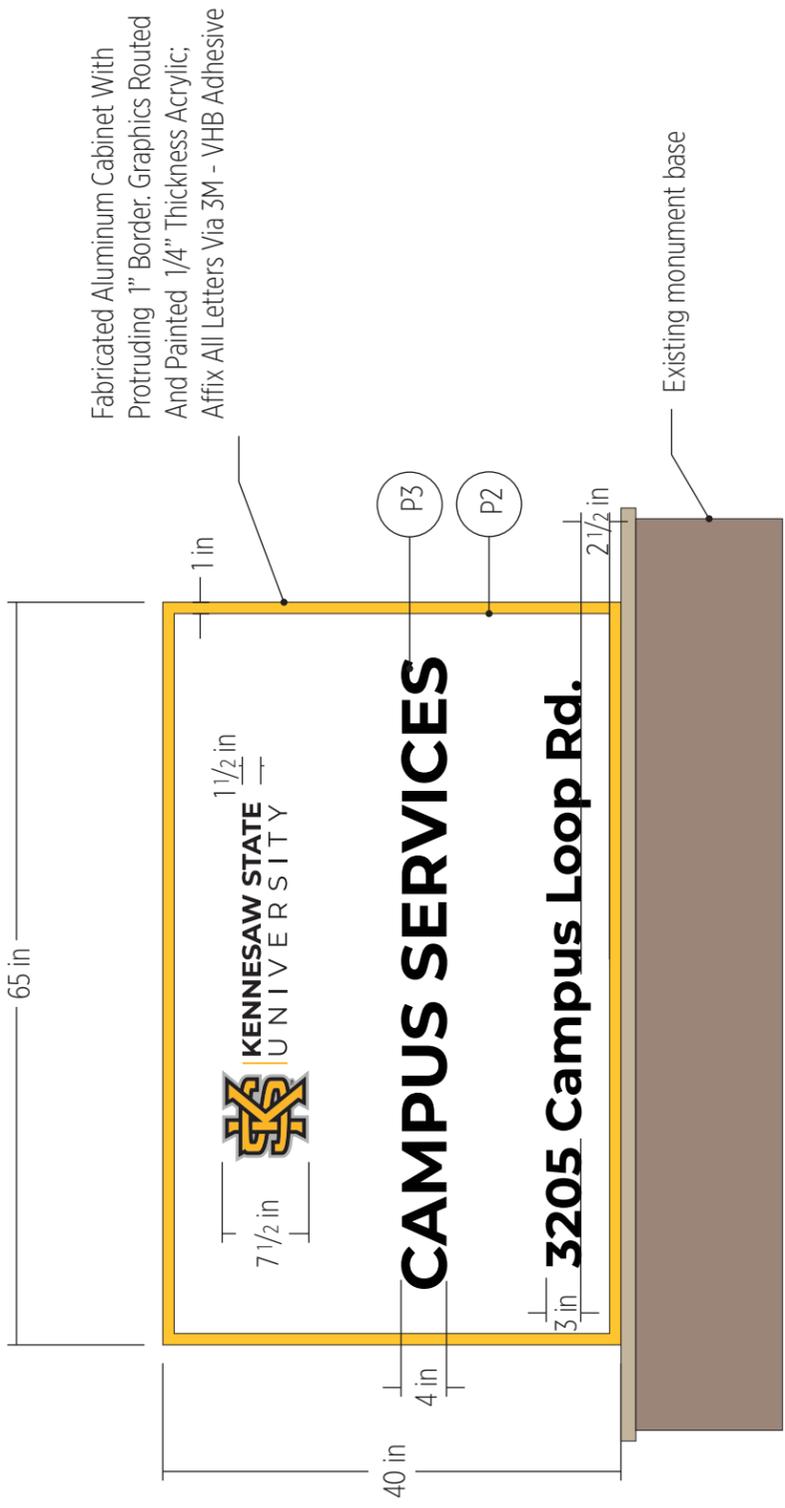
**SCALE: 3/4"=1'**

Installation: Remove existing foam monument  
Via Phillips headscrews on back.



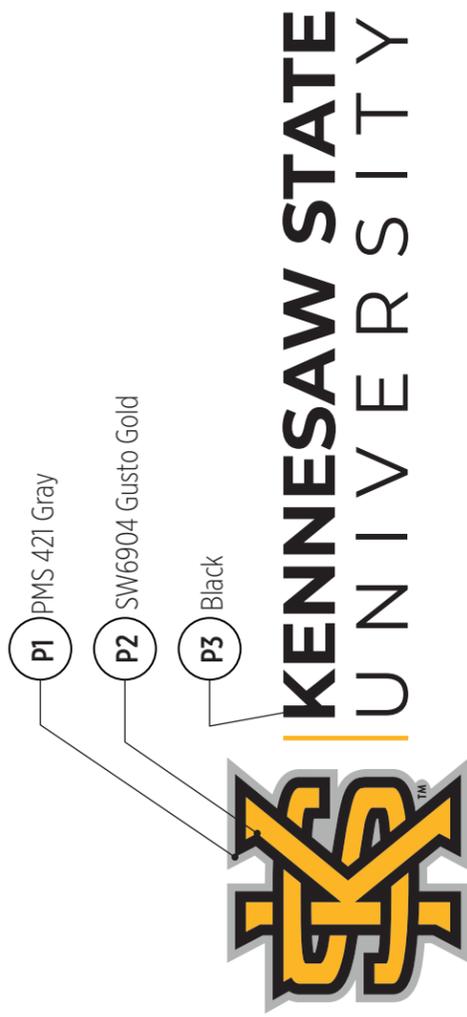
**4 EXISTING CONDITIONS (EAST FACE)**

**SCALE: NTS**



**1 MONUMENT ELEVATION (EAST FACE)**

**SCALE: 3/4"=1'**



**3 COLOUR CALL OUT**

**SCALE: NTS**



1349 Old 41 Hwy NW #240 | Marietta GA, 30060

P | 770.420.3008 W | 41SouthCreative.com

E | ideas@41southcreative.com

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Commercial > KSU Construction Services > 13657

**13657**

**Monument**

**13657**

**Kennesaw State  
Construction Services**

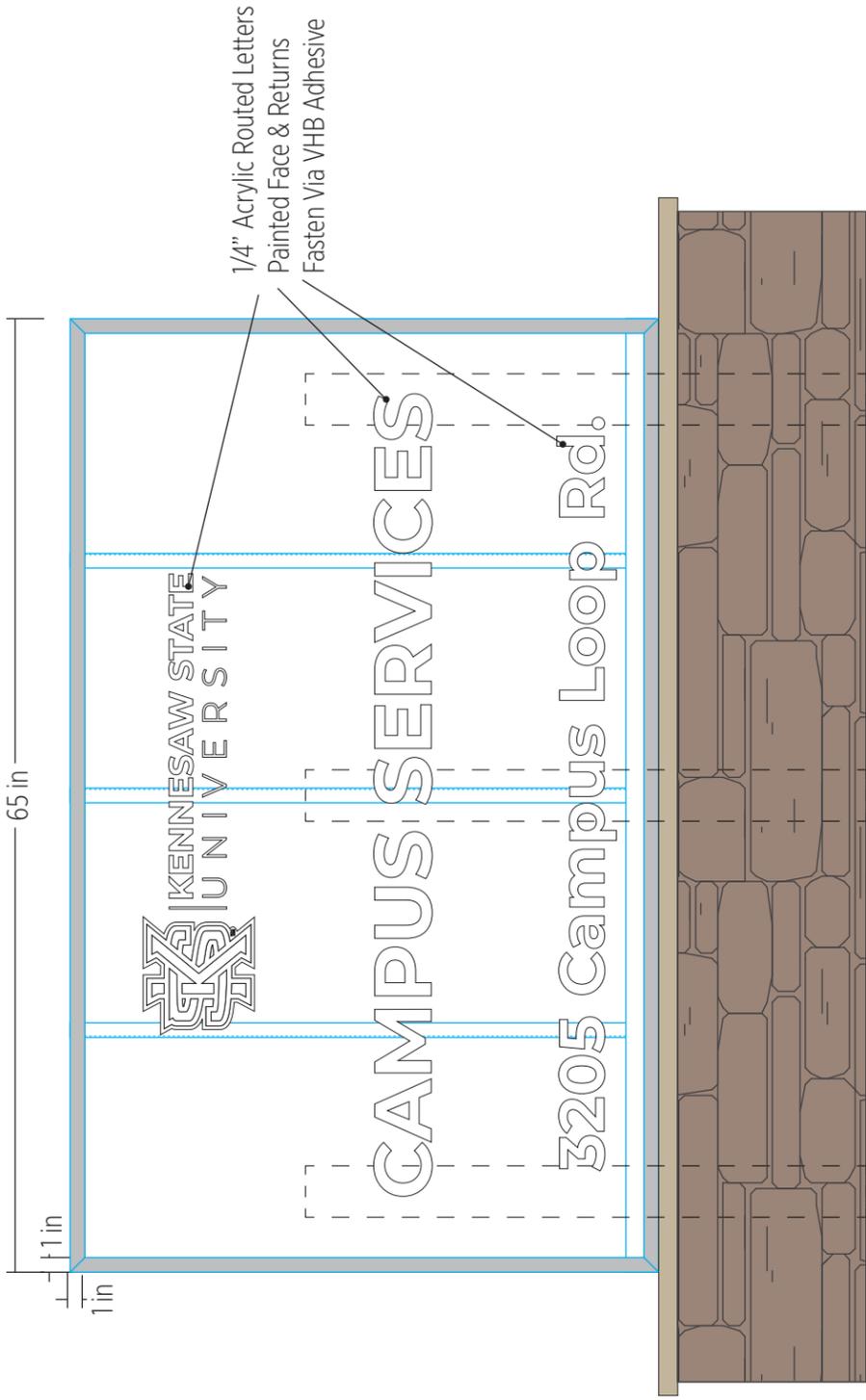
3205 Campus Loop Road,  
Kennesaw, GA 30144

**CLIENT TEAM**

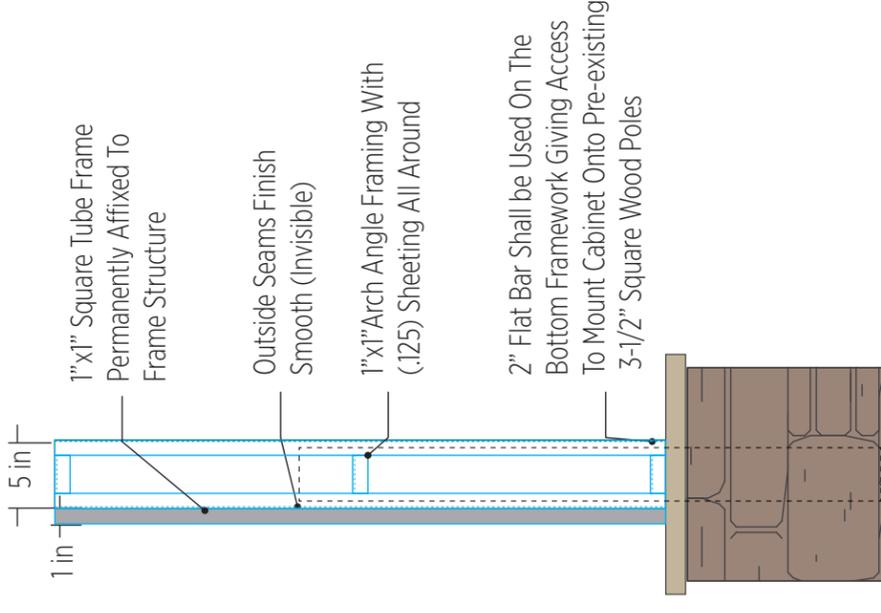
Lead Richard Rhodes  
Phone XXXX  
Email rrhodel2@kennesaw.edu  
Site XXXX  
Phone XXXX  
Email XXXX

**41SOUTH TEAM**

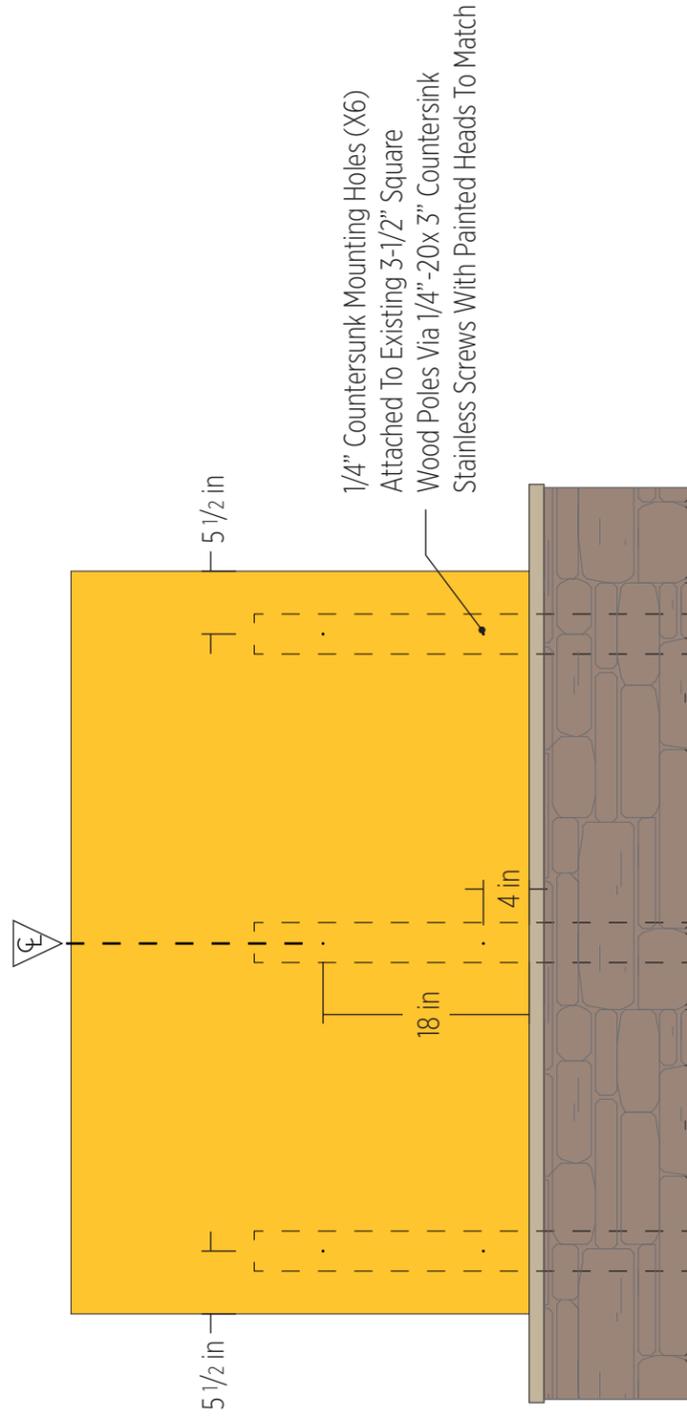
Lead Jeff Blankenship  
PM Maddie Richardson  
Design Jeff Blankenship



**1** FRAMEWORK - FACE VIEW  
SCALE: 1"=1'



**2** FRAMEWORK - END VIEW  
SCALE: 1"=1'



**3** MONUMENT ELEVATION - REAR VIEW  
SCALE: 3/4"=1'



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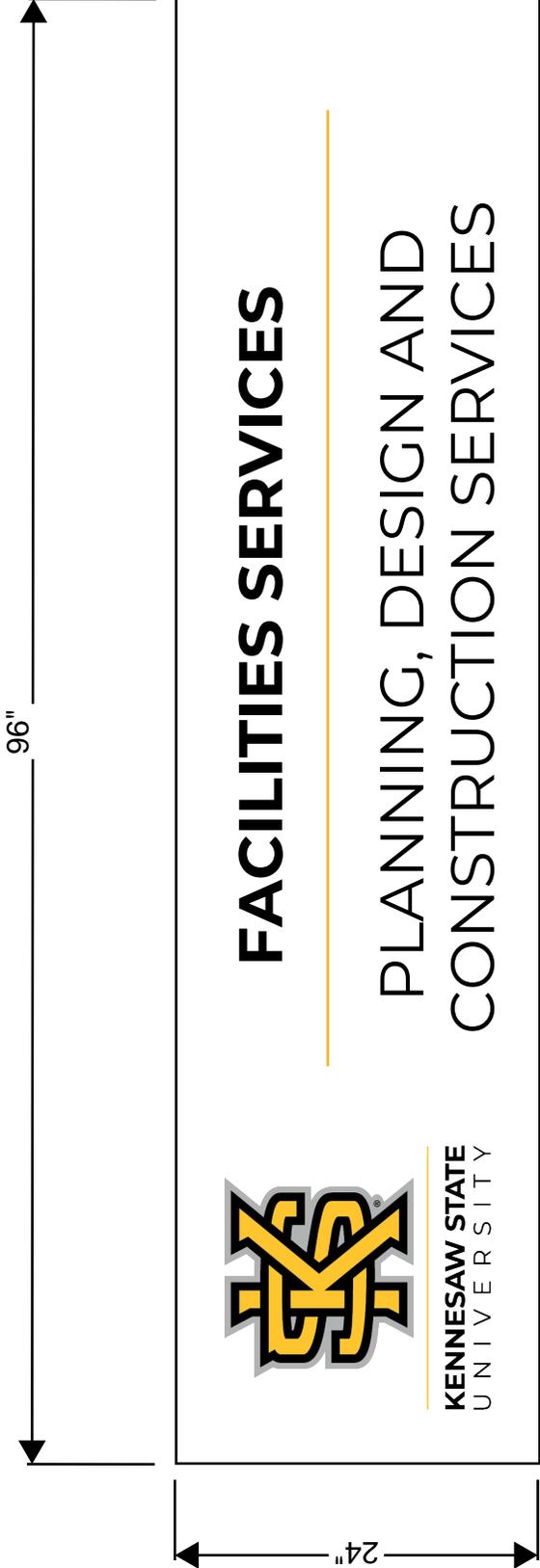
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Commercial > KSU Construction Services >  
13657 > Production > Route Master

13657

Cabinet Framing

13657



**SIGNAGE NOTES:**

1. SIGN PANEL TO BE 1/4" NON-GLARE WHITE ACRYLIC.
2. GRAPHICS & TEXT TO BE VINYL APPLIED, MONTERRAT BOLD & REGULAR FONT AS INDICATED, HEIGHT 2.8".
3. "YELLOW" LINE TO BE VINYL APPLIED, MATCH PMS 1235C - 3M SCOTCHCAL TRANSLUCENT 3630-125 "GOLDEN YELLOW" OR 3M ENVISION TRANSLUCEN 3730-125L "GOLDEN YELLOW" ARE ACCEPTABLE PRODUCTS.
4. PANEL TO FIT EXISTING ALUMINUM FRAME MOUNTED ON BUILDING.

**KSU TYPICAL EXTERIOR CHASTAIN POINTE SIGNAGE**

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# 2/90 Custom Plaque

# Sign Type A

### Specifications:

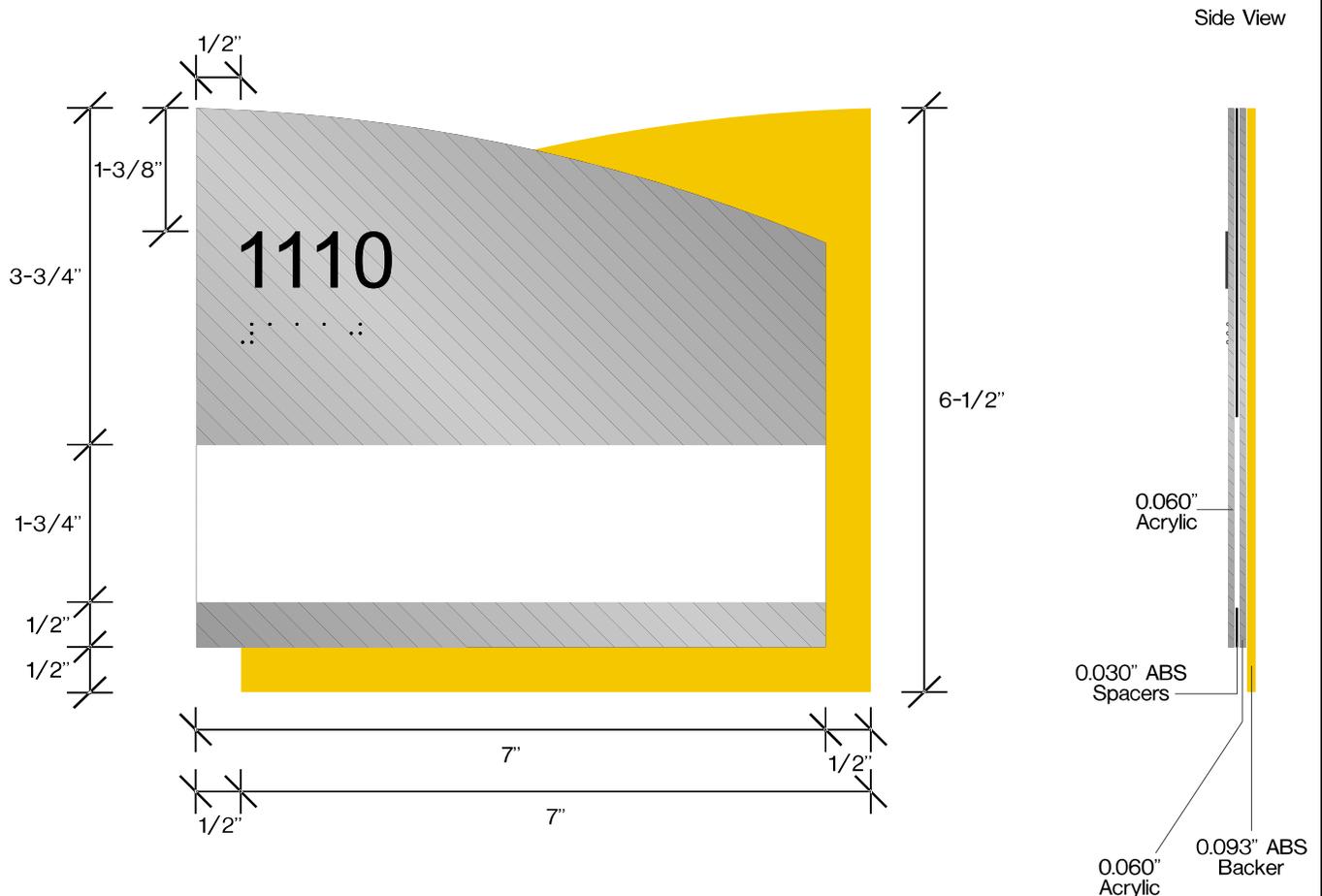
**Sign Size:** 6-1/2x7-1/2 overall  
**Mount Option:** A-Adhesive  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver, 408 White  
 PMS 123C Yellow

**Copy Option:** Tactile/Braille  
**Copy Style:** Arial  
**Copy Size:** 5/8  
**Copy Color:** 704 Black  
**Copy Position:** See Drawing

**Project:** KSU Room Signage  
**Cust. Name:** KSU  
**Date:** 08/16/16  
**Revision Date:** 10/07/16  
**Approved by:** \_\_\_\_\_ Name  
 \_\_\_\_\_ Date

**ADA/ANSI Standards for signage disclaimer\*:**
 ADA/ANSI Applies
  Doesn't Apply
  Compliant
  Non-Compliant

### Illustration:



### Notes:

Window to hold 2"x7" paper.

\*Guideline per 2/90's interpretation of ADA/ANSI A17.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

### Order:

Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

**Name:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_  
**Fax:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

Full Sign	
Qty.	Mount Option:



Grand Rapids, MI 49512  
 800-777-4310 www.290signs.com

# 2/90 Custom Plaque

# Sign Type B

## Specifications:

**Sign Size:** 6-1/2x7-1/2 overall  
**Mount Option:** A-Adhesive  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver  
 PMS 123C Yellow

**Copy Option:** Tactile/Braille  
**Copy Style:** Arial  
**Copy Size:** 5/8  
**Copy Color:** 704 Black  
**Copy Position:** See Drawing

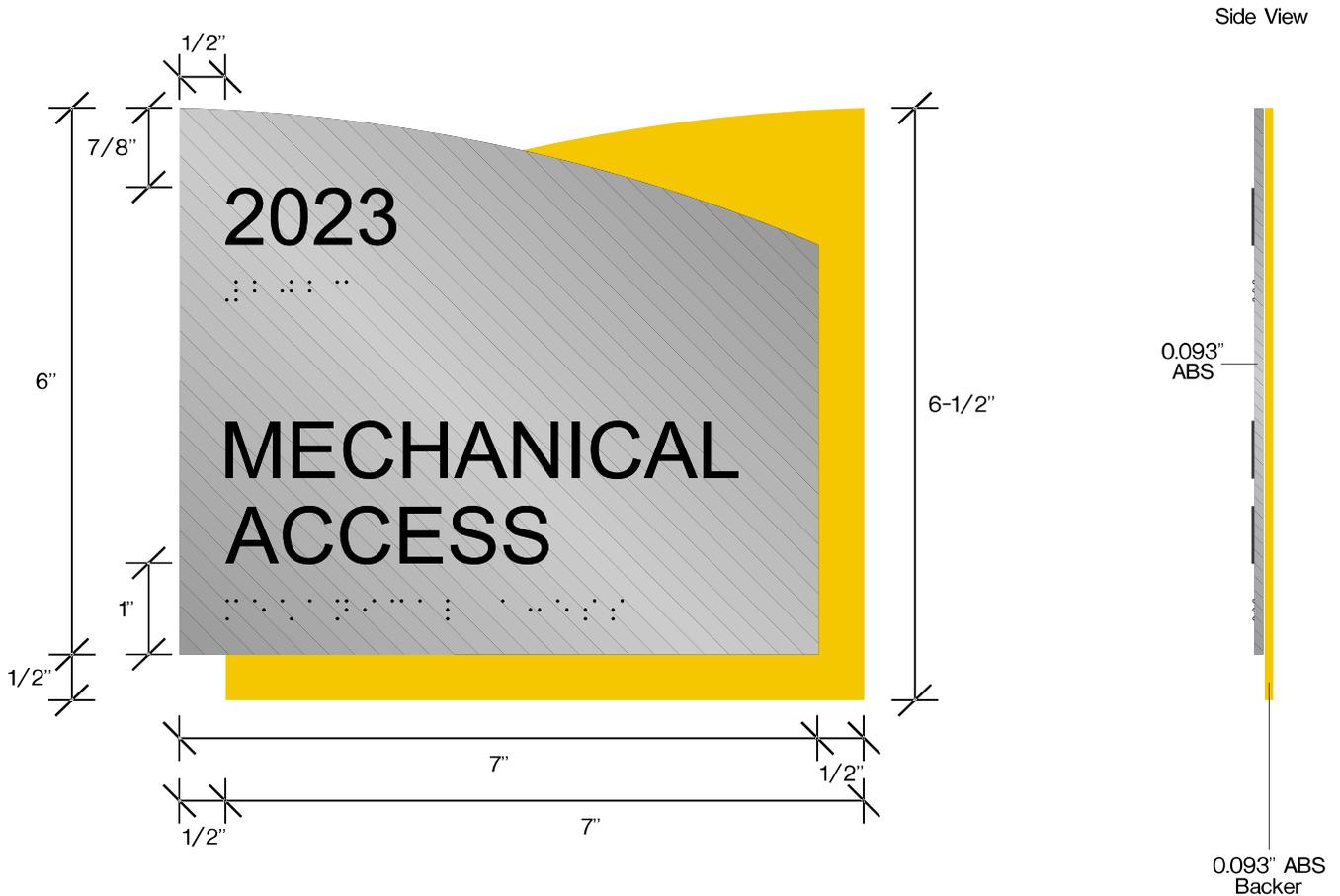
**Project:** KSU Room Signage  
**Cust. Name:** KSU  
**Date:** 03/10/16  
**Revision Date:** 04/01/16, 04/15/16  
**Approved by:** 10/07/16

Name \_\_\_\_\_  
 Date \_\_\_\_\_

## ADA/ANSI Standards for signage disclaimer\*:

ADA/ANSI Applies   
  Doesn't Apply   
  Compliant   
  Non-Compliant

## Illustration:



## Notes:

\*Guideline per 2/90's interpretation of ADA/ANSI A17.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

## Order:

Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

**Name:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_  
**Fax:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

Full Sign	
Qty.	Mount Option:



Grand Rapids, MI 49512  
 800-777-4310 www.290signs.com

# 2/90 Custom Plaque

# Sign Type B.2

### Specifications:

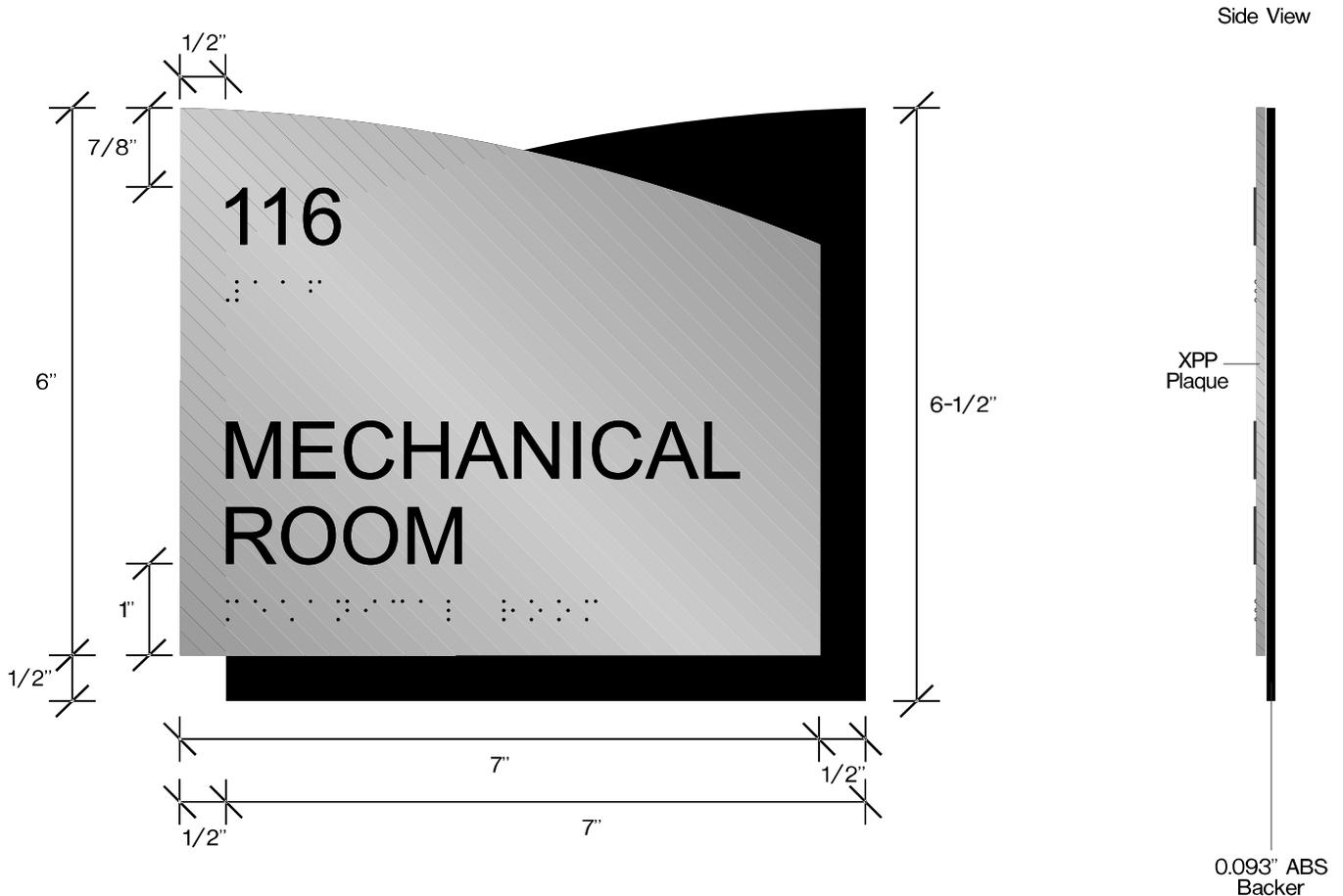
**Sign Size:** 6-1/2x7-1/2 overall  
**Mount Option:** A-Adhesive  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver  
 704 Black

**Copy Option:** Exterior Photopolymer/Braille  
**Copy Style:** Arial  
**Copy Size:** 5/8  
**Copy Color:** 704 Black  
**Copy Position:** See Drawing

**Project:** KSU Room Signage  
**Cust. Name:** KSU  
**Date:** 03/02/18  
**Revision Date:** 00/00/00  
**Approved by:** \_\_\_\_\_ Name  
 \_\_\_\_\_ Date

**ADA/ANSI Standards for signage disclaimer\*:**
 ADA/ANSI Applies
  Doesn't Apply
  Compliant
  Non-Compliant

### Illustration:



### Notes:

\*Guideline per 2/90's interpretation of ADA/ANSI A117.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

### Order:

Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

**Name:**  
**Phone:**  
**Fax:**  
**Date:**

Full Sign	
Qty.	Mount Option:



Grand Rapids, MI 49512  
 800-777-4310 www.290signs.com

# 2/90 Custom Plaque

# Sign Type C

## Specifications:

**Sign Size:** 10x7-1/2 overall  
**Mount Option:** A-Adhesive  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver  
 PMS 123C Yellow

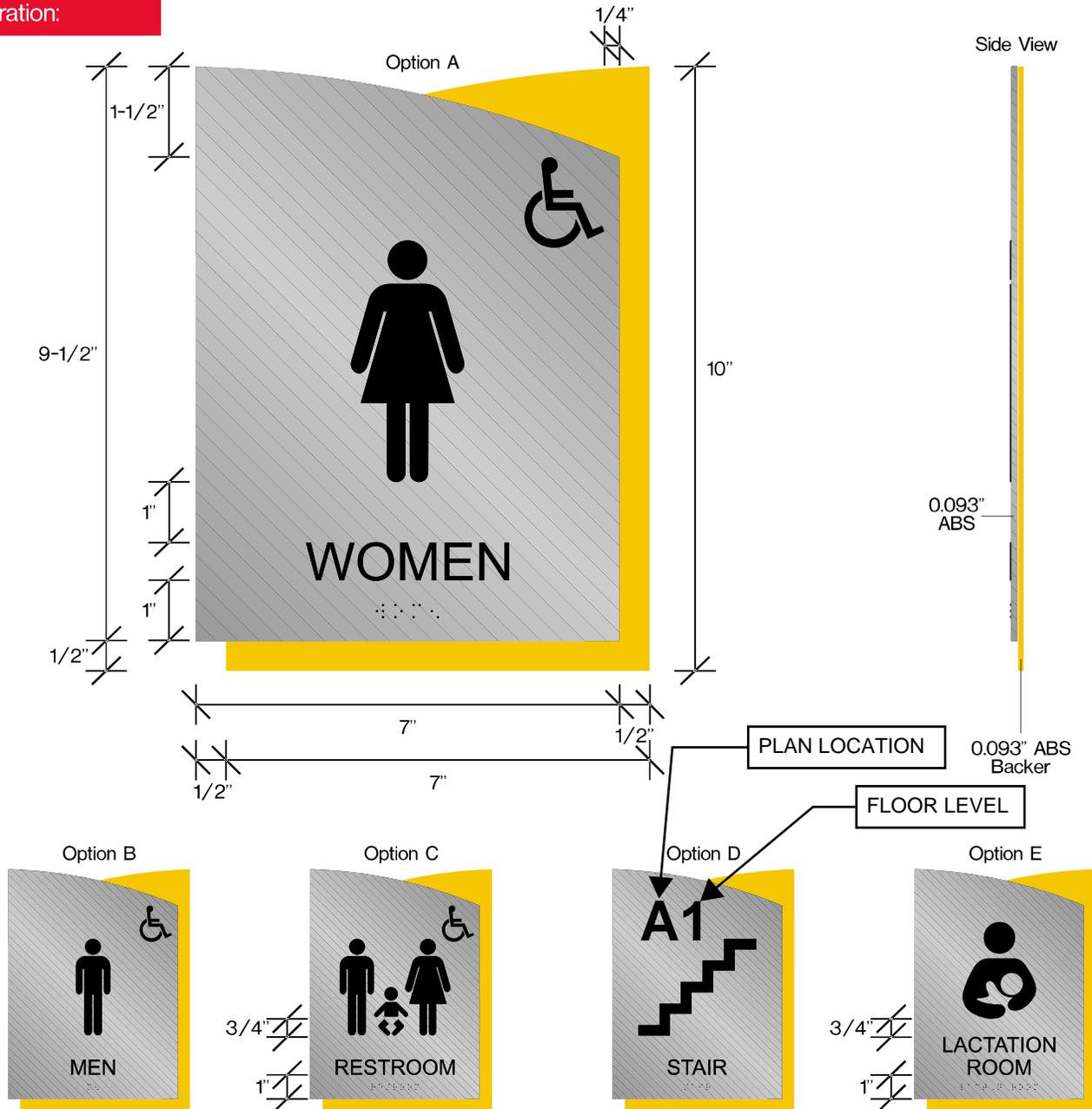
**Copy Option:** Tactile/Braille  
**Copy Style:** Symbols, Arial  
**Copy Size:** 4, 1-1/2, 5/8  
**Copy Color:** 704 Black  
**Copy Position:** See Drawing

**Project:** KSU Room Signage  
**Cust. Name:** KSU  
**Date:** 04/08/16  
**Revision Date:** 10/07/16, 11/04/16  
**Approved by:** 11/14/17, 03/02/18

Name \_\_\_\_\_  
 Date \_\_\_\_\_

**ADA/ANSI Standards for signage disclaimer\*:**
 ADA/ANSI Applies
  Doesn't Apply
  Compliant
  Non-Compliant

## Illustration:



## Notes:

\*Guideline per 2/90's interpretation of ADA/ANSI A17.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

## Order:

Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

**Name:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_  
**Fax:** \_\_\_\_\_  
**Date:** \_\_\_\_\_

Full Sign	
Qty.	Mount Option:



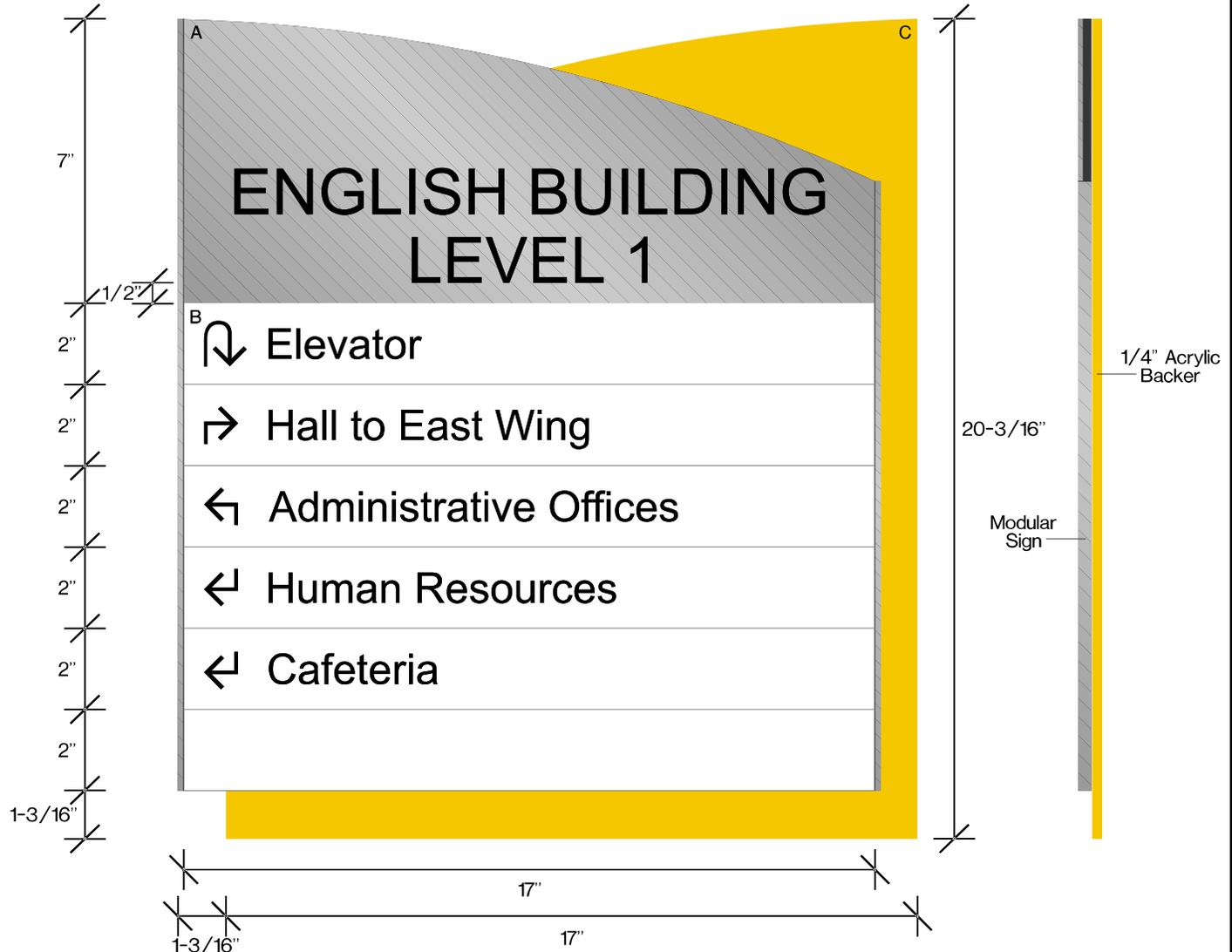
Grand Rapids, MI 49512  
 800-777-4310 www.290signs.com

<b>Specifications:</b>		Top/Bottom Trim Style: *	Project: KSU Room Signage
Sign Size: 19x17 Thin (15x17 rail)	Mount Option: D-Screw	Top/Bottom Trim Color(s): *	Cust. Name: KSU
End Cap Style: SL, Slimline	End Cap Color(s): 150 Silver	Accent Strip(s): *	Date: 04/08/16
		Accent Strip Color (s): *	Revision Date: 10/07/16, 06/01/17
			Approved by: 03/02/18
			Name _____
			Date _____

<b>Insert A</b>	<b>Insert B</b>	<b>Insert C</b>
Insert Size: 7x17 (custom shape)	Insert Size: 2x17	Insert Size: 20-3/16x17x1/4 Acrylic Plaque
Insert Color: 150 Silver	Insert Color: 708 White	Insert Color: PMS 123C Yellow
Copy Option: Direct Print	Copy Option: Direct Print	Copy Option: Blank
Copy Style: Arial	Copy Style: Arial	Copy Style: *
Copy Size: 1-1/8	Copy Size: 3/4	Copy Size: *
Copy Color: 704 Black	Copy Color: 704 Black	Copy Color: *
Copy Position: Center as shown	Copy Position: Left	Copy Position: *

ADA/ANSI Standards for signage disclaimer\*:  ADA/ANSI Applies  Doesn't Apply  Compliant  Non-Compliant

**Illustration:**



**Notes:** Left end cap is 19", Right end cap is 15" 4"x17" filler panel behind insert A

\*Guideline per 2/90's interpretation of ADA/ANSI A117.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

<b>Order:</b>		Complete this order form and Fax to 2/90 at: 616.656.4300	Name:
		<b>Indicate quantity in boxes below.</b>	Phone:
		Print desired copy above or attach copy schedule.	Fax:
		Designate Mount Option if ordering a full sign.	Date:
<b>Full Sign</b>		<b>Replacement Inserts</b>	
Qty.	Mount Option:	A Qty.	B Qty.
		C Qty.	D Qty.
		E Qty.	F Qty.



# 2/90 Custom Plaque

# Sign Type E

## Specifications:

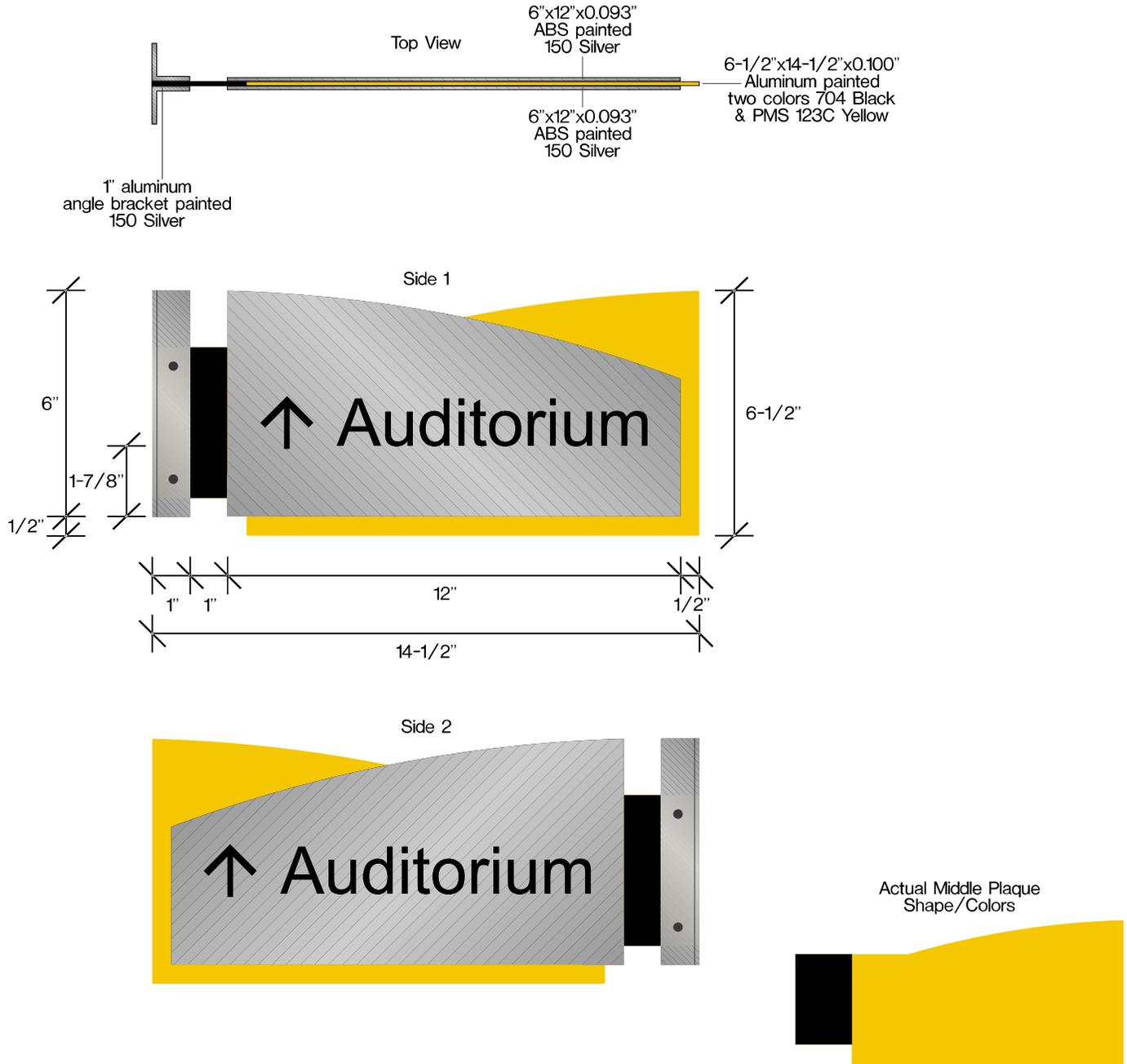
**Sign Size:** 6-1/2x14-1/2 overall  
**Mount Option:** Custom Perpendicular  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver  
 PMS 123C Yellow, 704 Black

**Copy Option:** Direct Print  
**Copy Style:** Arial  
**Copy Size:** 1-1/4  
**Copy Color:** 704 Black  
**Copy Position:** Center as shown

**Project:** Owls Nest  
**Cust. Name:** Kennesaw State University  
**Date:** 05/09/17  
**Revision Date:** 03/02/18, 03/07/18  
**Approved by:** \_\_\_\_\_  
 Name \_\_\_\_\_  
 Date \_\_\_\_\_

**ADA/ANSI Standards for signage disclaimer\*:**  ADA/ANSI Applies  Doesn't Apply  Compliant  Non-Compliant

## Illustration:



\*Guideline per 2/90's interpretation of ADA/ANSI A117.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

## Order:

Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

Full Sign	
Qty.	Mount Option:

Name:  
 Phone:  
 Fax:  
 Date:



Grand Rapids, MI 49512  
 800-777-4310 www.290signs.com

# 2/90 Custom Plaque

# Sign Type H

## Specifications:

**Sign Size:** 6-1/2x7-1/2 overall  
**Mount Option:** A-Adhesive  
**Square or Radius Corners:** Custom  
**Sign Color:** 150 Silver  
 PMS 123C Yellow

**Copy Option:** Tactile/Braille  
**Copy Style:** Arial  
**Copy Size:** 5/8  
**Copy Color:** 704 Black  
**Copy Position:** See Drawing

**Project:** KSU Room Signage  
**Cust. Name:** KSU  
**Date:** 03/02/18  
**Revision Date:** 00/00/00  
**Approved by:** \_\_\_\_\_ Name  
 \_\_\_\_\_ Date

**ADA/ANSI Standards for signage disclaimer\*:**
 ADA/ANSI Applies
  Doesn't Apply
  Compliant
  Non-Compliant

## Illustration:



## Notes:

\*Guideline per 2/90's interpretation of ADA/ANSI A117.1-200.3. Due to the ADA/ANSI's wide interpretation and other factors that may exist, 2/90 cannot affirm compliance in all situations and is hereby removed from responsibility regarding these issues.

**Order:** Complete this order form and Fax to 2/90 at: 616.656.4300  
**Indicate quantity in boxes below.**  
 Print desired copy above or attach copy schedule.  
 Designate Mount Option if ordering a full sign.

Full Sign	
Qty.	Mount Option:

Name:  
 Phone:  
 Fax:  
 Date:



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**SIGNAGE NOTES:**

1. SIGN PANEL TO BE 1/4" NON-GLARE ACRYLIC BACKED WITH 3M FASARA VINYL WHITE TRANSLUCENT FILM, "GLACE" SH2MAGL-1201.
2. TEXT TO BE 1/8" THICK BLACK ACRYLIC, MONTERRAT BOLD & REGULAR FONT AS INDICATED, HEIGHT 2.5".
3. "YELLOW" LINE TO BE 1/8" THICK ACRYLIC PAINTED TO MATCH "KSU GOLD", PMS 1235C. (SEE ATTACHED PAINT FORMULA)
4. STANDOFFS TO BE 3/4" DIA. X 1", FLAT TOP ALUMINUM STANDOFF, SATIN FINISH.

**KSU TYPICAL INTERIOR DEPT. SIGNAGE**



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**APPENDIX 09 – CAD STANDARDS (UNDER DEVELOPMENT)**

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**APPENDIX 10 – ACCESS CONTROL CRITERIA**

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SECTION 28 1000

ACCESS CONTROL SYSTEM DOOR TYPES

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Contract drawings, specifications, and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.
- B. All requirements stated in SECTION 28 0000 and SECTION 08 7100, DOOR HARDWARE shall apply and must be referenced.

**1.2 SUMMARY**

- A. Kennesaw State University has standardized on SALTO Access Control System (ACS). The Security Contractor shall ensure that any new deployments of access control devices are connected and controlled by the SALTO Access Control System (ACS).
- B. The overall goal is to eliminate “hard keys” as much as possible by installing ACS devices at doors where a record needs to be kept of who entered the door and / or the door needs to be secured. Typically, the ACS devices include a card reader, some form of electrified door hardware, a door position switch and a Request-to-Exit device / switch.
- C. The ACS shall provide options for wired online devices connected to the KSU network and centralized (or local) 12 / 24 VDC power supplies with battery back-up as well as wireless online or offline, battery operated devices that operate in a standalone mode or connected to the KSU network.
- D. The DOOR TYPE shall determine whether wireless or hardwired devices shall be deployed. This specification section details the ACCESS CONTROL SYSTEM DOOR TYPES that will be typical of existing and new ACS deployments. The expectation is that, whenever an ACCESS CONTROL SYSTEM DOOR TYPE is identified by the Construction Documents, all devices that are described by this document and for that door type, shall be provided.
- E. The DOOR TYPE shall also determine whether a door is secured with an “ONLINE AND WIRED” or an “ONLINE AND WIRELESS” or an “OFFLINE” ACS device. At doors that require real time and live monitoring (meaning an alarm transmitted back to the Kennesaw State University Police Department whenever the door be forced open and opened with a hard key), the “ONLINE AND WIRED” or “ONLINE AND WIRELESS” ACS device shall be specified based on the usage requirements. At doors that do not require real time and live monitoring as well as only require a valid card read to gain access based on schedule, an “OFFLINE” ACS device shall be specified.

**1.1 ACCEPTABLE MANUFACTURERS**

- A. Equipment and systems conforming to this section of the specifications manufactured by the following companies is acceptable:

1. SALTO

- B. Contractor must be an Enterprise Level Certified Dealer of the access control system manufacturer in order to qualify for this project.

1.2 **QUALITY ASSURANCE**

- A. Industry Referenced Standards. The following specifications and standards are incorporated into and become a part of this Specification by reference.
1. FCC compliance
  2. UL compliance
  3. NEC compliance

2.0 **DOOR TYPES**

- A. The following **“ONLINE AND WIRED”** DOOR TYPES shall be described as:
1. DOOR TYPE #1 – Online, wired and powered by 12/24 VDC, Building Exterior, Single, Doors shall receive the following ACS Devices:
    - a. Card Reader mounted at 42” A.F.F
    - b. Door Position Switch (DPS)
    - c. Request-to-Exit switches built into electrified door hardware
    - d. Electrified door hardware as required by the Door Hardware Specifications
    - e. 250 feet of plenum rated, low voltage, composite cable
  2. DOOR TYPE #2 – Online, wired and powered by 12/24 VDC , Building Exterior, Double, Doors shall receive the following ACS Devices:
    - a. Card Reader mounted at 42” A.F.F
    - b. Door Position Switch (DPS) on both leafs
    - c. Request-to-Exit switches built into electrified door hardware
    - d. Power Transfer Devices
    - e. Electrified door hardware as required by the Door Hardware Specifications
    - f. Unlockable (with key) and Removable Mullions
    - g. Door Pulls
    - h. 250 feet of plenum rated, low voltage, composite cable
  3. DOOR TYPE #3 – Online, wired and powered by 12/24 VDC, Building Interior, Single Doors shall receive the following ACS Devices:
    - a. Card Reader mounted at 42” A.F.F
    - b. Door Position Switch (DPS)
    - c. Request-to-Exit switches built into electrified door hardware
    - d. Electrified door hardware as required by the Door Hardware Specifications
    - e. 250 feet of plenum rated, low voltage, composite cable
  4. DOOR TYPE #4 – Online, wired and powered by 12/24 VDC, Building Interior, Double Doors shall receive the following ACS Devices:
    - a. Card Reader mounted at 42” A.F.F
    - b. Door Position Switch (DPS) on both leafs

- c. Request-to-Exit switches built into electrified door hardware
  - d. Power Transfer Devices
  - e. Electrified door hardware as required by the Door Hardware Specifications
  - f. Unlockable (with key) and Removable Mullions
  - g. Door Pulls
  - h. 250 feet of plenum rated, low voltage, composite cable
5. DOOR TYPE #5 / MONITORED ONLY – Online and wired, Building Exterior, Roll-up Doors shall receive the following ACS Devices:
- a. Online and wired ACS I/O Module
  - b. Roll-up Door Position Switch (DPS) surface mounted with armored cable
  - c. 250 feet of plenum rated, low voltage, composite cable
- B. The following **“ONLINE AND WIRED WITH ADA OPERATOR”** DOOR TYPES shall be described as:
1. DOOR TYPE #6 – Online, wired and powered by 12/24 VDC, Building Exterior, Single, Doors with ADA Operator shall receive the following ACS Devices:
    - a. Access Control interface with ADA Operator
    - b. Card Reader mounted at 42” A.F.F
    - c. Door Position Switch (DPS)
    - d. Request-to-Exit switches built into electrified door hardware
    - e. Electrified door hardware as required by the Door Hardware Specifications
    - f. 250 feet of plenum rated, low voltage, composite cable
  2. DOOR TYPE #7 – Online, wired and powered by 12/24 VDC , Building Exterior, Double, Doors with ADA Operator shall receive the following ACS Devices:
    - a. Access Control interface with ADA Operator
    - b. Card Reader mounted at 42” A.F.F
    - c. Door Position Switch (DPS) on both leafs
    - d. Request-to-Exit switches built into electrified door hardware
    - e. Power Transfer Devices
    - f. Electrified door hardware as required by the Door Hardware Specifications
    - g. Unlockable (with key) and Removable Mullions
    - h. Door Pulls
    - i. 250 feet of plenum rated, low voltage, composite cable
  3. DOOR TYPE #8 – Online, wired and powered by 12/24 VDC, Building Interior, Single Doors with ADA Operator shall receive the following ACS Devices:
    - a. Access Control interface with ADA Operator
    - b. Card Reader mounted at 42” A.F.F
    - c. Door Position Switch (DPS)
    - d. Request-to-Exit switches built into electrified door hardware
    - e. Electrified door hardware as required by the Door Hardware Specifications
    - f. 250 feet of plenum rated, low voltage, composite cable

4. DOOR TYPE #9 – Online, wired and powered by 12/24 VDC, Building Interior, Double Doors with ADA Operator shall receive the following ACS Devices:
  - a. Access Control interface with ADA Operator
  - b. Card Reader mounted at 42” A.F.F
  - c. Door Position Switch (DPS) on both leafs
  - d. Request-to-Exit switches built into electrified door hardware
  - e. Power Transfer Devices
  - f. Electrified door hardware as required by the Door Hardware Specifications
  - g. Unlockable (with key) and Removable Mullions
  - h. Door Pulls
  - i. 250 feet of plenum rated, low voltage, composite cable

C. The following **“ONLINE AND WIRED WITH DUAL AUTHENTICATION”** DOOR TYPES shall be described as:

1. DOOR TYPE #10 – Online, wired and powered by 12/24 VDC, Building Exterior, Single, Doors with Dual Authentication shall receive the following ACS Devices:
  - a. Card Reader w/ keypad mounted at 42” A.F.F
  - b. Door Position Switch (DPS)
  - c. Request-to-Exit switches built into electrified door hardware
  - d. Electrified door hardware as required by the Door Hardware Specifications
  - e. 250 feet of plenum rated, low voltage, composite cable
2. DOOR TYPE #11 – Online, wired and powered by 12/24 VDC , Building Exterior, Double, Doors with Dual Authentication shall receive the following ACS Devices:
  - a. Card Reader w/keypad mounted at 42” A.F.F
  - b. Door Position Switch (DPS) on both leafs
  - c. Request-to-Exit switches built into electrified door hardware
  - d. Power Transfer Devices
  - e. Electrified door hardware as required by the Door Hardware Specifications
  - f. Unlockable (with key) and Removable Mullions
  - g. Door Pulls
  - h. 250 feet of plenum rated, low voltage, composite cable
3. DOOR TYPE #12 – Online, wired and powered by 12/24 VDC, Building Interior, Single Doors with Dual Authentication shall receive the following ACS Devices:
  - a. Card Reader w/ keypad mounted at 42” A.F.F
  - b. Door Position Switch (DPS)
  - c. Request-to-Exit switches built into electrified door hardware
  - d. Electrified door hardware as required by the Door Hardware Specifications
  - e. 250 feet of plenum rated, low voltage, composite cable
4. DOOR TYPE #13 – Online, wired and powered by 12/24 VDC, Building Interior, Double Doors with Dual Authentication shall receive the following ACS Devices:
  - a. Card Reader w/ keypad mounted at 42” A.F.F
  - b. Door Position Switch (DPS) on both leafs
  - c. Request-to-Exit switches built into electrified door hardware
  - d. Power Transfer Devices

- e. Electrified door hardware as required by the Door Hardware Specifications
  - f. Unlockable (with key) and Removable Mullions
  - g. Door Pulls
  - h. 250 feet of plenum rated, low voltage, composite cable
- D. The following **“ONLINE AND WIRELESS”** DOOR TYPES that shall be described as:
- 1. DOOR TYPE #14 – Online, Wireless and Bluetooth functionality as well as battery powered, Building Interior, Single Doors shall receive the following ACS Devices:
    - a. Online, mortise, wireless and battery powered ACS Device with built-in card reader, door position switch, electric lock and Request-to-Exit
    - b. Gateway must be provided and installed for every eight (8) doors with online and wireless locks.
  - 2. DOOR TYPE #15 – Online, Wireless and Bluetooth functionality as well as battery powered, Building Interior, Double Doors shall receive the following ACS Devices:
    - a. Online, mortise, wireless and battery powered ACS Device with built-in card reader, door position switch, electric lock and Request-to-Exit to be installed on active leaf of door.
    - b. The in-active leaf shall be secured with mechanical door hardware that allows egress for Life Safety if needed by code. Otherwise, it will receive flush bolts on the top and bottom. The ACS device shall monitor both the in-active and active leafs of the door.
    - c. Gateway must be provided and installed for every eight (8) doors with online and wireless locks.
- E. The following **“ONLINE AND WIRELESS WITH DUAL AUTHENTICATION”** DOOR TYPES that shall be described as:
- 1. DOOR TYPE #16 – Online, Wireless and Bluetooth functionality as well as battery powered, Building Interior, Single Doors shall receive the following ACS Devices:
    - a. Online, mortise, wireless and battery powered ACS Device with built-in card reader and key pad, door position switch, electric lock and Request-to-Exit
    - b. Gateway must be provided and installed for every eight (8) doors with online and wireless locks.
  - 2. DOOR TYPE #17 – Online, Wireless and Bluetooth functionality as well as battery powered, Building Interior, Double Doors shall receive the following ACS Devices:
    - a. Online, mortise, wireless and battery powered ACS Device with built-in card reader and keypad, door position switch, electric lock and Request-to-Exit to be installed on active leaf of door.
    - b. The in-active leaf shall be secured with mechanical door hardware that allows egress for Life Safety if needed by code. Otherwise, it will receive flush bolts on the top and bottom. The ACS device shall monitor both the in-active and active leafs of the door.
    - c. Gateway must be provided and installed for every eight (8) doors with online and wireless locks.
- F. The following **“OFFLINE”** DOOR TYPES that shall be described as:
- 1. DOOR TYPE #18 – Offline, Wireless and Bluetooth ready as well as battery powered, Building Interior, Single Doors shall receive the following ACS Devices:
    - a. Offline mortise, wireless ready ACS Device with built-in card reader and electric lock, door position switch.

- b. No gateways required.
2. DOOR TYPE #19 – Offline, Wireless and Bluetooth ready as well as battery powered, Building Interior, Double Doors shall receive the following ACS Devices:
    - a. Offline mortise, wireless ready ACS Device with built-in card reader and electric lock, door position switch to be installed on active leaf of door.
    - b. The in-active leaf cannot be controlled by the ACS and will be equipped with a mechanical panic bar. It will be secured from the exit side and allow egress from the entry side if needed by code. Otherwise, it will receive flush bolts on the top and bottom.
    - c. No gateways required.
- G. The following **“OFFLINE WITH DUAL AUTHENTICATION”** DOOR TYPES that shall be described as:
1. DOOR TYPE #20 – Offline, Wireless and Bluetooth ready as well as battery powered, Building Interior, Single Doors shall receive the following ACS Devices:
    - a. Offline mortise, wireless ready ACS Device with built-in card reader, keypad and electric lock, door position switch.
    - b. No gateways required.
  2. DOOR TYPE #21 – Offline, Wireless and Bluetooth ready as well as battery powered, Building Interior, Double Doors shall receive the following ACS Devices:
    - a. Offline mortise, wireless ready ACS Device with built-in card reader, keypad and electric lock, door position switch to be installed on active leaf of door.
    - b. The in-active leaf cannot be controlled by the ACS and will be equipped with a mechanical panic bar. It will be secured from the exit side and allow egress from the entry side if needed by code. Otherwise, it will receive flush bolts on the top and bottom.
    - c. No gateways required.
- H. The following **“RESTROOM DOOR WITH ADA ELECTRIC OPERATOR”** DOOR TYPE that shall be described as:
1. DOOR TYPE #22 – Restroom Entrance shall be a Single Doors with the following Devices:
    - a. ADA Electric Door Operator
    - b. Keyed mortise lock per Kennesaw State University door hardware standards
    - c. Electric strike per Kennesaw State University door hardware standards
    - d. Touchless “Wave to Open” actuators
    - e. Integration between the ADA Electric Door Operator, Electric Strike and Wave to Open Actuators shall be as follows:
      - a) Upon activation of the outside “Wave to Open” actuator, the electric strike is released, the electric door operator is energized and the door will open for a specified time. Then the outside actuator is then disabled until the inside actuator is activated, so that another person cannot open the door while occupied. Activating the “Wave to Open” inside actuator releases the electric strike, energizes the electric door operator and opens the door for a specified time. The outside actuator “Wave to Open” actuator is reset. Should the actuators or electric door operator fail, the person inside is able to exit by using the inside handle of the lock set.

## 2.1 DOOR POSITION SWITCH CONTACTS

- A. Provide high security type balanced magnetic contacts where shown on the contract drawing.
- B. Surface mounted: Door contacts shall be balanced, triple-biased type. Door contacts shall be provided with supervised loop and shall have a flexible armored cable with total encapsulation to protect against moisture. Door contact shall have anodized aluminum finish, with stainless steel flexible cable. Door contacts shall be UL Listed and be warrantied for two years. Door contact for surface mount swing door locations shall be Sentrol 2700 series or approved equal. Door contacts for surface mount roll-up door locations shall be Sentrol 2720 series or approved equal. Door contacts for recessed mounted swing or sliding door locations shall be Sentrol 1078 or equal.

## 2.2 HANDICAP DOOR OPERATORS

- A. Handicap door operators shall be provided and installed by others. At doors equipped with handicap door operators, an interface between the Access Control System card reader and the handicap door operator shall be required. The interface as well as all wiring and terminations for the interface must be provided and installed by the Security Contractor.
- B. The handicap door operator has to be interfaced with the Access Control System and card reader at the door such that when the card reader is in the "LOCKED" mode, the actuator button on the exterior side of the door will only activate the handicap door operator when a valid card is presented. The interface must allow for the Access Control System to first unlock the door and then activate the handicap door operator. When the card reader is in the "UNLOCKED" mode, the actuator button on the exterior side of the door will activate the handicap door operator.
- C. The handicap door operator has to be interfaced with the Access Control System and card reader at the door such that when the card reader is in the "LOCKED" mode, the actuator button on the interior side of the door must allow for the Access Control System to first unlock the door and then activate the handicap door operator. When the card reader is in the "UNLOCKED" mode, the actuator button on the interior side of the door will activate the handicap door operator.

## 2.3 D.C POWER SUPPLY

- A. Provide low voltage power supply units associated with Local Interface Units and Door Control Panels and as required to provide 24 volt regulated, filtered D.C. power for locking controls, D.C. locks and signal devices. Output power shall be 12 or 24 volt D.C. with ampere rating not less than 150% of load imposed on power supply under most severe conditions of load. D.C. output shall be fused. Output voltage shall be regulated within plus or minus 5% from no load to full load. Power supply shall be UL listed. The only approved power supply is Altronix AL600ULXPD8 or PD16. There shall be one power supply for the ACS controller(s) and one power supply for the electrified door hardware.
- B. Contractor to provide power supplies for all electric and electro-magnetic door hardware not furnished with its own power supply. Contractor responsible for coordinating with project door hardware schedule.

## 2.4 WAVE TO OPEN ACTUATORS

- A. Provide Wave to Open Actuators where shown on the Contract Drawings.

- B. The approved models of the Wave to Open Actuators are:
  - 1. BEA-Magic Switch MS11A
  - 2. Norton 700 Wave to Open Switch
  - 3. Camden CM-324 SureWave Touchless

## 2.5 REQUEST TO EXIT DEVICES

- A. Provide request to exit (REX) devices where shown on the Contract Drawings.
- B. Wall mounted pneumatic type (REX) devices at 42 inches AFF. Coordinate exact mounting location with other wall mounted devices and equipment. Wall mounted (REX) devices shall be single-gang aluminum faceplate with heavy duty mushroom head type pushbutton. Pushbutton contacts shall have minimum contact ratings of 24 VDC/2 Amps, 120 VAC 60 Hz./5 Amps. (REX) shall have permanent text labeling to read "PUSH TO EXIT". (REX) shall fit standard single-gang electrical backbox and shall be secured to backbox using tamperproof type screws. Termination of (REX) device wiring may be by screw terminal or pigtail wiring using proper crimp type connectors.
- C. Mount wall mounted type passive infrared motion detectors (PIR), used as (REX) devices, to effect automatic unlocking of electric door operators and locks via ACS System's LIU's and/or DCP's. (PIR) devices shall have wide angle, long range lenses (adjustable) to detect motion of personnel desiring to exit through the door. Coordinate exact field mounting location to provide best operation of (PIR) type (REX) device. (PIR) device shall operate at 9.0 to 16.0 VDC and have form-C output contacts rated at minimum 24 VDC/0.5 amps.

## PART 3 - EXECUTION

### 3.1 WIRING SYSTEMS

- A. Protect all communication and data equipment against surge induced on all control, sensor and data cables. All cables and conductors which serve as control, sensor, or data conductors shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test and the electrical transient tests established in UL365. Fuses shall not be used for surge protection.
- B. The work under this section of the specifications includes the installation of all wiring for the electrified door hardware. The actual connections to the electrified hardware and the access control system shall be done under this section of the specifications. It is the responsibility of the Security Contractor to coordinate all electrical requirements and connections of the electrified hardware.

### 3.2 TESTING

- A. Testing requirements apply to all new construction.
- B. Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the access control system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

### 3.3 TRAINING

- A. The Contractor shall include in the base Contract all costs required to train Owner's Operating and Maintenance Personnel in the use and maintenance of systems provided under this section of the Specifications. Training sessions shall be conducted by instructors that are certified by the manufacturer of the specific system.
- B. Sessions shall be conducted for not less than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM. Training session schedules shall conform to the requirements of; therefore such schedules shall be submitted to the Owner for approval not less than two weeks prior to the training session. All training sessions shall be video-taped for future use. At the Owner's discretion, provisions shall be made to allow up to 2 owner personnel to participate in final system check out of all systems.
- C. The Contractor shall keep a sign-in sheet during training. Sign-in sheet must be provided as part of close out documentation.
- D. Video tapes shall be of professional quality both for video and audio and must be approved by the Owner/User. Provide two copies to Owner/User. Time to be included in base Contracts for specific systems shall be as follows:
  - 1. ACS System entirely - 24 hours

END OF SECTION 28 1000

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**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Commercial Mechanical door hardware, accessories and/or cylinders for the following:
    - a. Swinging doors.
    - b. Sliding/Folding doors.
    - c. Overhead/Roll-up doors.
- B. Related Sections include the following:
  - 1. Division 08 Section "Hollow Metal Doors and Frames"
  - 2. Division 08 Section "Flush Wood Doors"
  - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts"
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering and scheduling remain requirements of this Section.
  - 1. Permanent cores to be installed by Owner.

**1.3 REFERENCE STANDARDS**

- A. This Section references the following Codes/Standards:
  - 1. American National Standards Institute (ANSI) (Current Editions)
    - a. ANSI A117.1 – Accessible and Usable Buildings and Facilities
    - b. ANSI A156 (All related Sections)
  - 2. Builders Hardware Manufacturers Association (BHMA) (Current Editions)
    - a. ANSI/BHMA A156.XX (All related Sections)
  - 3. Door and Hardware Institute (DHI)
    - a. DHI/ANSI A115.IG – Installation Guide for Doors and Hardware.
    - b. DHI Sequence and Format for the Hardware Schedule.
    - c. DHI Recommended Locations for Builder's and Architectural Hardware.
  - 4. National Fire Protection Association (NFPA) (Current Editions)
    - a. NFPA 80 – Fire Doors and Windows
    - b. NFPA 101 – Life Safety Code
  - 5. International Building Code (IBC) (Current Editions)

**1.4 SUBMITTALS**

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
  - 1. Wiring Diagrams: Power, signal, and control wiring. Include the following:
    - a. System schematic.
    - b. Point-to-point wiring diagram.

- c. Riser diagram.
    - d. Elevation of each door.
  2. Detail interface between electrified door hardware, fire alarm, access control, security and building control systems or other systems as may apply.
  3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
  1. Samples will be returned to Contractor. Units that are acceptable through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Product Certificates: For electrified door hardware, signed by product manufacturer.
  1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- E. Qualification Data: For Installer and Architectural Hardware Consultant.
- F. Product Test Reports: If requested by the Architect provide reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks and closers.
- G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- H. Warranty: Special warranty specified in this Section.
- I. Other Action Submittals:
  1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    - b. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, and material of each door and frame.
      - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
      - 3) Complete designations of every item required for each door or opening including name and manufacturer.
      - 4) Fastenings and other pertinent information.
      - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
      - 7) Mounting locations for door hardware.
      - 8) Door and frame sizes and materials.
      - 9) Description of each electrified door hardware function, if applicable, including location, sequence of operation, and interface with other building control systems.
        - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to

- enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
- 10) List of related door devices specified in other Sections for each door and frame.
  - 11) Product Cut Sheets for all material scheduled.
- c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks as determined at Key Conference. Include schematic keying diagram and index each key set to unique door designations.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
  1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
  2. Installer shall have warehousing facilities in Project's vicinity.
  3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant (AHC) Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
  1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant (AHC) who is experienced in providing consulting services for electrified door hardware installations.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
  1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Keying Conference: If required by the Architect, conduct conference at a location to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.
  - 4. Address for delivery of keys.
- G. Pre-installation Conference: If required by the Architect, conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
  - 1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
  - 2. Review sequence of operation for each type of electrified door hardware.
  - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review required testing, inspecting, and certifying procedures.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores, if applicable, to Owner by hand delivery, registered mail or overnight package service.

#### 1.7 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system as applicable for this project.
- C. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: 3 years from date of Substantial Completion, except as follows:
    - a. Bored Locksets: 7 years from date of Substantial Completion.
    - b. Mortise Locksets: 10 years from date of Substantial Completion.
    - c. Exit Devices: 5 years from date of Substantial Completion.
    - d. Manual Closers: 10 years from date of Substantial Completion.
    - e. All other warranties and bonds are to be in accordance with Division 1, Section 01 7000 – Contract Close Out.

## 1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

## 1.10 EXTRA MATERIALS

- A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Refer to Hardware Sets indicating "Extra Material" in Part 3 "Door Hardware Sets" Article.

## PART 2 – PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door

Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required provide as specified.
  2. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
- C. In other Part 2 articles where titles below introduce lists of approved Manufacturers, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
1. Two Hinges: For doors with heights up to 60 inches.
  2. Three Hinges: For doors with heights 61 to 90 inches.
  3. Four Hinges: For doors with heights 91 to 120 inches.
  4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
1. Entrance Doors: Heavy weight Continuous hinges.
  2. Doors with Closers: Standard weight antifriction-bearing hinges.
  3. Interior Doors: Standard weight hinges. Provide antifriction-bearing as specified in Part 3 "Door Hardware Sets" Article.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior Hinges: Stainless steel, with stainless-steel pin or brass, with stainless-steel pin body and brass protruding heads as specified in Part 3 "Door Hardware Sets" Article.
  2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads, Steel, with steel pin or Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
  3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
1. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
  2. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
  3. Non-removable Pins (NRP): Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
  4. Corners: Square.
- F. Electrified Functions for Hinges: Comply with the following:
1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
  2. Monitoring: Concealed electrical monitoring switch.
  3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.
- G. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  2. Wood Screws: For wood doors and frames.

3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames (Pilot holes required for wood doors and/or frames). For NRP hinges finish screw heads to match surface of hinges.

## 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Approved Manufacturers:
  1. Hager Companies.
  2. McKinney Products Company.
  3. Stanley Hardware.

## 2.4 SPRING HINGES

- A. Self-Closing Hinges: BHMA A156.17. Listed under Category A in BHMA's "Certified Product Directory."
- B. Approved Manufacturers:
  1. Hager Companies.
  2. McKinney Products Company.
  3. Stanley Hardware.

## 2.5 PIVOTS AND PIVOT HINGES

- A. Pivots: BHMA A156.4. Listed under Category C in BHMA's "Certified Product Directory."
- B. Self-Closing Pivot Hinges: BHMA A156.17. Listed under Category A in BHMA's "Certified Product Directory."
- C. Approved Manufacturers:
  1. Rixson Specialty Door Controls.

## 2.6 CONTINUOUS HINGES

- A. Standard: BHMA A156.26. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches fabricated to full height of door and frame as recommended by the Manufacturer.
  1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.
- C. Continuous, Pin & Barrel Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.
  1. Base Metal for Exterior Hinges: Stainless steel.
  2. Base Metal for Interior Hinges: Stainless steel or steel.
  3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel or steel.
  4. Approved Manufacturers:
    - a. Bommer Hinge.
    - b. Stanley Hardware.
    - c. Pemko.

- D. Continuous, Geared Hinges: Extruded-aluminum, geared hinge leaves joined by a continuous extruded-aluminum channel cap with concealed, self-lubricating thrust bearings.
    - 1. Approved Manufacturers:
      - a. Bommer Hinge.
      - b. Stanley Hardware.
      - c. Pemko.
- 2.7 LOCKS AND LATCHES, GENERAL
- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
    - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
  - B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
  - C. Electrified Locking Devices: BHMA A156.25.
    - 1. Provide as specified in Part 3 "Door Hardware Sets" Article.
  - D. Lock Trim:
    - 1. Levers: Provide as specified in Part 3 "Door Hardware Sets" Article.
    - 2. Escutcheons (Roses): Provide as specified in Part 3 "Door Hardware Sets" Article.
    - 3. Dummy Trim: Match lock trim and escutcheons.
    - 4. Lockset Designs: Provide as specified in Part 3 "Door Hardware Sets" Article.
  - E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors and as follows:
    - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
    - 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
    - 3. Deadbolts: Minimum 1-inch bolt throw.
  - F. Backset: 2-3/4 inches, unless otherwise indicated.
  - G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
    - 1. Strikes for Bored Locks and Latches: BHMA A156.2.
    - 2. Strikes for Mortise Locks and Latches: BHMA A156.13.
    - 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
    - 4. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
    - 5. Extended Lip Strikes: For locks used on frames requiring the additional length to protect frame and trim.
    - 6. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
- 2.8 MECHANICAL LOCKS AND LATCHES
- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
    - 1. Bored Locks: BHMA A156.2.
    - 2. Mortise Locks: BHMA A156.13.
  - B. Bored Locks: BHMA A156.2, Listed under Category F in BHMA's "Certified Product Directory."
    - 1. Approved Manufacturers:

- a. Best Access Systems.
  - b. Sargent Manufacturing Company.
  - c. Schlage Commercial Lock.
- C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13. Listed under Category F in BHMA's "Certified Product Directory."
1. Approved Manufacturers:
    - a. Best Access Systems – 45H Series - 15H.
    - b. Sargent Manufacturing Company – 8200 Series - LNL.
    - c. Corbin Russwin - ML2200 Series - NSA.

## 2.9 AUXILIARY LOCKS AND LATCHES

- A. Auxiliary Locks: BHMA A156.5 Listed under Category E in BHMA's "Certified Product Directory."
1. Approved Manufacturers:
    - a. Accurate Lock & Hardware Co.
    - b. Adams Rite Manufacturing Co.
    - c. Best Access Systems.
    - d. Sargent Manufacturing Company.
    - e. Schlage Commercial Lock Division.

## 2.10 ELECTROMAGNETIC LOCKS

- A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door or as required for proper application. Listed under Category E in BHMA's "Certified Product Directory."
1. Type: Full exterior or full interior, as required by application indicated.
  2. Strength Ranking: Provide as specified in Part 3 "Door Hardware Sets" Article.
  3. Residual Magnetism: Not more than 0 lbf to separate door from magnet.
  4. Door Position Monitoring capability.
  5. Bond Sensor capability.
- B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory."
1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds, as required by NFPA 101.
  2. Security Grade: Activated from secure side of door by initiating device.
  3. Movement Grade: Activated by door movement as initiating device.
- C. Approved Manufacturers:
1. Door Controls International.
  2. Rutherford Controls Int'l. Corp.
  3. Securitron.
  4. Schlage Electromagnetic Locks.

## 2.11 ELECTROMECHANICAL LOCKS

- A. General: Grade 1 unless Grade 2 is indicated for type of lock indicated; motor or solenoid driven.
- B. Approved Manufacturers:
1. Best Access Systems.
  2. Rutherford Controls Int'l. Corp.

## 3. Securitron.

## 2.12 SELF-CONTAINED ELECTRONIC LOCKS

- A. General: Internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock; type and function indicated.
  - 1. Type: Bored or Mortised as specified in Part 3 "Door Hardware Sets" Article.
  - 2. Actuating Device: Provide as specified in Part 3 "Door Hardware Sets" Article.
    - a. Card: Manufacturer's standard.
  - 3. Faceplate Material: Provide as specified in Part 3 "Door Hardware Sets" Article.
  - 4. Trim: Provide as specified in Part 3 "Door Hardware Sets" Article.
- B. Accessory: Card encoder and software.
- C. Approved Manufacturers:
  - 1. Best Access Systems.

## 2.13 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  - 1. Dutch-Door Bolts: Minimum 3/4-inch throw.
  - 2. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
  - 1. Flush Bolt Heads: Minimum of 1/2-inch diameter rods of brass, bronze, or stainless steel with minimum 12-inch long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
  - 2. Approved Manufacturers:
    - a. Baldwin Hardware.
    - b. Ives Hardware.
    - c. Trimco.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.
  - 1. Approved Manufacturers:
    - a. Baldwin Hardware.
    - b. Ives Hardware.
    - c. Trimco.
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.
  - 1. Approved Manufacturers:
    - a. Baldwin Hardware.
    - b. Ives Hardware.
    - c. Trimco.

## 2.14 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated. Listed under Category G in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with

Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
- H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  1. Operation: Rigid or movable as specified in Part 3 "Door Hardware Sets" Article.
- I. Outside Trim: Material and finish to match locksets, unless otherwise indicated.
  1. Match design for locksets and latchsets, unless otherwise indicated.
- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors as specified in Part 3 "Door Hardware Sets" Article.
- K. Electronic Exit Bars: Non-latching electronic releasing device activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet of cord to route wiring off the door frame.
- L. Approved Manufacturers:
  1. Precision Hardware, Inc – APEX 2000 Series.
  2. Sargent Manufacturing Company – 8800 Series.
  3. Von Duprin – 98/99 Series.
  4. Adams Rite 8801 SE and EL (Only on approved locations by KSU Locksmith)

## 2.15 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.
  1. Key Control Level: Category A.
  2. Destructive Test Level: Category A.
  3. Surreptitious Entry Resistance Level: Category A.
- C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  1. Number of Pins: Six or Seven pin as required for this project.
  2. Mortise Type: Threaded cylinders with rings and cam as required for proper lock operation.
  3. Rim Type: Cylinders with back plate, flat type vertical or horizontal tailpiece and raised trim ring.
  4. Bored-Lock Type: Cylinders with tailpieces as required for proper lock operation.

- a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick and drill resistant testing requirements in UL 437 (Suffix A).
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  1. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
- E. Construction Keying: Comply with the following:
  1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
    - a. Replace construction cores with permanent cores as directed by Owner or Architect.
- F. Manufacturer: Same manufacturer as for locks and latches.
- G. Approved Manufacturers:
  1. Best Access Systems – Marietta Campus - CORMAX.
  2. YALE Security – Kennesaw Campus – Match existing key system/keyway.

## 2.16 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
  1. No Master Key System: Cylinders are operated by change keys only.
  2. Master Key System: Cylinders are operated by a change key and a master key.
  3. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
  4. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
  5. Existing System: Master key or grand master key locks to Owner's existing system.
  6. Existing System: Re-key Owner's existing master key system into new keying system.
  7. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
  1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation.
    - a. Notation: As specified and determined at keying conference.
  2. Quantity: In addition to one extra key blank for each lock, provide the following:
    - a. Cylinder Change Keys: Three.
    - b. Master Keys: Five.
    - c. Grand Master Keys: Five.
    - d. Great-Grand Master Keys: Five.

## 2.17 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
  1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

- B. Cross-Index System: Multiple index system for recording key information as specified in Part 3 "Door Hardware Sets" Article. Include three receipt forms for each key-holding hook. Set up by Hardware Distributor.
  - 1. Approved Manufacturers:
    - a. Key Control Systems, Inc.
- C. Key Lock Boxes: Designed for storage of two keys, with tamper switches to connect to intrusion detection system if required.
  - 1. Approved Manufacturers:
    - a. Knox Company.

## 2.18 ELECTRIC STRIKES

- A. Standard: BHMA A156.31, Grade 1.
- B. General: Use fail-secure electric strikes with fire-rated devices.
- C. Approved Manufacturers:
  - 1. HES, Inc.
  - 2. Stanley Hardware, Inc.
  - 3. Adams Rite.
  - 4. Rutherford Controls Int'l. Corp.

## 2.19 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from aluminum, brass, bronze or stainless steel, unless otherwise indicated in Part 3 "Door Hardware Sets" Article.
- C. Approved Manufacturers:
  - 1. Baldwin Hardware.
  - 2. Ives Hardware.
  - 3. Trimco.

## 2.20 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
  - 1. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- C. Power-Assist Closers: Surface mounted, electric low energy type conforming to ANSI A156.19 requirements and capable of meeting ANSI A117.1 guidelines. Outputs and relays on board in the operator to allow for coordination with exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and any specified auxiliary contacts.

1. Approved Manufacturers:
  - a. Stanley Door Closer CLD-4990 Series.
  - b. LCN 4600 Series.
  - c. Norton 6000 Series.
- D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- E. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  1. Approved Manufacturers:
    - a. LCN 4041 Series.
    - b. Stanley Door Closer D4550 Series.
    - c. Norton 7500 Series.
    - d. Stanley Commercial Hdwe QDC100 Series.

## 2.21 PROTECTIVE TRIM UNITS

- A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 3 sides (B4E); fabricated from material as specified in Part 3 "Door Hardware Sets" Article.
  1. Material: 0.050-inch thick.
  2. Approved Manufacturers:
    - a. Burns Manufacturing Incorporated.
    - b. Don-Jo Mfg., Inc.
    - c. Trimco.

## 2.22 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
  1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- D. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.
- E. Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
  1. Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.
- F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch fabricated for drilled-in application to frame.
- G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- H. Approved Manufacturers:
  1. Burns Manufacturing Incorporated.
  2. Rixson.
  3. Trimco.

## 2.23 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  - 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on fire and/or smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  - 1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Approved Manufacturers:
  - 1. Pemko.
  - 2. Reese.
  - 3. Zero International.

## 2.24 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
  - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

- D. Approved Manufacturers:
  - 1. Pemko.
  - 2. Reese.
  - 3. Zero International.

#### 2.25 SLIDING DOOR HARDWARE

- A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories as specified in Part 3 "Door Hardware Sets" Article.
- B. Approved Manufacturers:
  - 1. K. N. Crowder Mfg, Inc.
  - 2. Pemko Manufacturing Co.
  - 3. Stanley Hardware.

#### 2.26 FOLDING DOOR HARDWARE

- A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories as specified in Part 3 "Door Hardware Sets" Article.
- B. Approved Manufacturers:
  - 1. K. N. Crowder Mfg, Inc.
  - 2. Pemko Manufacturing Co.
  - 3. Stanley Hardware.

#### 2.27 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosures; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Auxiliary Hardware: BHMA A156.16, Grade 1.
- C. Approved Manufacturers:
  - 1. Burns Manufacturing Incorporated.
  - 2. H. B. Ives.
  - 3. Trimco.

#### 2.28 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended,

except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:
  - a. Mortise hinges to doors.
  - b. Strike plates to frames.
  - c. Closers to doors and frames.
3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
  - a. Surface hinges to doors.
  - b. Closers to doors and frames.
  - c. Surface-mounted exit devices.
4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.29 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series. Drill pilot holes of appropriate size for ALL wood door installations.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and/or as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards
  - 3. Drill pilot holes of appropriate size for ALL wood door installations.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated verify location with Architect.
  - 1. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

### 3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately 6 months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

## 3.5 CLEANING AND PROTECTION

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

## 3.6 DOOR HARDWARE SETS

**(BASIS OF DESIGN – Intent is to show minimum door hardware required for sample door types. This does not cover all door hardware sets in the building. Actual door design and operation may require additional components to be specified by the architectural consultant that complies with the KSU PDCS Door Hardware Design Criteria):**

**SET 01 – EXTERIOR ENTRY STOREFRONT DOOR W/ ACCESS CONTROL**

1	Continuous hinge	FM83HD- EPT	628	Bommer
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98NL-OP	630	VonDuprin
1	Closer	4040XP	689	LCN
1	Rim or mortise cylinder	as required	US26D	Yale
1	Pull bar (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Threshold	545A	Alum	Zero
1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto

**SET 02 – PAIR EXTERIOR ENTRY STOREFRONT DOORS W/ ACCESS CONTROL**

2	Continuous hinges	FM83HD- EPT	628	Bommer
2	Power transfers	EPT-10	630	VonDuprin
2	Exit Devices	QEL-98NL-OP	630	VonDuprin
2	Closers	4040XP	689	LCN
1	Keyed Removable Mullion	KR4954	SP28	VonDuprin
2	Rim or mortise cylinder	as required	US26D	Yale
2	Pull bars (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Threshold	545A	Alum	Zero
2	Door position switches	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto

**SET 03 – EXTERIOR ENTRY STOREFRONT DOOR W/ OPERATOR & ACCESS CONTROL**

1	Continuous hinge	FM83HD- EPT	628	Bommer
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98NL-OP	630	VonDuprin
1	Power-Assist Closer	4640 Series	689	LCN
1	Rim or mortise cylinder	as required	US26D	Yale
1	Pull bar (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Threshold	545A	Alum	Zero

1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto

#### SET 04 – PAIR EXTERIOR ENTRY STOREFRONT DOORS W/ OPERATOR & ACCESS CONTROL

2	Continuous hinges	FM83HD- EPT	628	Bommer
2	Power transfers	EPT-10	630	VonDuprin
2	Exit Devices	QEL-98NL-OP	630	VonDuprin
1	Power-Assist Closer	4640 Series	689	LCN
1	Closer	4040XP	689	LCN
1	Keyed Removable Mullion	KR4954	SP28	VonDuprin
2	Rim or mortise cylinder	as required	US26D	Yale
2	Pull bars (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Threshold	545A	Alum	Zero
2	Door position switches	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto

#### SET 05 – CLASSROOM/LAB WIRED ACCESS CONTROL

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Closer	4040XP	689	LCN
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98L-03	630	VonDuprin
1	Rim or mortise cylinder	as required	US26D	Yale
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals/Silencers (per Arch.)			
1	Card reader	XS4 Wall Reader	Black	Salto

#### SET 06 – PAIR CLASSROOM/LAB WIRED ACCESS CONTROL

6	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
2	Closers	4040XP	689	LCN
1	Keyed Removable Mullion	KR4954	SP28	VonDuprin
2	Power transfers	EPT-10	630	VonDuprin
2	Exit Devices	QEL-98L-03	630	VonDuprin
2	Rim or mortise cylinders	as required	US26D	Yale
2	Door stops	1211 or 1270	626	Trimco
2	Door position switches	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals/Silencers (per Arch.)			
1	Card reader	XS4 Wall Reader	Black	Salto

**SET 07 – FACULTY/STAFF OFFICE WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 08 – STORAGE WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Kick plate (push side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 09 – JANITOR WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Mop plate (push side)	KA050 48"H. B4E	630	Trimco
1	Kick plate (pull side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 10 – RESTROOMS**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Push plate	1001-3 4" x 16"	630	Trimco
1	Pull plate	1018-3B 4" x 16" 10" CTC	630	Trimco
1	Closer	4040XP	689	LCN
1	Kick plate (push side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 11 – UNISEX RESTROOM W/ OPERATOR**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Privacy lockset	L9440 X Indicator X 06A	630	Schlage
1	Electric strike	F2 X Deadbolt monitor	603	RCI
1	Power supply	400UL PD8		Altronix
1	Relay	RB-524		Altronix
1	Power-Assist Closer	4640 Series	689	LCN
2	Actuators	8310-856		LCN
1	Occupancy sensor	OSC1D-MOW		Leviton
1	Kick plate (push side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Seals/Silencers (per Arch.)			

**(Door Operation:** When room unoccupied door may be opened with either lockset or actuator. When room occupied exterior actuator disabled, door is locked and indicator shows "OCCUPIED". Exit room using either lockset or actuator and hardware is reset for next occupant.)

**SET 12 – MOTHER'S ROOM WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Kick plate (push side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 13 – OFFICE SUITE STOREFRONT ENTRY WIRELESS ACCESS CONTROL**

2	Pivot hinges (by storefront manuf.)			
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98NL-OP	630	VonDuprin
1	Closer	4040XP	689	LCN
1	Rim or mortise cylinder	as required	US26D	Yale
1	Pull bar (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto

**SET 14 – ELEC./MECH. ROOM WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Kick plate (push side)	K0050 8"H. B4E	630	Trimco
1	Kickdown holder	1220	626	Trimco
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 15 – MDF/IDF ROOM WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 16 – CONFERENCE ROOM WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

**SET 17 – CONFERENCE ROOM STOREFRONT WIRELESS ACCESS CONTROL**

2	Pivot hinges (by storefront manuf.)			
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98NL-OP	630	VonDuprin
1	Closer	4040XP	689	LCN
1	Rim or mortise cylinder	as required	US26D	Yale
1	Pull bar (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals by door manufacturer			
1	Card reader	XS4 Wall Reader	Black	Salto

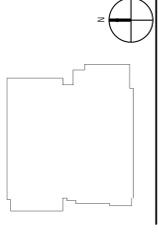
**SET 18 – STUDENT STUDY/MEETING ROOM WIRELESS ACCESS CONTROL**

3	Hinges	TA2714 4-1/2X4-1/2	US26D	McKinney
1	Wireless Card Lock	XS4 A69 X N Lever	626	Salto
1	Closer	4040XP	689	LCN
1	Door stop	1211 or 1270	626	Trimco
1	Door position switch	MC-4		DORMA
1	Seals/Silencers (per Arch.)			

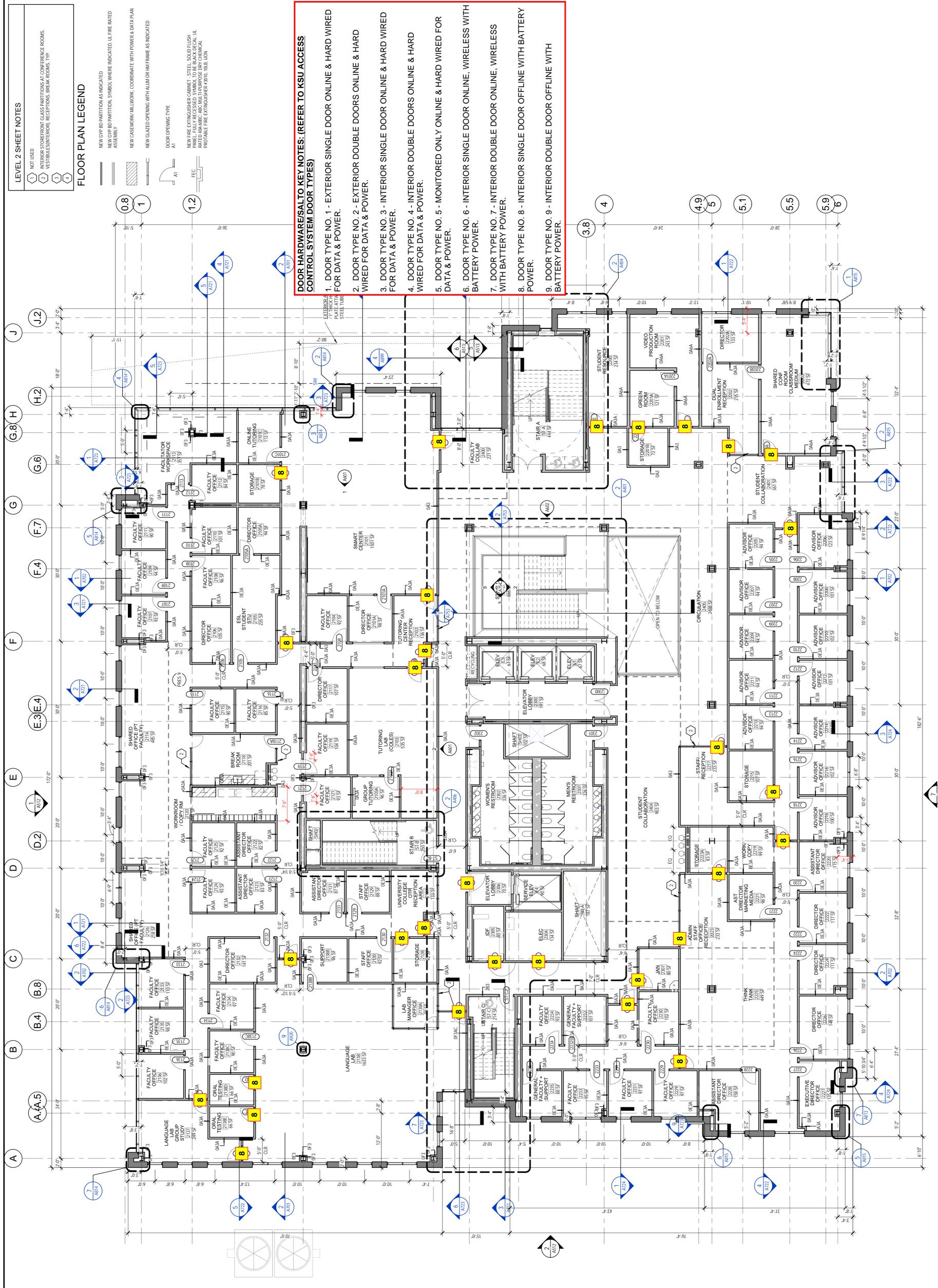
**SET 19 – STUDENT STUDY/MEETING ROOM STOREFRONT WIRELESS ACCESS CONTROL**

2	Pivot hinges (by storefront manuf.)			
1	Power transfer	EPT-10	630	VonDuprin
1	Exit Device	QEL-98NL-OP	630	VonDuprin
1	Closer	4040XP	689	LCN
1	Rim or mortise cylinder	as required	US26D	Yale
1	Pull bar (Alt. per Arch.)	AP221-E-CTC12	630	Trimco
1	Door position switch	MC-4		DORMA
1	Power supply	PS914-2RS		VonDuprin
1	Seals (by storefront manuf.)			
1	Card reader	XS4 Wall Reader	Black	Salto





No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/15/2017
3	SCHEMATIC DESIGN	09/12/2017
4	DESIGN DEVELOPMENT	12/15/2017

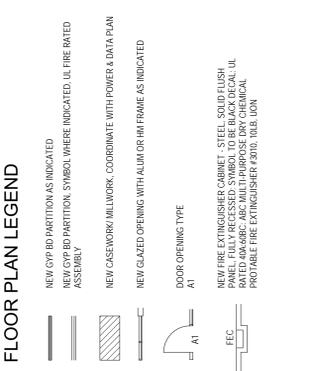


**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

- DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

**LEVEL 2 SHEET NOTES**

- NOT USED
- INTERIOR STAIRWELL, ELEVATOR PARTITION & CONFERENCE ROOMS, RESTROOMS, INTERIOR RECEPTIONS, BREAK ROOMS, ETC.
- NEW GYP BOARD PARTITION AS INDICATED
- NEW GYP BOARD PARTITION, SYMBOL WHERE INDICATED, UL FIRE RATED ASSEMBLY



**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 1 - 3/15/18**

LEVEL 3 SHEET NOTES

- NOT USED
- INTERIOR STAIRWELL, ELEVATOR PARTITIONS & CONFERENCE ROOMS, RESTROOMS, INTERIOR, RECEPTIONS, BREAK ROOMS, ETC.
- 3 HR RATED GLASS
- INTUMESCENT FIREPROOF COATING ON COLUMN

FLOOR PLAN LEGEND

- NEW GYP BD PARTITION AS INDICATED
- NEW GYP BD PARTITION, SYMBOL WHERE INDICATED, UL FIRE RATED ASSEMBLY
- NEW CASEWORK/MILWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR HM FRAME AS INDICATED
- DOOR OPENING TYPE  
A1
- NEW FIRE EXTINGUISHER CABINET, STEEL, SOLID FLUSH, 20 LB, 1.5 GAL, 1.5 A, 1.5 B, 1.5 C, 1.5 D, 1.5 E, 1.5 F, 1.5 G, 1.5 H, 1.5 I, 1.5 J, 1.5 K, 1.5 L, 1.5 M, 1.5 N, 1.5 O, 1.5 P, 1.5 Q, 1.5 R, 1.5 S, 1.5 T, 1.5 U, 1.5 V, 1.5 W, 1.5 X, 1.5 Y, 1.5 Z, 1.5 AA, 1.5 AB, 1.5 AC, 1.5 AD, 1.5 AE, 1.5 AF, 1.5 AG, 1.5 AH, 1.5 AI, 1.5 AJ, 1.5 AK, 1.5 AL, 1.5 AM, 1.5 AN, 1.5 AO, 1.5 AP, 1.5 AQ, 1.5 AR, 1.5 AS, 1.5 AT, 1.5 AU, 1.5 AV, 1.5 AW, 1.5 AX, 1.5 AY, 1.5 AZ, 1.5 BA, 1.5 BB, 1.5 BC, 1.5 BD, 1.5 BE, 1.5 BF, 1.5 BG, 1.5 BH, 1.5 BI, 1.5 BJ, 1.5 BK, 1.5 BL, 1.5 BM, 1.5 BN, 1.5 BO, 1.5 BP, 1.5 BQ, 1.5 BR, 1.5 BS, 1.5 BT, 1.5 BU, 1.5 BV, 1.5 BW, 1.5 BX, 1.5 BY, 1.5 BZ, 1.5 CA, 1.5 CB, 1.5 CC, 1.5 CD, 1.5 CE, 1.5 CF, 1.5 CG, 1.5 CH, 1.5 CI, 1.5 CJ, 1.5 CK, 1.5 CL, 1.5 CM, 1.5 CN, 1.5 CO, 1.5 CP, 1.5 CQ, 1.5 CR, 1.5 CS, 1.5 CT, 1.5 CU, 1.5 CV, 1.5 CW, 1.5 CX, 1.5 CY, 1.5 CZ, 1.5 DA, 1.5 DB, 1.5 DC, 1.5 DD, 1.5 DE, 1.5 DF, 1.5 DG, 1.5 DH, 1.5 DI, 1.5 DJ, 1.5 DK, 1.5 DL, 1.5 DM, 1.5 DN, 1.5 DO, 1.5 DP, 1.5 DQ, 1.5 DR, 1.5 DS, 1.5 DT, 1.5 DU, 1.5 DV, 1.5 DW, 1.5 DX, 1.5 DY, 1.5 DZ, 1.5 EA, 1.5 EB, 1.5 EC, 1.5 ED, 1.5 EE, 1.5 EF, 1.5 EG, 1.5 EH, 1.5 EI, 1.5 EJ, 1.5 EK, 1.5 EL, 1.5 EM, 1.5 EN, 1.5 EO, 1.5 EP, 1.5 EQ, 1.5 ER, 1.5 ES, 1.5 ET, 1.5 EU, 1.5 EV, 1.5 EW, 1.5 EX, 1.5 EY, 1.5 EZ, 1.5 FA, 1.5 FB, 1.5 FC, 1.5 FD, 1.5 FE, 1.5 FF, 1.5 FG, 1.5 FH, 1.5 FI, 1.5 FJ, 1.5 FK, 1.5 FL, 1.5 FM, 1.5 FN, 1.5 FO, 1.5 FP, 1.5 FQ, 1.5 FR, 1.5 FS, 1.5 FT, 1.5 FU, 1.5 FV, 1.5 FW, 1.5 FX, 1.5 FY, 1.5 FZ, 1.5 GA, 1.5 GB, 1.5 GC, 1.5 GD, 1.5 GE, 1.5 GF, 1.5 GH, 1.5 GI, 1.5 GJ, 1.5 GK, 1.5 GL, 1.5 GM, 1.5 GN, 1.5 GO, 1.5 GP, 1.5 GQ, 1.5 GR, 1.5 GS, 1.5 GT, 1.5 GU, 1.5 GV, 1.5 GW, 1.5 GX, 1.5 GY, 1.5 GZ, 1.5 HA, 1.5 HB, 1.5 HC, 1.5 HD, 1.5 HE, 1.5 HF, 1.5 HG, 1.5 HH, 1.5 HI, 1.5 HJ, 1.5 HK, 1.5 HL, 1.5 HM, 1.5 HN, 1.5 HO, 1.5 HP, 1.5 HQ, 1.5 HR, 1.5 HS, 1.5 HT, 1.5 HU, 1.5 HV, 1.5 HW, 1.5 HX, 1.5 HY, 1.5 HZ, 1.5 IA, 1.5 IB, 1.5 IC, 1.5 ID, 1.5 IE, 1.5 IF, 1.5 IG, 1.5 IH, 1.5 II, 1.5 IJ, 1.5 IK, 1.5 IL, 1.5 IM, 1.5 IN, 1.5 IO, 1.5 IP, 1.5 IQ, 1.5 IR, 1.5 IS, 1.5 IT, 1.5 IU, 1.5 IV, 1.5 IW, 1.5 IX, 1.5 IY, 1.5 IZ, 1.5 JA, 1.5 JB, 1.5 JC, 1.5 JD, 1.5 JE, 1.5 JF, 1.5 JG, 1.5 JH, 1.5 JI, 1.5 JJ, 1.5 JK, 1.5 JL, 1.5 JM, 1.5 JN, 1.5 JO, 1.5 JP, 1.5 JQ, 1.5 JR, 1.5 JS, 1.5 JT, 1.5 JU, 1.5 JV, 1.5 JW, 1.5 JX, 1.5 JY, 1.5 JZ, 1.5 KA, 1.5 KB, 1.5 KC, 1.5 KD, 1.5 KE, 1.5 KF, 1.5 KG, 1.5 KH, 1.5 KI, 1.5 KJ, 1.5 KK, 1.5 KL, 1.5 KM, 1.5 KN, 1.5 KO, 1.5 KP, 1.5 KQ, 1.5 KR, 1.5 KS, 1.5 KT, 1.5 KU, 1.5 KV, 1.5 KW, 1.5 KX, 1.5 KY, 1.5 KZ, 1.5 LA, 1.5 LB, 1.5 LC, 1.5 LD, 1.5 LE, 1.5 LF, 1.5 LG, 1.5 LH, 1.5 LI, 1.5 LJ, 1.5 LK, 1.5 LL, 1.5 LM, 1.5 LN, 1.5 LO, 1.5 LP, 1.5 LQ, 1.5 LR, 1.5 LS, 1.5 LT, 1.5 LU, 1.5 LV, 1.5 LW, 1.5 LX, 1.5 LY, 1.5 LZ, 1.5 MA, 1.5 MB, 1.5 MC, 1.5 MD, 1.5 ME, 1.5 MF, 1.5 MG, 1.5 MH, 1.5 MI, 1.5 MJ, 1.5 MK, 1.5 ML, 1.5 MN, 1.5 MO, 1.5 MP, 1.5 MQ, 1.5 MR, 1.5 MS, 1.5 MT, 1.5 MU, 1.5 MV, 1.5 MW, 1.5 MX, 1.5 MY, 1.5 MZ, 1.5 NA, 1.5 NB, 1.5 NC, 1.5 ND, 1.5 NE, 1.5 NF, 1.5 NG, 1.5 NH, 1.5 NI, 1.5 NJ, 1.5 NK, 1.5 NL, 1.5 NM, 1.5 NO, 1.5 NP, 1.5 NQ, 1.5 NR, 1.5 NS, 1.5 NT, 1.5 NU, 1.5 NV, 1.5 NW, 1.5 NX, 1.5 NY, 1.5 NZ, 1.5 OA, 1.5 OB, 1.5 OC, 1.5 OD, 1.5 OE, 1.5 OF, 1.5 OG, 1.5 OH, 1.5 OI, 1.5 OJ, 1.5 OK, 1.5 OL, 1.5 OM, 1.5 ON, 1.5 OO, 1.5 OP, 1.5 OQ, 1.5 OR, 1.5 OS, 1.5 OT, 1.5 OU, 1.5 OV, 1.5 OW, 1.5 OX, 1.5 OY, 1.5 OZ, 1.5 PA, 1.5 PB, 1.5 PC, 1.5 PD, 1.5 PE, 1.5 PF, 1.5 PG, 1.5 PH, 1.5 PI, 1.5 PJ, 1.5 PK, 1.5 PL, 1.5 PM, 1.5 PN, 1.5 PO, 1.5 PP, 1.5 PQ, 1.5 PR, 1.5 PS, 1.5 PT, 1.5 PU, 1.5 PV, 1.5 PW, 1.5 PX, 1.5 PY, 1.5 PZ, 1.5 QA, 1.5 QB, 1.5 QC, 1.5 QD, 1.5 QE, 1.5 QF, 1.5 QG, 1.5 QH, 1.5 QI, 1.5 QJ, 1.5 QK, 1.5 QL, 1.5 QM, 1.5 QN, 1.5 QO, 1.5 QP, 1.5 QQ, 1.5 QR, 1.5 QS, 1.5 QT, 1.5 QU, 1.5 QV, 1.5 QW, 1.5 QX, 1.5 QY, 1.5 QZ, 1.5 RA, 1.5 RB, 1.5 RC, 1.5 RD, 1.5 RE, 1.5 RF, 1.5 RG, 1.5 RH, 1.5 RI, 1.5 RJ, 1.5 RK, 1.5 RL, 1.5 RM, 1.5 RN, 1.5 RO, 1.5 RP, 1.5 RQ, 1.5 RR, 1.5 RS, 1.5 RT, 1.5 RU, 1.5 RV, 1.5 RW, 1.5 RX, 1.5 RY, 1.5 RZ, 1.5 SA, 1.5 SB, 1.5 SC, 1.5 SD, 1.5 SE, 1.5 SF, 1.5 SG, 1.5 SH, 1.5 SI, 1.5 SJ, 1.5 SK, 1.5 SL, 1.5 SM, 1.5 SN, 1.5 SO, 1.5 SP, 1.5 SQ, 1.5 SR, 1.5 SS, 1.5 ST, 1.5 SU, 1.5 SV, 1.5 SW, 1.5 SX, 1.5 SY, 1.5 SZ, 1.5 TA, 1.5 TB, 1.5 TC, 1.5 TD, 1.5 TE, 1.5 TF, 1.5 TG, 1.5 TH, 1.5 TI, 1.5 TJ, 1.5 TK, 1.5 TL, 1.5 TM, 1.5 TN, 1.5 TO, 1.5 TP, 1.5 TQ, 1.5 TR, 1.5 TS, 1.5 TU, 1.5 TV, 1.5 TW, 1.5 TX, 1.5 TY, 1.5 TZ, 1.5 UA, 1.5 UB, 1.5 UC, 1.5 UD, 1.5 UE, 1.5 UF, 1.5 UG, 1.5 UH, 1.5 UI, 1.5 UJ, 1.5 UK, 1.5 UL, 1.5 UM, 1.5 UN, 1.5 UO, 1.5 UP, 1.5 UQ, 1.5 UR, 1.5 US, 1.5 UT, 1.5 UV, 1.5 UW, 1.5 UX, 1.5 UY, 1.5 UZ, 1.5 VA, 1.5 VB, 1.5 VC, 1.5 VD, 1.5 VE, 1.5 VF, 1.5 VG, 1.5 VH, 1.5 VI, 1.5 VJ, 1.5 VK, 1.5 VL, 1.5 VM, 1.5 VN, 1.5 VO, 1.5 VP, 1.5 VQ, 1.5 VR, 1.5 VS, 1.5 VT, 1.5 VU, 1.5 VV, 1.5 VW, 1.5 VX, 1.5 VY, 1.5 VZ, 1.5 WA, 1.5 WB, 1.5 WC, 1.5 WD, 1.5 WE, 1.5 WF, 1.5 WG, 1.5 WH, 1.5 WI, 1.5 WJ, 1.5 WK, 1.5 WL, 1.5 WM, 1.5 WN, 1.5 WO, 1.5 WP, 1.5 WQ, 1.5 WR, 1.5 WS, 1.5 WT, 1.5 WU, 1.5 WV, 1.5 WW, 1.5 WX, 1.5 WY, 1.5 WZ, 1.5 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**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

- DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.



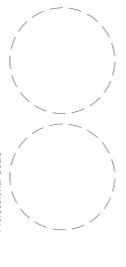
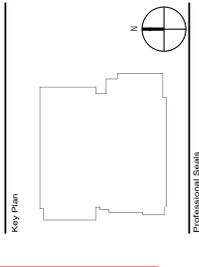
**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 1 - 3/15/18**



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**NBP Engineers, Inc.**  
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 316 Corporate Parkway  
 Marietta, GA 30129, 1 478 745 1691



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/31/2017
3	SCHEMATIC DESIGN	09/12/2017
4	DESIGN DEVELOPMENT	12/05/2017

Date of First Issue:	Project No.:	Sheet Title:
08/09/2017	16-16017.00	FLOOR PLAN - LEVEL 04



**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

1. DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
2. DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
3. DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
4. DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
5. DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
6. DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
7. DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
8. DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
9. DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

**FLOOR PLAN LEGEND**

- NEW GYP/BD PARTITION AS INDICATED
- NEW GYP/BD PARTITION, SYMBOL WHERE INDICATED, UL FIVE RATED ASSEMBLY
- NEW CASEWORK/MILWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR HM FRAME AS INDICATED
- DOOR OPENING TYPE
- NEW FIRE EXTINGUISHER CABINET - STEEL, SOLID FLUSH PANEL, FULLY RECESSED SYMBOL TO BE BLACK DECAL, UL PROTECTIVE FIRE EXTINGUISHER #300, 10LB, 100V

**LEVEL 4 SHEET NOTES**

1. NOT USED
2. INTERIOR STAGEFRONT GLASS PARTITIONS, CONFERENCE ROOMS, RESTROOMS, INTERIORS, RECEPTIONS, BREAK ROOMS, ETC.

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 1 - 3/15/18**

1 FLOOR PLAN - LEVEL 4

18" = 1'-0"



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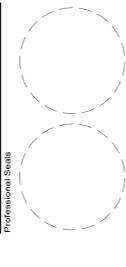
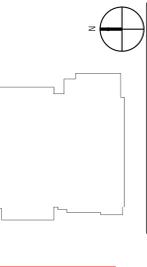
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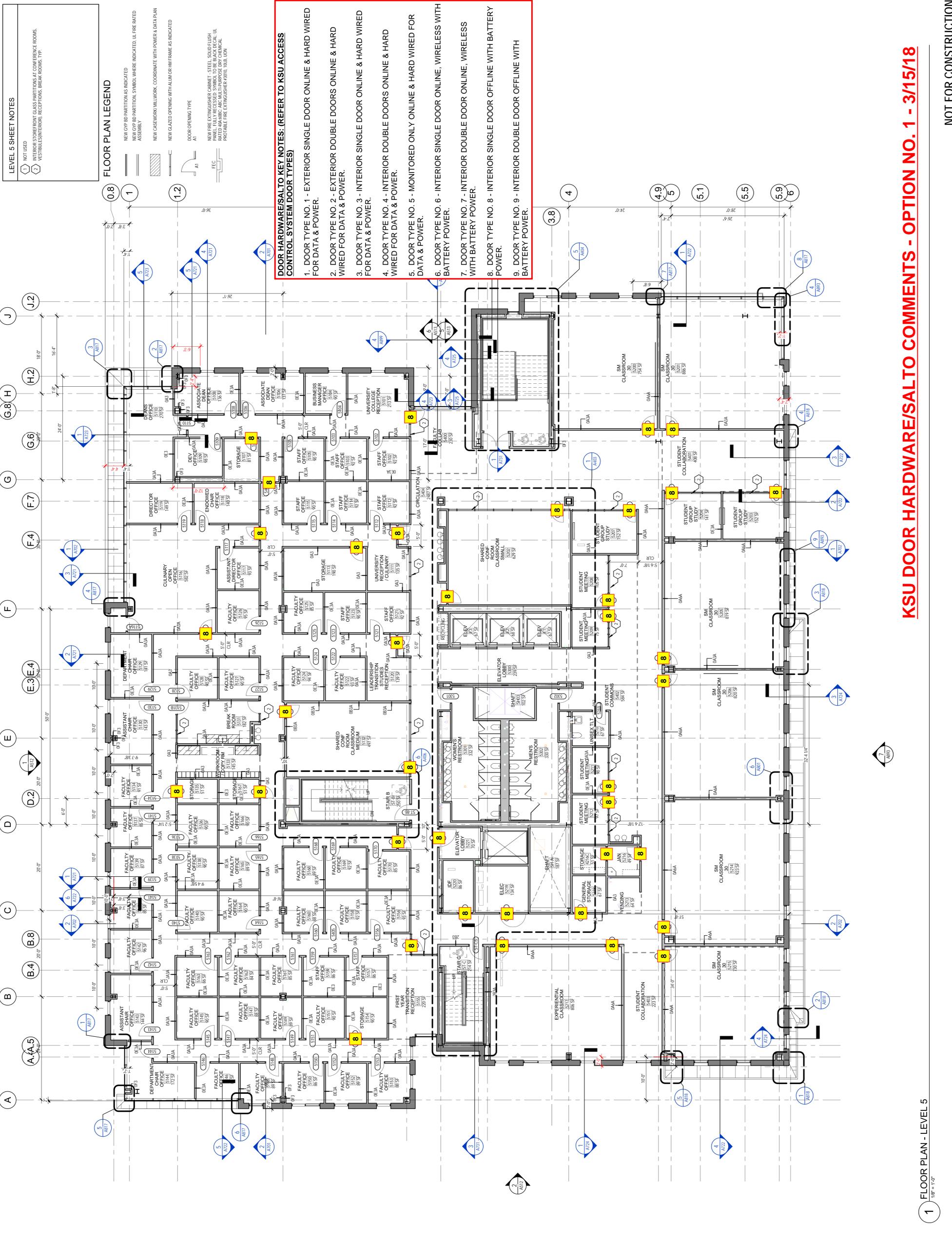
Key Plan



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/15/2017
3	SCHEMATIC DESIGN DEVELOPMENT	08/22/2017
4	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:  
Project No:  
Sheet Title  
Sheet No

16-16017.00  
FLOOR PLAN - LEVEL  
05



LEVEL 5 SHEET NOTES

- NOT USED
- INTERIOR STORAGE CASE PARTITIONS & CONFERENCE ROOMS, RESTROOMS/INTERIOR, RECEPTIONS BREAK ROOMS, ETC.

FLOOR PLAN LEGEND

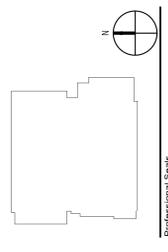
- NEW COP/BIP PARTITION AS INDICATED
- NEW COP/BIP PARTITION SYMBOL WHERE INDICATED, ILL-FIRE RATED ASSEMBLY
- NEW CASEWORK MILLWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR IM FRAME AS INDICATED
- DOOR OPENING TYPE
- NEW FIRE EXTINGUISHER CABINET - STEEL, SOLID FLUSH PANEL, FULLY RECESSED. SYMBOL TO BE BLACK DECAL ILL. PROTECTABLE FIRE EXTINGUISHER #2010, 10.0A, 1.0A
- NEW FIRE EXTINGUISHER CABINET - STEEL, SOLID FLUSH PANEL, FULLY RECESSED. SYMBOL TO BE BLACK DECAL ILL. PROTECTABLE FIRE EXTINGUISHER #2010, 10.0A, 1.0A

**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

- DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 1 - 3/15/18**

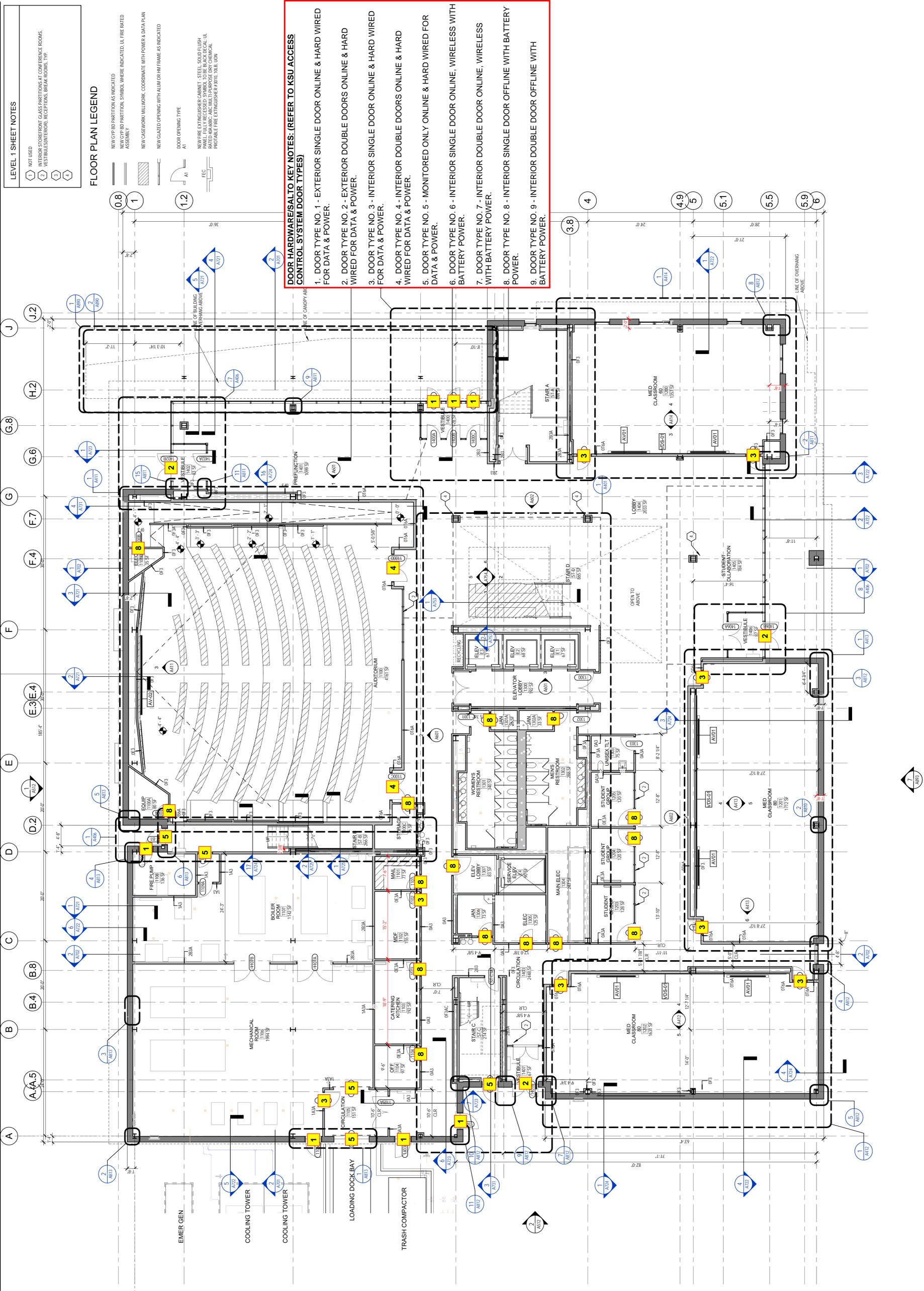




No.	Description	Date
1	SCHEMATIC DESIGN	06/09/2017
2	SCHEMATIC DESIGN PRICING	06/09/2017
3	DD DESIGN	11/03/2017
4	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:	16.16017.00
Project No.:	16.16017.00
Sheet Title:	FLOOR PLAN - LEVEL
Sheet Number:	01

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**



**LEVEL 1 SHEET NOTES**

- NOT USED
- INTERIOR STORMBOLT GLASS PARTITIONS AT CONFERENCE ROOMS, VESTIBULES/INTERIOR RECEPTIONS, BREAK ROOMS, ETC.
- 
- 

**FLOOR PLAN LEGEND**

NEW GFD-80 PARTITION AS INDICATED  
 NEW GFD-80 PARTITION SYMBOL WHERE INDICATED. IN THE RATED ASSEMBLY.

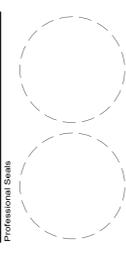
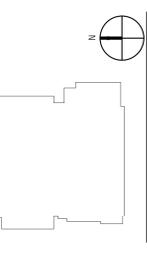
NEW CASEWORK/MILLWORK, COORDINATE WITH POWER & DATA PLAN  
 NEW GLAZED OPENING WITH ALUM OR HW FRAME AS INDICATED

DOOR OPENING TYPE  
 AT

NEW FIRE EXTINGUISHER CABINET, STEEL, SOLID FLUSH PANEL FULLY RECESSED SYMBOL TO BE BLACK RECAL UL HOUSING AND FULLY RECESSED SYMBOL TO BE BLACK RECAL UL HOUSING. PROVIDE FIRE EXTINGUISHER APPROX. 10' DIA. OR PROVIDABLE FIRE EXTINGUISHER DATA TAG, OR.

**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

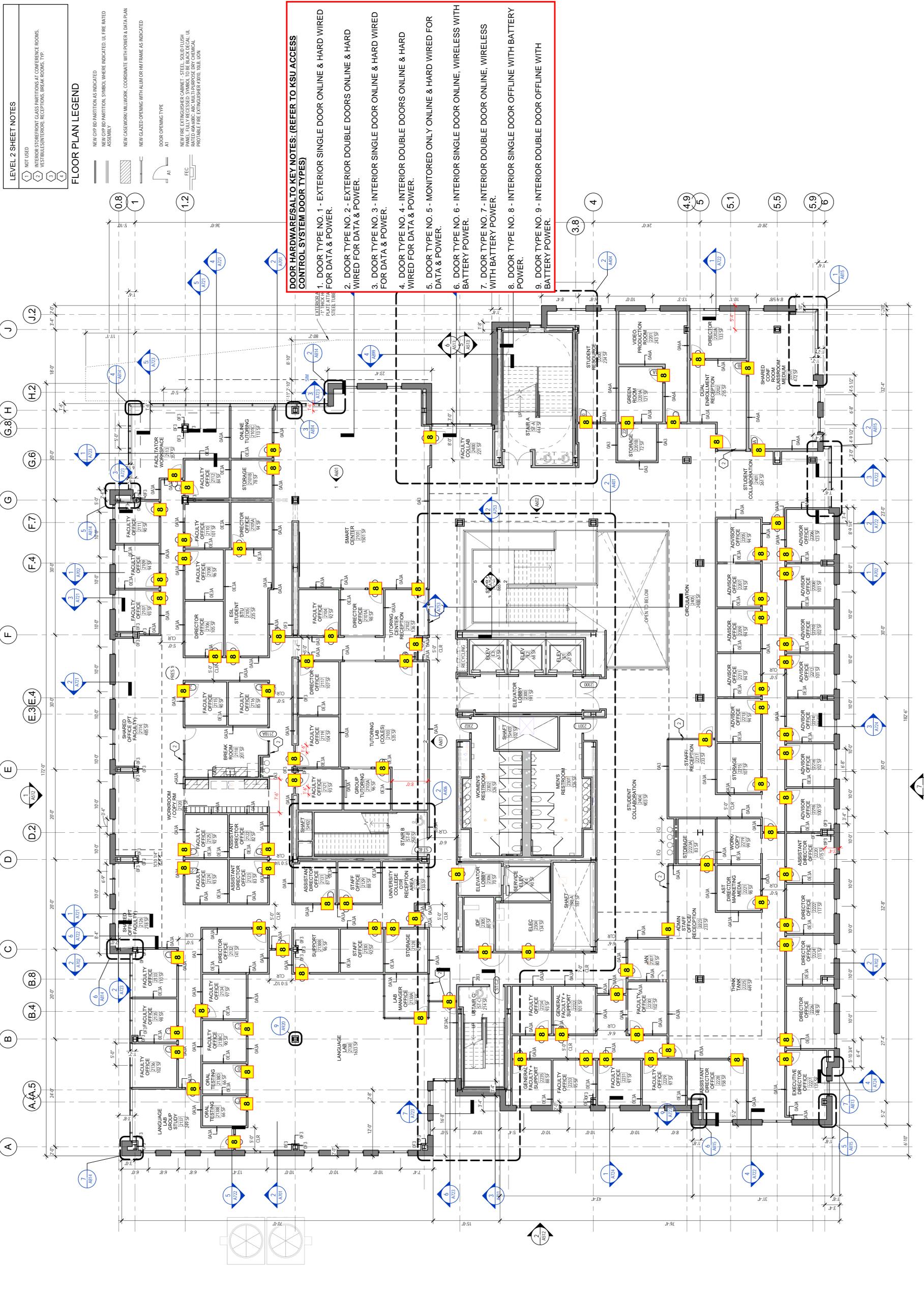
- DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
- DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/15/2017
3	SCHEMATIC DESIGN	09/12/2017
4	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:  
 Project No:  
 Sheet Title  
 Sheet No:

16.16017.00  
 FLOOR PLAN - LEVEL  
 02



**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

1. DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
2. DOOR TYPE NO. 2 - EXTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
3. DOOR TYPE NO. 3 - INTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
4. DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
5. DOOR TYPE NO. 5 - MONITORED ONLY ONLINE & HARD WIRED FOR DATA & POWER.
6. DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
7. DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
8. DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
9. DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

LEVEL 2 SHEET NOTES

- 1 NOT USED
- 2 INTERIOR STAIRWELL, GLASS PARTITIONS & CONFERENCE ROOMS, RESTROOMS/INTERIOR, RECEPTIONS/BREAK ROOMS, ETC.
- 3
- 4

FLOOR PLAN LEGEND

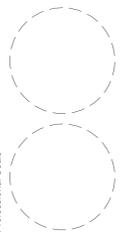
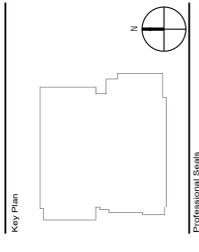
- NEW GYP BOARD PARTITION AS INDICATED
- NEW GYP BOARD PARTITION, SYMBOL WHERE INDICATED, UL FIRE RATED ASSEMBLY
- NEW CASWORK/MILINOAK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR IRM FRAME AS INDICATED
- DOOR OPENING TYPE
- NEW FIRE EXTINGUISHER CABINET - STEEL, GLOBE FLAME RATED, FULLY RECESSED, SYMBOL TO BE BLACK, OCA, UL PHOTOGRAPHIC FIRE EXTINGUISHER #200, 10LB, 10LON

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**



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**NBP Engineers, Inc.**  
Engineers - Electrical, Plumbing, & Fire Protection  
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Marietta, GA 31210 T +1 478 745 1691



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/31/2017
3	SCHEMATIC DESIGN	09/15/2017
4	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:  
Project No:  
Sheet Title

16-16017.00  
FLOOR PLAN - LEVEL  
03

LEVEL 3 SHEET NOTES

- NOT USED
- INTERIOR STAIRWELL, ELEVATOR PARTITIONS & CONFERENCE ROOMS, RESTROOMS, INTERIOR, RECEPTIONS, BREAK ROOMS, ETC.
- 3 HR RATED GLASS
- INTUMESCENT FIREPROOF COATING ON COLUMN

FLOOR PLAN LEGEND

- NEW GYP BD PARTITION AS INDICATED
- NEW GYP BD PARTITION, SYMBOL WHERE INDICATED, UL FIRE RATED ASSEMBLY
- NEW CASEWORK/MILWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR HM FRAME AS INDICATED
- DOOR OPENING TYPE
- NEW FIRE EXTINGUISHER CABINET, STEEL, SOLID FLUSH
- RATED 40-60: ABC, ALA, 1-PURPOSE DRY CHEMICAL
- PROTABLE FIRE EXTINGUISHER 200B, 10LB, UON

**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

- DOOR TYPE NO. 1 - EXTERIOR SINGLE DOOR ONLINE & HARD WIRED FOR DATA & POWER.
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- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
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- DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.



**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**



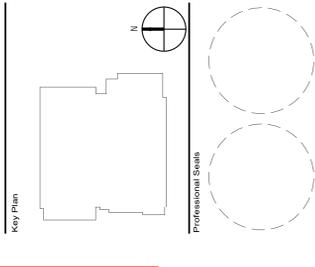
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**NBP Engineers, Inc.**  
 Mechanical, Electrical, Plumbing, & Fire Protection Engineers  
 316 Corporate Parkway  
 Marietta, GA 31210, T 478 745 1691



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/31/2017
3	SCHEMATIC DESIGN	09/14/2017
4	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:	Project No.:	Sheet Title:
08/09/2017	16-16017.00	FLOOR PLAN - LEVEL 04



**FLOOR PLAN LEGEND**

- NEW GYP BOARD PARTITION AS INDICATED
- NEW GYP BOARD PARTITION, SYMBOL WHERE INDICATED, UL FIVE RATED ASSEMBLY
- NEW CASEWORK/MILWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUMINUM OR HM FRAME AS INDICATED
- DOOR OPENING TYPE
- AI
- NEW FIRE EXTINGUISHER CABINET - STEEL, SOLID FLUSH PANEL, FULLY RECESSED SYMBOL TO BE BLACK DECAL. UL PROTECTIVE FIRE EXTINGUISHER #320, 10LB, 100V
- REC

**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

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6. DOOR TYPE NO. 6 - INTERIOR SINGLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
7. DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
8. DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
9. DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

**LEVEL 4 SHEET NOTES**

- 1 NOT USED
- 2 INTERIOR STAGEFRONT GLASS PARTITIONS AT CONFERENCE ROOMS, RESTROOMS/INTERIOR, RECEPTIONS, BREAK ROOMS, ETC.

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**



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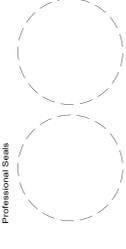
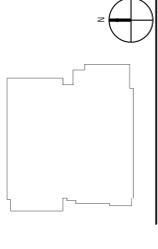
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 Atlanta, GA 30303 | 404.439.9000

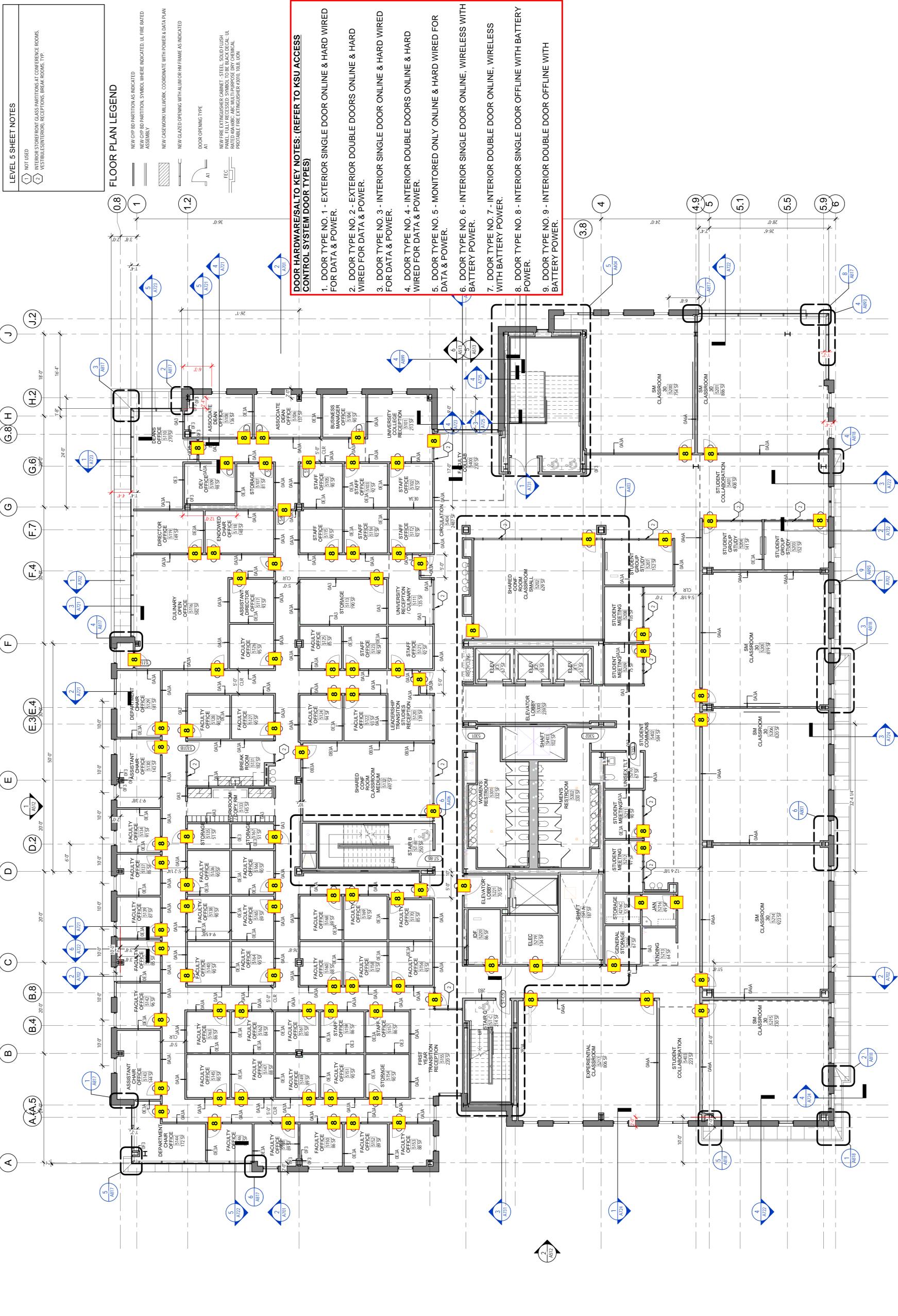
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 Marietta, GA 30120 | 1.478.745.1691

Key Plan



No.	Description	Date
1	SCHEMATIC DESIGN PRICING	08/09/2017
2	SCHEMATIC DESIGN	08/15/2017
3	SCHEMATIC DESIGN	08/22/2017
4	DESIGN DEVELOPMENT	12/15/2017
5	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:	Project No.:	Sheet Title:
08/09/2017	16-16017.00	FLOOR PLAN - LEVEL 05



**LEVEL 5 SHEET NOTES**

- NOT USED
- INTERIOR STORAGE CASE PARTITIONS & CONFERENCE ROOMS, RESTROOMS/INTERIOR, RECEPTIONS BREAK ROOMS, ETC.

**FLOOR PLAN LEGEND**

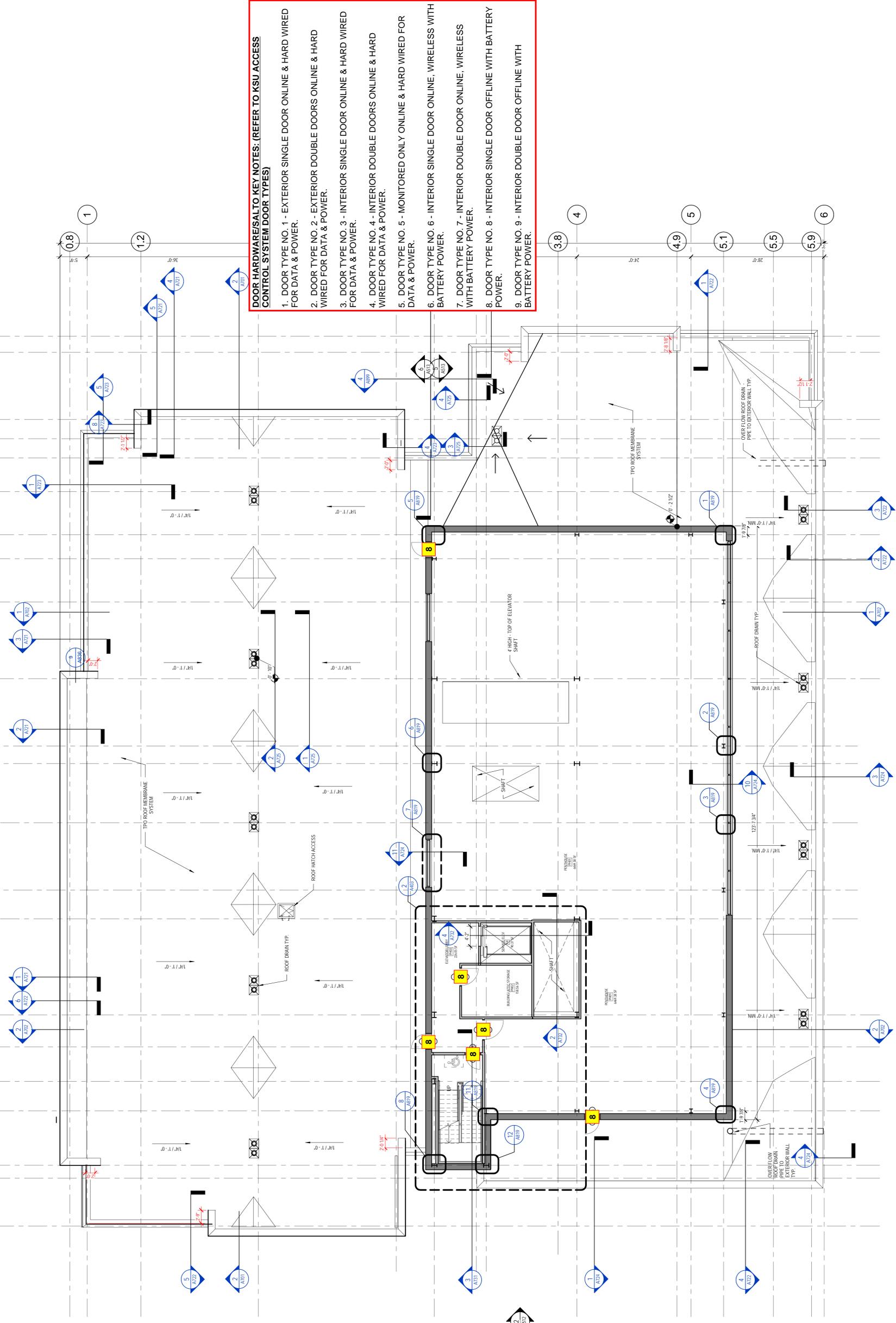
- NEW CYP BID PARTITION AS INDICATED
- NEW CYP BID PARTITION SYMBOL WHERE INDICATED, ILL-FIRE RATED ASSEMBLY
- NEW CASEWORK MILLWORK, COORDINATE WITH POWER & DATA PLAN
- NEW GLAZED OPENING WITH ALUM OR IM FRAME AS INDICATED
- DOOR OPENING TYPE
- NEW FIRE EXTINGUISHER CABINET - STEEL, SOLID FLUSH PANEL, FULLY RECESSED. SYMBOL TO BE BLACK DECAL UL PROTABLE FIRE EXTINGUISHER #2010, 10.0A, 10.0A

**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

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- DOOR TYPE NO. 4 - INTERIOR DOUBLE DOORS ONLINE & HARD WIRED FOR DATA & POWER.
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- DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
- DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
- DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**

PENTHOUSE LEVEL SHEET NOTES  
1



**DOOR HARDWARE/SALTO KEY NOTES: (REFER TO KSU ACCESS CONTROL SYSTEM DOOR TYPES)**

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7. DOOR TYPE NO. 7 - INTERIOR DOUBLE DOOR ONLINE, WIRELESS WITH BATTERY POWER.
8. DOOR TYPE NO. 8 - INTERIOR SINGLE DOOR OFFLINE WITH BATTERY POWER.
9. DOOR TYPE NO. 9 - INTERIOR DOUBLE DOOR OFFLINE WITH BATTERY POWER.



Project  
ACADEMIC LEARNING  
CENTER - PROJECT NO.  
J-296

Civil Drive  
Kennesaw, GA 30144  
Prepared For  
**KENNESAW STATE  
UNIVERSITY**  
Contract No: 16-16017.00



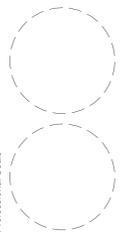
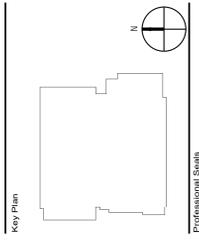
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No.	Description	Date
1	SCHEMATIC DESIGN	08/31/2017
2	DD PIRING	11/03/2017
3	DESIGN DEVELOPMENT	12/15/2017

Date of First Issue:	Project No:	Sheet Title
16-16017.00	16-16017.00	PENTHOUSE

**KSU DOOR HARDWARE/SALTO COMMENTS - OPTION NO. 2 - 3/15/18**

**APPENDIX 11 – SPECIAL TERMS & CONDITIONS FOR CONSTRUCTION SERVICES**

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## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

These Special Terms and Conditions for Construction Services supplement those terms and conditions of the Purchase Order Addendum issued with a University purchase order. In the event of any conflict between these Special Terms and Conditions and those of the Purchase Order Addendum, priority and preference shall be given to these Special Terms and Conditions. References to the "Contractor" herein shall have the same meaning as the "Seller" in the Purchase Order Addendum.

### **1 DEFINITIONS**

#### **1.1 OWNER**

Wherever the term "Owner" appears in these Special Terms and Conditions, it shall mean "The Board of Regents of the University System of Georgia by and on behalf of Kennesaw State University", or the Owner's Representative.

#### **1.2 OWNER'S REPRESENTATIVE**

Wherever the term "Owner's Representative" appears in these Special Terms and Conditions, it shall mean the Director of Facility Planning and Design Services, or designated assignee, Kennesaw State University, 1000 Chastain Road, Kennesaw, Georgia, 30144. Telephone: 770-499-3602; Fax: 770-499-3589.

#### **1.3 ARCHITECT/ENGINEER**

Wherever the term "Architect" or "Engineer" appears in these Special Terms and Conditions, it shall mean the firm or individual responsible for the design of the work called for in the contract documents.

- 1.4 Whenever the term "Contractor" appears in the contract documents, it shall mean the "Seller," as provided in the Purchase Order Addendum, and shall include all subcontractors (at any tier or level), as well as Contractor's agents and assigns.

### **2 EXISTING FACILITIES TO BE KEPT IN OPERATION**

#### **2.1 INGRESS AND EGRESS**

2.1.1 The Contractor is hereby made aware that the campus will remain open during the construction period, and work must be performed with due regard for safety and for other activities on Campus.

2.1.2 All routes of ingress and egress (including sidewalks, corridors, etc.) shall be kept passable and free of debris at all times.

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

2.1.3 When work is not physically being performed, these areas shall be free of the Contractor's material, equipment and debris.

### **3 SAFETY**

- 3.1 The Contractor shall be responsible for the safety of all contractor personnel, as well as University personnel, students, invitees and visitors to, at or near the work site.
- 3.2 The Contractor shall use whatever precautions are necessary to prevent accidents and shall not permit unauthorized traffic within the area of the work. Access to occupied buildings and occupied spaces must be maintained in a safe manner.
- 3.3 All work shall be carried out in a safe manner.
- 3.4 Caution must be taken to protect all parties from hazards arising from Contractor's operations.
- 3.5 Contractor shall comply with all OSHA safety regulations as well as all safety regulations provided by Georgia law.
- 3.6 Any person requesting after-hours access to University facilities must have a multi-state criminal background check before he or she is granted access. In the event of an extreme emergency situation, access may be granted under the direct supervision of a KSU employee.

### **4 HAZARDOUS CHEMICAL AND RIGHT TO KNOW ACT**

- 4.1 All Contractor personnel shall read the MSDS sheet for each product to be utilized by them during the course of this project and certify that they comprehend the information therein contained.
- 4.2 The Contractor shall be responsible for ensuring that all Contractor's employees have and utilize protective clothing, glasses, masks, and hats as well as tools, materials, supplies and equipment required by any law, rule or regulation for the safety and protection of personnel.

### **5 SMOKING IS PROHIBITED ON ALL UNIVERSITY PROPERTIES**

- 5.1 Kennesaw State University is committed to the promotion of a healthy environment for all Georgia citizens including students, employees, faculty and visitors of KSU. The use of tobacco products of any kind will be prohibited on all KSU properties, including all buildings, parking lots and

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

green spaces on the main campus and at satellite facilities. This policy will apply to employees, students, contractors, vendors, visitors, etc.

- 5.2 For the purposes of this policy, smoking is defined as burning any type of tobacco product including, but not limited to, cigarettes, e-cigarettes, cigars, cigarillos and pipes.

### **6 PROTECTIVE BARRIERS**

- 6.1 The Contractor shall erect and maintain suitable barriers or barricades, as may be required, around construction areas.
- 6.2 The barriers shall be properly marked, so as to restrict foot and/or vehicle traffic within the work areas.
- 6.3 If exterior barriers are required to protect the work area at night, they shall be equipped with appropriate blinking lights.

### **7 PRE-CONSTRUCTION MEETINGS**

Prior to the Notice to Proceed, the Owner's Representative will conduct a pre-construction meeting with the successful bidder. The Contractor, his superintendent and representatives of his prime subcontractors shall be present at the meeting. The following items will be reviewed at this meeting:

- 7.1 Bidding documents and specifications.
- 7.2 Contractor's submittals. Contractor shall check all specification sections to determine the extent of submittals required.
- 7.3 Contractor's proposed project schedule.

### **8 SUPERVISION**

- 8.1 All construction shall be performed under the personal and constant supervision of a qualified supervisor experienced in the classes of work required by the specifications.
- 8.2 The superintendent/supervisor shall be an employee of the Contractor and shall be on the job site at all times work is in progress.
- 8.3 The name of the superintendent/supervisor will be furnished to the Owner's Representative at the pre-construction conference before any work begins.

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

### 9 QUALITY WORKMANSHIP

- 9.1 The Contractor shall ensure that all work performed shall be executed in the best, most skillful manner by qualified personnel experienced in their respective trades in strict accordance with the plans, specifications and approved shop drawings.
- 9.2 Unless previously provided in connection with a bid or other solicitation in connection with the work, the Contractor will provide examples and references for Contractor's best projects, demonstrating the successful and competent quality of work on three similar projects.

### 10 WORK SCHEDULE

- 10.1 Work affecting campus should be coordinated in advance with the Owner's Representative.
- 10.2 Upon commencement of the work, the Contractor shall be on the job site, as scheduled, with an appropriate work force and the approved superintendent.

### 11 INSPECTION OF EXISTING FACILITIES

#### 11.1 INSPECTION PROCEDURE

Prior to commencing work, the Contractor shall visit the job site for the purpose of inspecting for existing damage. The Contractor is responsible for reporting existing damage to the Owner's Representative in writing prior to any construction activities at the site of the work.

- 11.2 It is agreed that the preparation of this report is for the benefit of the Contractor and is intended to enable him to have the protection afforded by a record of such existing damage as is visually ascertainable.

- 11.3 The Contractor will not be responsible for the repair of any damage which shall appear on the above-mentioned schedule, nor shall he be responsible for repairing any existing damage which was not ascertainable by visual inspection or which was not the result of negligence on his part.

### 12 LANDSCAPE

- 12.1 Contractor shall restore existing trees, shrubs, grass, sprinklers, sidewalks, etc., to their original condition if disturbed. Grass should be replaced between April 1 and September 1 as follows: Match existing turf with Tifton Tifway '419' Bermuda grass sod or Meyer Zoysia grass sod. (Annual Rye

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

may be used, 400 pounds/acre, only if restoration takes place outside of the above time frame).

### **13 PROTECTION OF PROPERTY**

13.1 The Contractor shall be responsible for any damage to grounds, buildings, utilities and landscaping. Any damage resulting from work by the Contractor to the grounds, buildings, walks, curbs, utilities and roads shall be repaired immediately by the Contractor, at the Contractor's expense.

13.2 In the event of damage to property, the Contractor shall restore same to a condition equivalent to that existing at the time of the start of operations.

13.2.1 All repairs shall conform to the original design and detail and shall be approved by the Owner's Representative.

13.3 The Contractor shall return all keys and entry cards provided by the Owner's Representative for access to the work site. Failure to return keys and entry cards in a timely manner will subject Contractor to re-keying costs, which may be deducted from any remaining payment(s) due the Contractor.

### **14 TRASH DISPOSAL**

14.1 All scrap building material and trash shall be properly disposed of off-campus at the Contractor's expense, and as soon as practicable. Cleanup of construction shall be continuous and ongoing during the course of construction.

14.2 Burning of material on-site will not be permitted.

14.3 At the completion of the work, any remaining trash and refuse shall be properly disposed of off-campus, and the site shall be left in "broom-clean" condition, unless contract documents provide for a higher standard.

### **15 STORAGE AND DELIVERY OF MATERIALS**

15.1 No storage facilities are available on the Kennesaw State University campus.

15.2 No Kennesaw State University employee is authorized to accept contractor materials or equipment delivered to the campus.

15.3 The Contractor shall ensure that adequate personnel are on the job site to receive and unload materials consigned to this project.

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

### 16 LOCATING UTILITIES

16.1 The Contractor is solely responsible for locating all utilities. The Contractor shall be solely responsible for the protection and the repair of any damage to utilities in connection with the work. The Contractor should contact Utility Protection Services ('Call Before You Dig') but, Utility Protection Services **DOES NOT** locate most utilities on campus. Therefore the Contractor should make necessary arrangements with a utility location contractor. Disrupted utilities shall be IMMEDIATELY repaired by the Contractor and reinstated to original condition. If the Contractor should fail to repair damaged utilities immediately, the owner reserves the right to make the needed repairs and will deduct the cost thereof from the payment, then or thereafter, due the Contractor, without limitation to other remedies available to the Owner.

### 17 SANITATION

17.1 The Contractor shall provide and maintain adequate sanitation facilities for Contractor's personnel for the duration of this contract.

17.2 Portable toilets, when required, shall be placed in a location approved by the Owner's Representative.

### 18 PARKING

18.1 The Contractor's employees working on campus for more than 4 consecutive days will need to sign up with KSU Parking Operations for paid contractor parking prior to the work start date. Temporary parking passes for Contractors on campus less than 4 days may be obtained from the Welcome Center, at no charge. All campus traffic and parking enforcement policies will apply to this Contract.

### 19 INSPECTIONS

19.1 All completed work shall be inspected and approved by the Owner's Representative for strict conformity with the drawings and specifications.

19.2 Any work not approved and in variance with above shall be repaired or rebuilt at the Contractor's expense.

### 20 JOB CONDITIONS

20.1 Prior to bidding the work, the Contractor shall have:

## **SPECIAL TERMS AND CONDITIONS FOR CONSTRUCTION SERVICES**

- 20.1.1 Visited the work site to verify benchmarks, reference points, and dimensions and shall have ascertained all job conditions and logistics.
- 20.1.2 Inspected work environment for conditions which would affect the satisfactory execution of the work, and for conditions at variance with drawings and specifications.
- 20.1.3 Reported any discrepancies to the Owner's Representative, in writing, at least seven days prior to bid.

### 21 COMPLIANCE WITH LAWS

The Contractor shall comply with all laws, rules, regulations, ordinances, and orders of any government agency having jurisdiction over the performance of the work. Without limiting the generality of the foregoing, the following laws are specifically referenced:

- 21.1.1 High Voltage Safety Act, O.C.G.A. § 46-3-30 *et seq.*
- 21.1.2 Georgia Facility Protection Act, O.C.G.A. § 25-9-1 *et seq.*  
(*Underground Gas Pipe Law*)
- 21.1.3 Federal Occupational Safety and Health Act, 29 U. S. C. § 651 *et seq.*
- 21.1.4 Hazardous Chemical Protection and Right to Know Act; O.C.G.A. 45-22-2 *et seq.*,
- 21.1.5 Drug-Free Workplace Act – O.C.G.A. § 50-24-1, *et seq.*
- 21.1.6 Federal Register-National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR PART 61.
- 21.1.7 Standards and Requirements for Construction, Alterations, etc., O.C.G.A. § 8-2-1 *et seq.*
- 21.1.8 Control of Soil Erosion and Sedimentation, O.C.G.A. § 12-7.1, *et seq.*
- 21.1.9 Regulation of Fire and other Hazards, O.C.G.A. § 25-2-1 *et seq.*

### 22 ASBESTOS PRODUCT

- 22.1 The Contractor shall not install any product or material that contains asbestos. If such is specified in error, the Contractor shall inform the Owner's Representative and request a substitute.

### 23 GUARANTEE

- 23.1 Upon satisfactory completion of the work and prior to final compensation, the Contractor shall furnish a guarantee and warranty covering all materials and workmanship for a period of one year. All other warranties, guarantees and bonds are still required as called for in construction documents.

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**APPENDIX 12 – UTILITY METERING STANDARDS**

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## I. EXECUTIVE SUMMARY

Kennesaw State University (KSU) operates facilities to minimize utility consumption and greenhouse gas emissions on campus. Toward this end, KSU intends to continuously monitor its utilities through the Building Automation System(s) and the Periscope Dashboard System overlay. The continuous monitoring system, outlined in this Metering Standard, is designed to provide accessible, accurate and consistent performance metrics to inform the maintenance and operations team regarding the performance of campus buildings. Service categories to be monitored are:

- Electric Power
- Natural Gas
- Domestic Water
  - Makeup Water
- Chilled Water
- Heating Hot Water
- Solar PV

The Metering Standard provides a description of the devices and techniques that will be used to measure energy and water performance and outlines implementation measures, such as the methods for measuring, storing and reporting building utility usage. This Metering Standard is for meter selection and data integration and should not be confused with or substituted for construction documents or installation specifications.

## II. INTRODUCTION

- A. The intent of this Metering Standard is to define the framework for real-time and on-going measurement and storage of KSU's energy and water consumption data to evaluate building efficiencies.
- B. KSU desires to document and understand the utility performance of its buildings in order to develop strategies to help minimize energy and water consumption and to discover and investigate operations and maintenance issues. This Metering Standard addresses the provisions necessary to accurately measure and monitor the utilities serving campus buildings in a consistent manner.
- C. A Data Acquisition Device and Periscope Dashboard will be used to collect, store and display the data defined by this Metering Standard. Data acquisition devices are defined as any device that has the ability to communicate with the meter, capture the required meter data, store for a defined period of time, and serve the meter data up to a combination of both the local BAS and Periscope Dashboard servers utilizing the defined communications protocols in this Standard. KSU currently has several BAS controllers and front ends that are being utilized to collect and store meter data, however a data acquisition device that is separate from the

BAS may be used to collect the meter information provided it can effectively communicate with and pass along the desired data to the local BAS and Periscope platforms. The following BAS controllers and systems are currently used to collect meter data and relay the information to the dashboard platform:

- i. Automated Logic (ALC)
- ii. Siemens
- iii. Andover
- iv. Trane

D. The primary goals of this Standard are to:

- i. Identify acceptable measurement devices for building utility usage.
- ii. Define acceptable data acquisition devices and the communications protocols utilized for connection of the meters to the BAS (if required) and Dashboard systems.
- iii. Define the parameters that need to be measured and stored for each metering device and the associated data to be stored for long term use/analysis.
- iv. Establish a consistent approach for data collection in the data acquisition device, BAS and Dashboard systems.

### III. MEASUREMENTS AND METRICS

A. Unit Definitions:

kW	Electric demand - Kilowatt(s) accounting for voltage, amperage, and power factor
kWh	Electric consumption - Kilowatt hours, accounting for kW demand
pf	Electrical Power Factor
kVA	Electrical Apparent Power
kVAR	Electrical Reactive Power
cf	Cubic feet (natural gas, water)
ccf	100 cubic feet (natural gas, water)
cfm	Cubic feet per minute (natural gas)
cfh	Cubic feet per hour (natural gas)
gpm	Gallons per minute (water flow)
10 <sup>2</sup> gal	Deca-gallons - 100 gallons (water consumption)
10 <sup>3</sup> gal	Kilo-gallons (Kgal) - 1000 gallons (water consumption)
°F	Temperature in degrees Fahrenheit
°C	Temperature in degrees Celsius
BTU	British Thermal Units (energy)
kBTU	1,000 BTU
MBTU	1,000,000 BTU
BTU/hr	Energy rate, British Thermal Units per Hour

Therm	Unit of heat equivalent to 100,000 Btu (gas consumption)
Ton	12,000 btu/hr (heat removal rate)
Ton-Hour	Average tons of chilled water used in an hour
Lbs/hr	Pounds per hour (steam)
W/m <sup>2</sup>	Watts per square meter, measurement of solar irradiance
ΔT	Temperature differential for supply and return temperatures in °F
mA	milliAmps
VDC	Volts DC
MV	Megavolt
Niagara <sup>AX</sup>	Open, Java-based framework that can connect almost any embedded device or system—regardless of manufacturer or communication protocol.

B. Abbreviations:

AGA	American Gas Association
ALC	Automated Logic
AWWA	American Water Works Association
BACnet IP	Open Internet (Ethernet) Data Communication Protocol for Building Automation and Control Networks Developed by ASHRAE
BACnet MS/TP	Open Serial Token Passing Protocol for Building Automation Developed by ASHRAE
BAS	Building Automation System
BBMD	BACnet/IP Broadcast Management Device
KSUK	Kennesaw State University Kennesaw Campus
KSUM	Kennesaw State University Marietta Campus
Modbus RTU	Open, Serial (RS-232 or RS-485) Protocol Widely Used in Building Management and Industrial Automation Systems
Modbus TCP	Open, Ethernet Transmission Control Protocol Widely Used in Building Management and Industrial Automation Systems
OEM	Original Equipment Manufacturer
OAT	Outside Air Temperature

C. Continuous measurement and trending is required for the following categories of metering devices:

i. Electric

1. Electrical Demand - kW
2. Electrical Consumption - kWh
3. Electrical Apparent Power - kVA
4. Electrical Reactive Power - kVAR
5. Electrical Power Factor - pF

- ii. Natural Gas
  - 1. Natural Gas Consumption - cf
  - 2. Natural Gas Demand - cfm or cfh
- iii. Domestic Water
  - 1. Domestic Water Consumption - gal or kgal
  - 2. Domestic Water Flow - gpm
- iv. Makeup Water
  - 1. Makeup Water Consumption - gal
  - 2. Makeup Water Flow - gpm
- v. Chilled Water - Flow Meter and BTU Calculation Device
  - 1. CHW Energy Consumption - BTU, kBTU & MBTU
  - 2. CHW Energy Flow - BTU/hr, kBTU/hr & MBTU/hr
  - 3. CHW Tons of Refrigeration - Tons
  - 4. CHW Ton-hours - Ton-Hours
  - 5. CHW Supply Temp - °F
  - 6. CHW Return Temp - °F
  - 7. CHW Delta Temp - °F
  - 8. CHW Flow - gpm
- vi. Heating Hot Water - Flow Meter and BTU Calculation Device
  - 1. HHW Energy Consumption - BTU, kBTU, & MBTU
  - 2. HHW Energy Flow - BTU/hr, kBTU/hr & MBTU/hr
  - 3. HHW Supply Temp - °F
  - 4. HHW Return Temp - °F
  - 5. HHW Delta Temp - °F
  - 6. HHW Flow - gpm
- vii. Solar Photovoltaic
  - 1. Solar kW - kW
  - 2. Solar kWh - kWh
  - 3. Solar Irradiance - W/m<sup>2</sup>
  - 4. Outside Air Temperature - °F (Data from local weather station)

#### **IV. MEASURED VALUES**

- A. Completed Measured Values tables can be found in Appendix A. Other appendices include B & C that contain the following information:

- i. Appendix A: The live and historical metrics that need to be measured for each respective utility and the increment of capturing the data (trending) for long term use and analysis.
  - ii. Appendix B: Required naming convention for meter points and trends in the BAS and Dashboard.
  - iii. Appendix C: Diagrams of Meter Communications Infrastructure
    1. Diagram A - Metering and Communications Architecture When Utilizing a Niagara Based Data Acquisition Device
    2. Diagram B - Metering and Communications Architecture When Utilizing a Non-Niagara Based Data Acquisition Device or Local BAS Controller
- B. Each measured value in Appendix A shall be available at the local data acquisition device, BAS server (if necessary) and Dashboard server as both a live and historical value.
- C. Each data point shall be captured (trended) on the specified interval (15 minutes) and stored for a minimum of 60 months in the BAS server (if necessary) and Dashboard server databases.
- D. For buildings being served by multiple utilities, a rollup of overall building energy usage shall be calculated for the overall energy (BTU, kBTU, and MBTU) consumption and a history created in the BAS database in 15 minute increments.
- E. Data trending requirements at the Data Acquisition Device, BAS Server (if necessary) and Dashboard Server:
- i. Meter consumption data shall not be set up to rollover or reset to zero at any point. Instead, the data shall be captured in one of two ways (preferably the delta format):
    1. **Delta (preferred)** - A numeric interval consumption history that captures the difference or change in a consumption value from one timestamp to the next (15 minute intervals). Delta histories are preferred if the meter has an inherent register rollover value because they are more fault tolerant for long term data collection.
    2. **Accumulating** - A constantly increasing consumption value for a specified meter. A meter consumption history can be setup in the database as accumulating *only if* the necessary logic is implemented at the data acquisition device and server levels to capture/account for the specified meter registry rollover value (to be obtained from the meter manufacturer). This ensures that the meter never resets to

zero and continues to accumulate in value without rolling over.

- ii. All specified measured values shall be captured in 15 minute increments at the Data Acquisition Device, BAS Server (if necessary) and Dashboard Server.
- iii. Meter interval data shall be captured with a timestamp ending with :00, :15, :30, and :45 for every hour of data recorded for consistency with utility billing. For example, a kWh trend shall be captured at 1:00, 1:15, 1:30, 1:45, and 2:00 pm, etc.

## V. COMMUNICATIONS

### A. Meter Communication Requirements (See Appendix C, Diagram A & B for Meter Communication Architecture)

- i. Meters shall have the ability to communicate to the data acquisition device via at least one of the following protocols (acceptable protocols will vary based on the metering application):
  - 1. Serial & Ethernet Communications:
    - a. BACnet IP and MSTP
    - b. Modbus TCP and RTU
  - 2. Analog & Digital Output:
    - a. 4-20 mA
    - b. 0-10 VDC
    - c. Scaled pulse
- ii. All metering devices are to be connected to the existing secured data network. The MAC and IP address are to be provided by KSU IT where applicable.
- iii. The Data Acquisition Device shall accept the meter output for short term data storage and transition to the BAS server (where applicable) and Dashboard Servers.
- iv. Verification of communication from the sub-meter to the data acquisition device shall take place before meter is approved and purchased.

### B. Environment

- i. Data head hardware shall be suitable for the conditions ranging from -20°F to 140°F. Data heads used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures

and shall be rated for operation at conditions ranging from -20°F to 140°F.

### C. Data Acquisition Device Requirements

- i. The data acquisition device shall have the following communications capabilities:
  1. Serial & Ethernet Communications:
    - a. BACnet IP and MSTP
    - b. Modbus TCP and RTU
  2. Analog & Digital Inputs:
    - a. 4-20 mA
    - b. 0 to 10 VDC
    - c. Scaled pulse
- ii. The specific communications capabilities, drivers & IO modules required by each Data Acquisition Device will be defined based on the number of and types of meters that are to be integrated in the particular building of interest.
- iii. The data acquisition device shall maintain and store all meter data for at least 72 hours in the event of a power or communication interruption. Upon power and communication restoration, the controller will automatically archive the stored data to the BAS Server (where required) and Dashboard Server to prevent data loss.
- iv. The Data Acquisition Device shall collect all of the required meter measured values. The data shall be available as a live point value and be captured and stored as a 15 minute numeric intervals.
- v. Data storage on the controller shall be set up to roll at a minimum of 500 records to allow for power and communication interruptions and prevent unnecessary overuse of memory, resources and storage at the data acquisition device level.
- vi. Blank or null values in the database will be replaced with actual data.
- vii. The Data Acquisition Device shall archive the collected meter data to the BAS Server (where required) and Dashboard Server at a minimum of once per hour.
- viii. If a local building controller is being used as the Data Acquisition Device, the meter data points shall be exposed to the BACnet

network via BACnet IP immediately upon setup for discovery into the Dashboard System.

1. The BAS Controls Contractor shall provide the following information to KSU Facilities for ease of discovery of BACnet meter data into the Dashboard System:
  - a. Device name containing the meter data
  - b. Device ID
  - c. Network number
  - d. MAC Address of the device
  - e. BBMD table information (if necessary)
  - f. Unit of measurement
  - g. The description/naming convention of the point.  
This naming convention shall match the names provided in Appendix B

D. BAS Server (ALC, Siemens, Andover, and Trane)

- i. IF the data is required to be stored in the BAS (determined by KSU Facilities Team), all data will be stored in the BAS server database for a minimum of 60 months. It is the responsibility of the BAS Controls Contractor to coordinate with KSU IT to ensure that the server has the required storage capacity for the specified data. The specific BAS server utilized will depend on the local controls in the building being metered due to the various controls systems in place on the KSUK and KSUM campuses.
- ii. Sufficient data storage capacity will comprise at least five years of data for all meter data histories.
- iii. The data will be fully contained in a single file or table for each point/trend. Data will not span multiple files or database tables. Users can have the option to modify the start and end dates for exporting files depending on third-party program requirements to evaluate the data.
- iv. Meter data will be added to the appropriate display pages and graphics in the BAS server (front end).
- v. BAS server shall have the ability to expose the data to the BACnet network via BACnet IP for discovery into the Dashboard System.
- vi. Meter data points at the BAS server shall be exposed to the BACnet network via BACnet IP immediately upon setup for discovery into the Dashboard System.

#### E. Dashboard SoftJACE & Server

- i. If a BAS local controller is being used as the Data Acquisition Device, the data shall be pulled into the KSU SoftJACE via BACnet IP communications from the local BAS controller or BAS Server.
- ii. Meter data shall be archived from the SoftJACE to the Dashboard Server (Niagara AX Supervisor) via the Niagara network at a minimum of once per hour.
  1. In the event that a native Niagara device is used as the Data Acquisition Device, the device may communicate directly to the Dashboard Server instead of the campus SoftJACE via the Niagara network (Fox protocol).
- iii. The meter histories exposed to the SoftJACE shall be trended and captured in 15 minute increments.
- iv. Data storage at the SoftJACE shall be set up to roll a minimum of 500 records to allow for power and communication interruptions and prevent overuse of memory and storage.
- v. The SoftJACE shall maintain and store all meter data for at least 72 hours in the event of a power or communication interruption. Upon power and communication restoration, the SoftJACE will automatically archive the stored data to the Dashboard Server to prevent data loss.

#### F. Network Accessibility

- i. Network access is to be coordinated with the Kennesaw State University Information Technology (KSU IT) team.

### **VI. METERS, HARDWARE & DEVICES**

#### A. General

- i. The meter shall be installed to manufacturers' guidelines and any questions regarding the installation shall be referred to the local meter representative for confirmation prior to installation.
- ii. All metering equipment shall have a minimum of a 1 year warranty. Refer to specific utility function and meter for more strict warranties.
- iii. All device installations (meters and Data Acquisition Devices) shall have a minimum parts and labor warranty of 1 year to account for any inconsistencies or discrepancies with this Standard.

- iv. Power, where needed, shall be obtained from a dedicated 20 Amp circuit in the nearest local building electrical panel unless otherwise stated.
- v. Networking, where needed, shall be coordinated and obtained from a data drop provided by the KSU IT team.
- vi. When possible, all meters shall be installed in an easily accessible location that allows for direct and easy reading of the visual display and convenient calibration and maintenance provided the install follows all OEM installation guidelines.

## B. Electrical Metering

### i. General

1. Power meter shall measure at minimum electrical energy consumption (kWh) and peak real power demand (kW).
2. Power meter shall utilize the acceptable communications protocols identified above to transfer data to the Data Acquisition Device for data capture and transfer to the BAS server (if required) and Dashboard Server.
3. Power meter shall capture total building electrical consumption for the building. This meter shall be referred to as Meter 1.
4. If additional power sub-metering is required, for specified areas of the building or to measure specific equipment or loads such as HVAC, lighting, plug load, etc., the metering shall be done using a multi-point meter. This meter, or meters if necessary, shall be referred to as Meter 2, 3, 4, etc.

### ii. Type

1. The power meter shall be installed to capture total building electric data.
2. The power meter shall be fully electronic with a multi-line backlit display showing measured parameters on a local display.

### iii. Measurements and Accuracy

1. The power meter shall perform, at minimum, the electrical measurements defined in Appendix A.

2. The power meter shall perform to the accuracy standards provided by the original equipment manufacturer.
3. If utilizing BACnet IP or Modbus TCP (Ethernet) communications, the power meter shall have data logging capability to protect the data in the event of a communications or power failure. The meter shall have a real-time clock that allows for time stamping of all the data collected in the meter when log events are created.

iv. Communications

1. The power meter shall communicate to the Data Acquisition Device via one of the following protocols:
  - a. Serial & Ethernet (preferred):
    - i. BACnet IP and/or MSTP
    - ii. Modbus TCP and/or RTU
  - b. Analog & Digital:
    - i. 4-20 mA
    - ii. 0 to 10 VDC
    - iii. Scaled pulse

v. Location and Install Requirements

1. The meter shall be located in a readable location, three to five feet off finished floor if possible. Mounting position shall be horizontal.
2. The meter shall be installed to the manufacturer's guidelines, accounting for size, amperage and voltage of the measured line.

vi. Acceptable manufacturer and model for power meter products are any of the following:

1. Shark 200 Series (or above) Energy Meter
2. Emon-Dmon Class 3200 or 5000 Smart Meter
3. Veris H81XX Series Energy Meter

vii. Instrument Transformers

1. Power supply to the meter shall be no greater than 120 volts.

2. Appropriately sized and NEMA rated instrument transformers shall be used to step down voltage to 120 volts for power supply for the meter if necessary.

viii. Current Transformers (CTs)

1. The CTs shall be standard 5A secondary and conform to the ANSI Standard accuracy class for metering service of 0.3 or better (revenue metering) with burden B-0.1 to B-2.0 (with burden equal to or greater than that of the installed meter and any other connected equipment).
2. CTs secondary wiring length shall be minimized. The contractor/engineer shall calculate the additional burden of CT wiring and ensure that the total burden of the meter and associated wiring is within the rating of the CTs at the intended accuracy class of 0.3 or better.
3. CT accuracy class shall be sufficient for use in revenue metering with burden equal to or greater than that of the installed meter and any other connected equipment. Split core and solid core CTs are permitted but must conform to the accuracy specifications.

ix. Potential Transformers (PTs)

1. Where system voltages are below 480/277, no potential transformers are required.
2. Where potential transformers are used, they shall be protected by fuses on the primary and secondary sides.
3. Potential transformers shall be instrument transformers of suitable accuracy for revenue metering and shall supply only meters and protective relays. Control power transformers shall not be used as the metering potential source.
4. Fuses shall be class CC or as recommended by the meter manufacturer.

C. Natural Gas Metering

i. General

1. If available and approved by the local natural gas utility provider, a pulse signal may be captured by the Data Acquisition Device for 15 minute interval gas consumption and flow data from the utility grade meter serving the building.

2. If additional natural gas sub-metering is desired and a pulse option is not available on the utility meter, a natural gas sub-meter shall be installed to capture building natural gas consumption and flow.
3. Building natural gas supply shall be sub-metered to capture at minimum total building gas flow and total consumption.
4. Meter shall have a visual display of measured variables and if not, shall be paired with a network communication device with a backlit visual display along with BACnet or Modbus network communication capabilities.
5. The meter shall be selected based upon the size of the line, operating pressure, temperature, mass and volume requirements of the measured gas line.
6. The required enclosure for the meter shall be rated for the environmental conditions it will be exposed to (interior versus exterior).

ii. Type

1. The natural gas meter shall utilize thermal dispersion or Coriolis technology that is temperature and pressure compensated according to the specifics of the line that is being metered.
2. Basis of design for the natural gas meter shall be an insertion thermal mass flow meter, inline thermal mass flow meter, or Coriolis metering technology.

iii. Measurements and Accuracy

1. The natural gas meter shall perform, at minimum, the measurements defined in Appendix A.
2. The natural gas meter shall perform to the accuracy standards provided by the original equipment manufacturer.

iv. Communications

1. The natural gas meter shall communicate to the Data Acquisition Device via one of the following protocols:
  - a. Serial & Ethernet Communications (preferred):

- i. BACnet IP and/or MSTP
- ii. Modbus TCP and/or RTU

b. Analog & Digital:

- i. 4-20 mA
- ii. 0 to 10 VDC
- iii. Scaled pulse

v. Location and Install Requirements

1. The meter shall be located in a readable location, three to five feet off finished floor if possible. Mounting position shall be horizontal.
2. Local Display
  - a. A remote flow display (register) will be provided when the meter location prevents direct reading of the meter register from a standing position on grade or finished floor. Remote register shall be installed at 4' to 5' above grade or finished floor. Remote register shall be compatible with the installed meter, shall be from the same manufacturer, and shall have a straight reading odometer or digital type display.
3. The meter shall be installed to the manufacturer's guidelines, accounting for required straight pipe before and after the meter. A flow conditioner may be required to meet these conditions. Any questions regarding installation shall be referred to the local meter representative for confirmation prior to installation.
4. Required power and mounting shall conform to the manufacturer's recommendations.

vi. Acceptable manufacturer and model for natural gas meter products are any of the following:

1. Onicon F-5100 Series Thermal Mass Flow Meter (inline or insertion).
  - a. May be paired with the Onicon D-100 Flow Display for a local indication of data and network interface for BACnet or Modbus.
2. TRICOR Coriolis Mass Flow Meter

- a. TCM XXXX - Specific series/meter type dependent upon line size, max volumetric flow rate, and max mass flow rate.
  - b. TCE 8000-C Compact Version Transmitter with Modbus output option.
3. Sage Prime Natural Gas Thermal Mass Flow Meter (inline or insertion)

#### D. Domestic and Makeup Water Metering

##### i. General

1. If available and approved by the local utility water provider, a pulse signal may be captured by the Data Acquisition Device for 15 minute interval water consumption and flow data from the utility grade meter serving the building.
2. If additional domestic and make-up water sub-metering is required, a water sub-meter shall be installed for domestic and make-up water metering.
3. All water meters will be installed per manufacturer guidelines with sufficient pipe run before and after the flow meter for accurate measurements.
4. Materials which will be wetted shall be made from non-corrosive materials and shall not contaminate water.
5. Include particulate strainer, isolation valves, and bypass lines where necessary.
6. Meters shall have a minimum warranty of 2 years.
7. Meters shall utilize standard 24 VDC power supply. Required power and mounting shall conform to the original equipment manufacturer's recommendations.

##### ii. Type

1. The water meter shall utilize electromagnetic or ultrasonic (for Onicon), turbine (for Neptune), or Water Signal metering technology.

##### iii. Measurement and Accuracy

1. The water meter shall perform, at minimum, the measurements defined in Appendix A.

- a. If utilizing an approved Water Signal device, Appendix A does not apply and the only metric necessary to capture is hourly consumption in gallons.
  2. The water meter shall perform to the accuracy standards provided by the original equipment manufacturer.
  3. The turndown ratio of the meter shall be calculated according to the operational flow range of the water line that is being measured.
- iv. Communications
  1. The water meter shall communicate to the Data Acquisition Device via one of the following protocols:
    - a. Serial & Ethernet Communications (preferred):
      - i. BACnet IP and/or MSTP
      - ii. Modbus TCP and/or RTU
    - b. Analog & Digital:
      - i. 4-20 mA
      - ii. 0 to 10 VDC
      - iii. Scaled pulse
    - c. Cellular
      - i. Cellular communications are only acceptable when utilizing Water Signal devices.
- v. Location and Install Requirements
  1. Meters shall be installed to provide easy access for readings, maintenance and repairs.
  2. Meters shall be flanged and valved to permit convenient replacement or calibration of metering device.
  3. Each flow meter shall be equipped with an identification tag indicating the size and location for the specified water line.
  4. Local Flow Display
    - a. Flow meters without a digital backlit display for data visualization shall be coupled with a local flow display for viewing captured data metrics and

providing additional BACnet and Modbus network communications capabilities.

- i. Local flow display is not required for Water Signal installations.
  - b. A remote flow display (register) will be provided when the meter location prevents direct reading of the meter register from a standing position on grade or finished floor. Remote register shall be installed at 4' to 5' above grade or finished floor. Remote register shall be compatible with the installed meter, shall be from the same manufacturer, and shall have a straight reading odometer or digital type display.
- vi. Acceptable manufacturer and model for domestic and makeup water meter products are any of the following:
1. Water Signal Device
  2. Onicon - Optional Inline (F-3100 & F-3200 series) and Insertion (F-3500) Electromagnetic Meters, or Clamp-On Ultrasonic (F-4200) Flow Meter
    - a. Onicon F-3200 Inline Electromagnetic Flow Meter - for pipe sizes greater than or equal to 1" in diameter.
      - i. F-3200 is the preferred Onicon meter for water (particularly domestic) with low flow parameters. Turndown shall be established at 0.05 feet per second for low end velocity applications.
    - b. Onicon F-3100 Inline Electromagnetic Flow Meter - for pipe sizes up to 1" in diameter.
    - c. Onicon F-3500 Insertion Electromagnetic Flow Meter - for pipes ranging in size from 3" to 72" in diameter.
      - i. May be paired with the Onicon D-100 Flow Display for a local indication of data and network interface for BACnet or Modbus.
    - d. Onicon F-4200 Clamp-On Ultrasonic Flow Meter - for pipes ranging in size from ½" to 48" in diameter.
      - i. Shall include a visible display of data captured with Modbus RTU communications capabilities.

- ii. Appropriate transducers shall be selected based on pipe diameter.
3. Neptune - Optional TRU/FLO Compound Meter or High Performance Turbine Meter
  - a. TRU/FLO Compound Meter - for the following pipe diameter sizes: 2" HP, 3", 4", 6", and 6" X 8"
  - b. High Performance Turbine Meter for pipe sizes ranging from 1 ½" to 10" in diameter.
  - c. All Neptune meters shall be paired with a Tricon/E3 Transmitter for a digital pulse and analog output to be integrated with the Data Acquisition Device for data capture. A transmitter is required for each register (high and low flow registers for the TRU/FLO Compound Meters).

#### E. Chilled Water Metering (CHW)

##### i. General

1. A CHW meter shall be installed for chilled water applications where a chiller is providing chilled water for multiple buildings on campus to provide the ability to measure the overall energy consumption of each building.
2. All CHW BTU meters shall be installed per manufacturer guidelines.
3. CHW BTU meters shall have a minimum warranty of 2 years.
4. CHW BTU meters shall utilize standard 24 VDC power supply. Required power and mounting shall conform to the original equipment manufacturer's recommendations.

##### ii. Type

1. Each CHW metering system shall include a flow meter and a BTU energy meter.
2. The CHW BTU meter shall include two temperature sensors, one for supply and one for return, a BTU processor, and BACnet or Modbus network communications capabilities for integration with the Data Acquisition Device.

3. The CHW BTU meter, flow meter, and temperature sensors shall be from the same manufacturer for each installed BTU system.

iii. Measurement and Accuracy

1. The CHW BTU meter shall perform, at minimum, the measurements defined in Appendix A.
2. The CHW BTU meter shall measure the total BTUs delivered and used at the building level.
3. The chilled water flow meter shall be sized to read at mid-point for the nominal operating system load. The meter shall not be sized for the maximum capacity of the installed system.

iv. Communications

1. The CHW BTU meter shall communicate to the Data Acquisition Device via one of the following serial protocols:
  - a. Serial Communications:
    - i. BACnet MSTP
    - ii. Modbus RTU

v. Location and Install Requirements

1. CHW BTU and flow meters shall be installed to provide easy access for readings, maintenance and repairs.
2. All CHW BTU meters shall be installed per manufacturer guidelines with sufficient pipe run before and after the flow meter for accurate water measurements.
3. Chilled water flow meters shall be flanged and valved to permit convenient replacement or calibration of metering device.
4. Each flow meter shall be equipped with an identification tag indicating the size and location for the specified water line.

vi. Acceptable manufacturer and model for CHW BTU meter products are any of the following:

1. Onicon System-10 BTU Meter
  - a. Shall include BACnet MSTP or Modbus RTU output communication capability.

- b. Shall include the required temperature sensors for CHW supply and return temperatures.
- c. Shall be paired with one of the following Onicon flow meters:
  - i. F-3200 Inline Electromagnetic Flow Meter - for pipe sizes greater than or equal to 1" in diameter.
  - ii. F-3100 Inline Electromagnetic Flow Meter - for pipe sizes up to 1" in diameter.
  - iii. F-3500 Insertion Electromagnetic Flow Meter - for pipes ranging in size from 3" to 72" in diameter.

## 2. Spire Metering Technology

- a. CHW BTU meter shall be one of the following:
  - i. SpireMag Series T-Mag Electromagnetic BTU Meter
  - ii. ThermoPro Series TP10 Ultrasonic Thermal Energy Meter
- b. Shall include BACnet MSTP or Modbus RTU output communication capability.
- c. Shall include the required temperature sensors and for CHW supply and return temperatures and flow meter.

## 3. Flexim Fluxus BTU Meter (aka F704 Series)

- a. Shall include BACnet MSTP or Modbus RTU output communication capability.
- b. Shall include the appropriate ultrasonic transducer components that are dependent on pipe diameter.
- c. Shall include the required temperature sensors for CHW supply and return temperatures.

## F. Heating Hot Water (HHW)

### i. General

1. A HHW meter shall be installed for heating hot water applications where a boiler is providing hot water for multiple buildings on campus to provide the ability to measure the overall energy consumption of each building.
2. All HHW BTU meters shall be installed per manufacturer guidelines.
3. HHW BTU meters shall have a minimum warranty of 2 years.
4. HHW BTU meters shall utilize standard 24 VDC power supply. Required power and mounting shall conform to the original equipment manufacturer's recommendations.

### ii. Type

1. Each HHW metering system shall include a flow meter and a BTU energy meter.
2. The HHW BTU meter shall include two temperature sensors, one for supply and one for return, a BTU processor, and BACnet or Modbus network communications capabilities for integration with the Data Acquisition Device.
3. The HHW BTU meter, flow meter, and temperature sensors shall be from the same manufacturer for each installed BTU system.

### iii. Measurement and Accuracy

1. The HHW BTU meter shall perform, at minimum, the measurements defined in Appendix A.
2. The HHW BTU meter shall measure the total BTUs delivered and used at the building level.
3. The flow meter shall be sized to read at mid-point for the nominal operating system load. The meter shall not be sized for the maximum capacity of the installed system.

### iv. Communications

1. The HHW BTU meter shall communicate to the Data Acquisition Device via one of the following serial protocols:

- a. Serial Communications:
  - i. BACnet MSTP
  - ii. Modbus RTU
  
- v. Location and Install Requirements
  1. HHW BTU and flow meters shall be installed to provide easy access for readings, maintenance and repairs.
  2. All HHW BTU meters shall be installed per manufacturer guidelines with sufficient pipe run before and after the flow meter for accurate water measurements.
  3. Hot water flow meters shall be flanged and valved to permit convenient replacement or calibration of metering device.
  4. Each flow meter shall be equipped with an identification tag indicating the size and location for the specified water line.
  
- vi. Acceptable manufacturer and model for HHW BTU meter products are any of the following:
  1. Onicon System-10 BTU Meter
    - a. Shall include BACnet MSTP or Modbus RTU output communication capability.
    - b. Shall include the required temperature sensors for HHW supply and return temperatures.
    - c. Shall be paired with one of the following Onicon flow meters:
      - i. F-3200 Inline Electromagnetic Flow Meter - for pipe sizes greater than or equal to 1" in diameter.
      - ii. F-3100 Inline Electromagnetic Flow Meter - for pipe sizes up to 1" in diameter.
      - iii. F-3500 Insertion Electromagnetic Flow Meter - for pipes ranging in size from 3" to 72" in diameter.
  2. Spire Metering Technology
    - a. HHW BTU meter shall be one of the following:

- i. SpireMag Series T-Mag Electromagnetic BTU Meter
    - ii. ThermoPro Series TP10 Ultrasonic Thermal Energy Meter
  - b. Shall include BACnet MSTP or Modbus RTU output communication capability.
  - c. Shall include the required temperature sensors and for HHW supply and return temperatures and flow meter.
3. Flexim Fluxus BTU Meter (aka F704 Series)
  - a. Shall include BACnet MSTP or Modbus RTU output communication capability.
  - b. Shall include the appropriate ultrasonic transducer components that are dependent on pipe diameter (refer to OEM for further information).
  - c. Shall include the required temperature sensors for HHW supply and return temperatures.

G. Solar Photovoltaic (PV)

i. General

1. Data from campus solar photovoltaic installations shall be integrated into the Data Acquisition Device and Dashboard server for display in the Periscope Dashboard system.
2. All solar PV data shall be displayed in the Periscope Dashboard system in the single and/or multisite solar viewlet.
3. Data from the solar installations shall be captured directly from the solar inverter.

ii. Measurement

1. The solar PV system shall provide, at minimum, the measurements defined in Appendix A.

iii. Communications

1. The solar inverter shall communicate to the Data Acquisition Device via one of the following protocols:

- a. Serial Communications (preferred):
  - i. BACnet IP or MSTP
  - ii. Modbus TCP or RTU

## **VII. COMMISSIONING OF METER INSTALLATIONS**

- A. Each meter integrated to a Data Acquisition Device, the BAS server (where required) and the Periscope server shall be commissioned to verify functionality and accuracy of the parameters defined in this Standard. This includes but is not limited to:
  - i. Verification of successful communications of the meters to the data acquisition devices and servers.
  - ii. Verification of required live point data at device and server levels.
  - iii. Verification of continuous historical trending at the device and server levels. :
    - 1. Type of historical trend created in the database and required logic (delta vs accumulating)
    - 2. Increments of data storage
    - 3. Timestamp of data records
    - 4. Length of data storage at device and server levels
    - 5. Metrics and measured values for each meter application
  - iv. Point to point verification of collected data at the meter, device, and server levels (for water and electrical).
  - v. Review of anticipated life cycle and recalibration time periods for all installed meters.

**APPENDIX A: Building Level Measured Utility Metrics (Live Point and Historical Trend Increment).**

CATEGORY	DESCRIPTION	UNIT	INCREMENT
Electrical	Demand	kW	15 min
	Consumption	kWh	15 min
	Power Factor	pF	15 min
	Apparent Power	kVA	15 min
	Reactive Power	kVAR	15 min
Natural Gas	Flow	cfm or cfh	15 min
	Consumption	cf	15 min
Domestic Water	Flow	gpm	15 min
	Consumption	gallons	15 min
Makeup Water	Flow	gpm	15 min
	Consumption	gallons	15 min
Chilled Water (CHW)	Energy Rate	kBTU/hr	15 min
	Energy Consumption	kBTU	15 min
	CHW Tons of Refrigeration	Tons	15 min
	CHW Ton-Hours	Ton-hours	15 min
	CHW Supply Temp	°F	15 min
	CHW Return Temp	°F	15 min
	CHW Delta T	°F	15 min
	Flow	gpm	15 min
Heating Hot Water (HHW)	Energy Rate	kBTU/hr	15 min
	Energy Consumption	kBTU	15 min
	HHW Supply Temp	°F	15 min
	HHW Return Temp	°F	15 min
	HHW Delta T	°F	15 min
	Flow	gpm	15 min
Solar PV	Solar Power	kW	15 min
	Solar kWh Produced	kWh	15 min
	Solar Irradiance	W/m <sup>2</sup>	15 min
	Local Outside Air Temperature	°F	15 min

***APPENDIX B: Naming Conventions for Meter Points and Trends in the Data Acquisition Device, BAS server (if necessary) and Dashboard server.***

METER TYPE	POINT/TREND NAME*	UNIT	DESCRIPTION
Electric	“Location”_ELECTMETER_kWh	kWh	Electric consumption for Meter A
	“Location”_ELECTMETER_kW	kW	Electric demand for Meter A
	“Location”_ELECTMETER_kVA	kVA	Electric kVA for Meter A
	“Location”_ELECTMETER_kVAR	kVAR	Electric kVAR for Meter A
	“Location”_ELECTMETER_pf	Pf	Electric power factor for Meter A
Natural Gas	“Location”_GASMETER_Flow	Cfm	Natural gas flow for Meter A
	“Location”_GASMETER_CF	Cf	Natural gas consumption for meter A
Domestic Water	“Location”_DWMETER_Flow	Gpm	Domestic water flow for Meter A
	“Location”_DWMETER_Gal	Gallons	Domestic water consumption for Meter A
Makeup Water	“Location”_MUMETER_Flow	Gpm	Makeup water flow for Meter A
	“Location”_MUMETER_Gal	Gallons	Makeup water consumption for Meter A
Chilled Water (CHW)	“Location”_CHWMETER_EnergyRate	kBTU/hr	Energy rate for CHW Meter A
	“Location”_CHWMETER_TotalEnergy	kBTU	Energy Consumption for CHW Meter A
	“Location”_CHWMETER_Tons	Tons	Tons of Refrigeration for CHW Meter A
	“Location”_CHWMETER_TonHours	Ton-Hours	Ton-Hours for CHW Meter A
	“Location”_CHWMETER_ST	°F	Supply Temp for CHW Meter A
	“Location”_CHWMETER_RT	°F	Return Temp for CHW Meter A
	“Location”_CHWMETER_DeltaT	°F	Delta Temp for CHW Meter A
	“Location”_CHWMETER_Flow	Gpm	Water flow for CHW Meter A

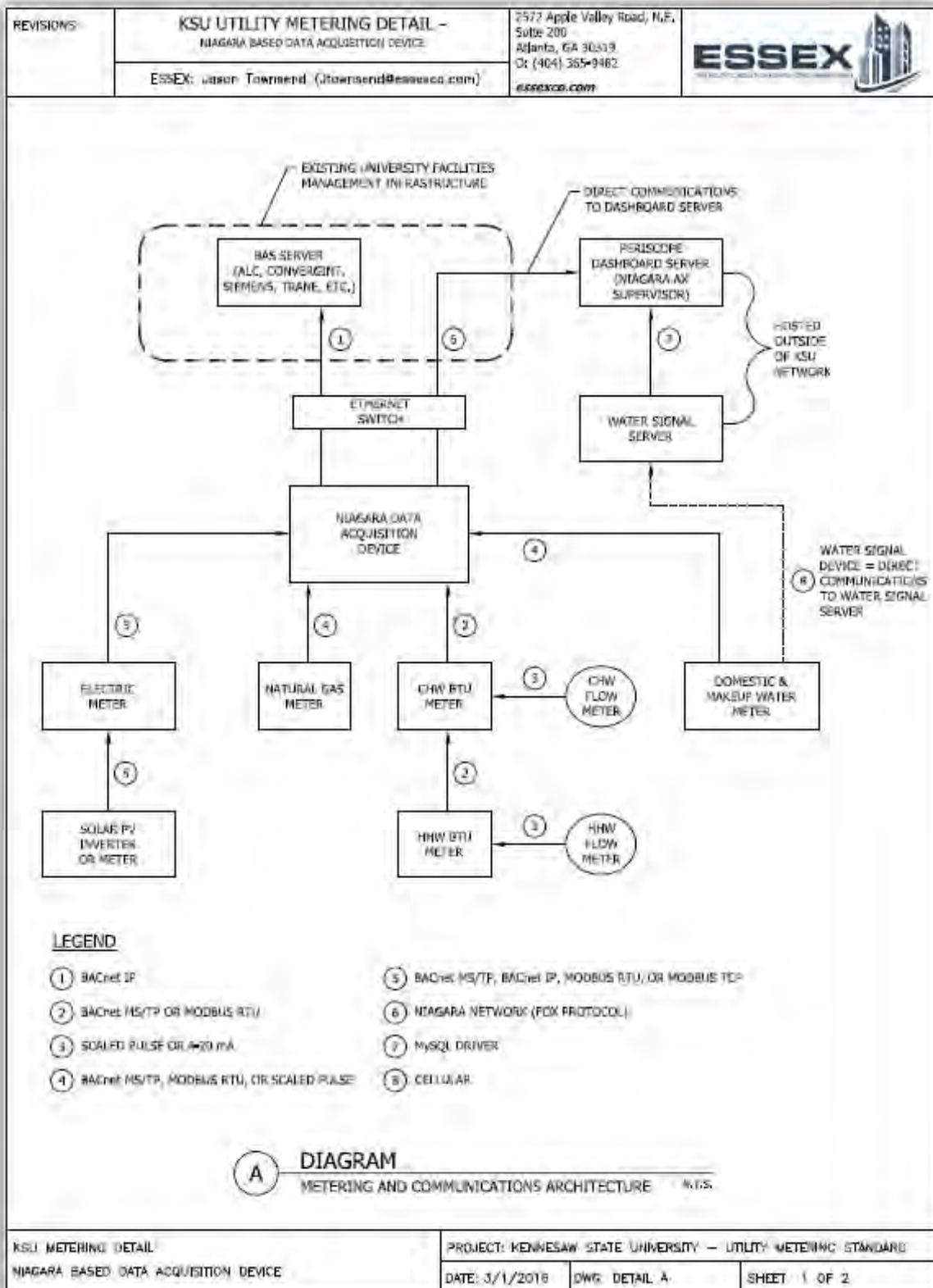
Heating Hot Water (HHW)	"Location"_HHWMETER_EnergyRate	kBTU/hr	Energy Rate for HHW Meter A
	"Location"_HHWMETER_TotalEnergy	kBTU	Energy Consumption for HHW Meter A
	"Location"_HHWMETER_ST	°F	Supply Temp for HHW Meter A
	"Location"_HHWMETER_RT	°F	Return Temp for HHW Meter A
	"Location"_HHWMETER_DeltaT	°F	Delta Temp for HHW Meter A
	"Location"_HHWMETER_Flow	Gpm	Water flow for HHW Meter A
Solar PV	"Location"_SolarPV_kWh	kWh	kWh for Solar PV A
	"Location"_SolarPV_kW	kW	kW for Solar PV A
	"Location"_SolarPV_Irradiance	W/m <sup>2</sup>	Solar Irradiance for Solar PV A
	"Campus"_OAT	°F	Outside Air Temp from Local Weather Station

**APPENDIX B NOTES:**

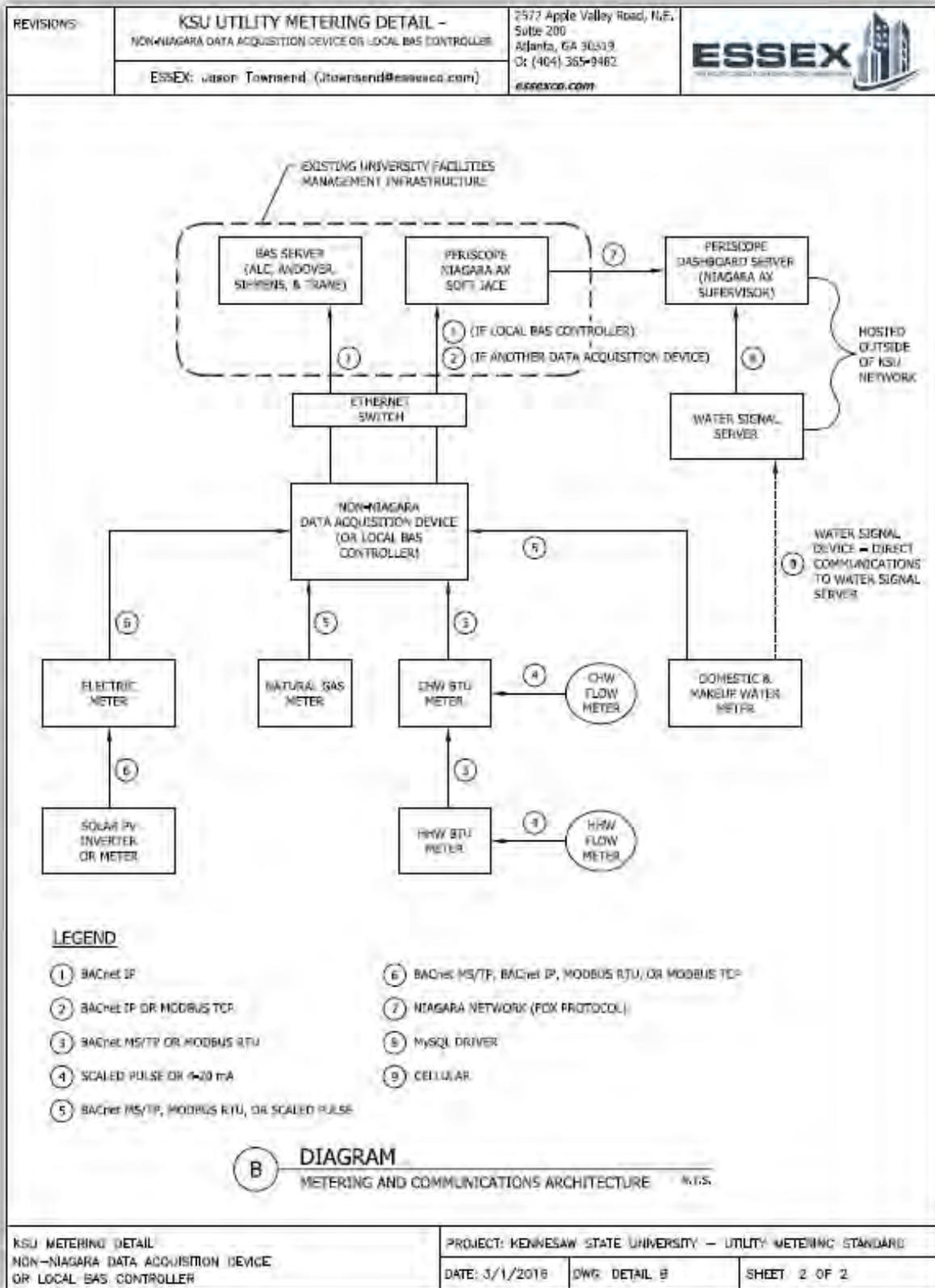
- "Location" in the table above refers to the square footage that is being metered.
  - If the meter is for the total building, use the building name in place of "location" in the table above.
    - For example, an electrical meter measuring building electrical consumption for the KSU Rec Center will have the point/trend name of "RecCenter\_ELECMETER\_kWh".
  - If the meter is measuring a sub-section of the building or specific equipment, use the name of the building and space or equipment that is being measured in place of "location" in the table above.
    - For example, an electrical meter measuring office electrical consumption in the Rec Center will have the point/trend name of "RecCenter\_Office\_ELECMETER\_kWh".

**APPENDIX C: Metering Communications Diagrams**

Diagram A - Metering and Communications Architecture When Utilizing a Niagara Based Data Acquisition Device.



**Diagram B - Metering and Communications Architecture When Utilizing a Non-Niagara Based Data Acquisition Device or Local BAS Controller.**



**APPENDIX 13 – UTILITY LOCATING PROCEDURES**

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## GA811 and KSU SOP for all Utility Locates and Excavations: 1-26-19

**Note:** The following standard operating procedure(SOP), as it relates to the contractor in charge of calling in the locate to GA811, does not relieve the contractor, subcontractor, or vendor of the burden and responsibilities that the PO or Contract requires, along with the rules and regulations of the State Mandated **GA811** Call Before You Dig Program.

KSU requires an **Intent to Dig** email notification ([ksucampuslocates@kennesaw.edu](mailto:ksucampuslocates@kennesaw.edu)) be sent to KSU Operations and a **mandatory** pre-dig meeting will be scheduled between the contractor and KSU Operations to review the following procedures:

- 1) Contractor calls GA811 to do locate on Campus (Kennesaw or Marietta Campus). Email a copy of locate ticket to [ksucampuslocates@kennesaw.edu](mailto:ksucampuslocates@kennesaw.edu). In addition, email us a Google Geo Map, Campus map, or engineered drawing identifying location of excavation.
- 2) Contractor clearly describes the area to be located within the call to GA811. Provide building name and address and request **ALL** utilities be located.
- 3) Contractor clearly marks the site with white paint as required by GA811.
- 4) Contractor shall email KSU to be present when locate is scheduled. Operations copies UITS to attend.
- 5) Locating company gives sufficient notice to contractor to notify KSU when locate will be done.
- 6) When all parties meet at the locate site KSU will attempt to verify utility locations with the contractor and the locate technician.
- 7) KSU will have 48 hours to study locate and verify, to the best of his/her knowledge, if the locates are accurate.
- 8) KSU will notify the contractor of any issues and, during this time, the contractor will **not** proceed to excavate.
- 9) After 48 hours and having reviewed locate with KSU the contractor may proceed to excavate by hand or machine.
- 10) If utilities are located in the area of the dig, potholing should be performed to confirm utility or utility locations.
- 11) Drilling, coring, jackhammering, or saw cutting of existing concrete floors, walls, or roofs must be x-rayed.

**Note:** If at any time it appears a utility has not been located, all work is to stop immediately, KSU is to be notified and another locate requested to the locate company. The above procedures will start over with each new locate request.

KSU Email Distribution List: Operations, Design and Construction, UITS, Parking, Public Safety, Housing, Grounds, Sports Stadium Complex, Environmental Health and Safety, Town Point, KSU Center.

KSU Locating Company is RHD Utility Locating, 404-874-8585, Contact Lesa Franitza, [RHDlocating.com](http://RHDlocating.com)

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**APPENDIX 14 – PLANT LIST**

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# Kennesaw State University Plant List

		Light				Soil				Ornamental Value										
		Native Plants	Ornamental	Shade Tree	Deciduous	Evergreen	Perennial	Specimen	Full Sun	Partial Shade	Shade	Dry Soil	Well-Drained	Moist Wooded Areas	Wet Soil	Wildlife	Flower	Leaf Color	Fall Color	Disease Resistance
<b>Large Trees</b>																				
Acer rubrum	Red Maple	■		■	■			■	■						■			■	■	
Acer saccharum	Sugar Maple	■		■	■			■	■					■				■	■	
Betula nigra	River Birch	■		■	■					■					■					
Ginkgo biloba	Ginkgo																	■	■	
Liriodendron tulipifera	Tulip-poplar	■		■	■			■	■					■					■	
Magnolia grandiflora	Southern Magnolia	■		■	■			■	■					■			■			
Pinus glabra	Spruce Pine	■		■	■			■	■					■						
Pinus strobus	White Pine	■		■	■			■	■				■							
Pinus taeda	Loblolly Pine	■			■						■									
Pinus virginiana	Virginia Pine	■			■						■									
Quercus alba	White Oak	■		■	■			■	■			■								
Quercus coccinea	Scarlet Oak	■		■	■			■	■			■							■	
Quercus hemisphaerica	Laurel Oak	■		■	■			■	■			■								
Quercus phellos	Willow Oak	■		■	■			■	■					■						
Quercus rubra	Northern Red Oak	■		■	■			■	■					■					■	
Taxodium distichum	Bald Cypress	■		■	■			■	■						■				■	
Ulmus athena	Athens Elm		■	■	■			■	■					■						
Ulmus parvifolia	Chinese Elm		■	■	■			■	■					■						
Zelkova serrata	Zelkova			■	■			■	■			■	■							

## Small Trees

Acer barbatum	Southern Sugar Maple	■		■	■			■	■			■							■	
Acer japonicum	Japanese Maple			■	■			■	■		■	■							■	
Carpinus Caroliniana	Ironwood				■			■	■			■							■	
Cercis canadensis	Eastern Redbud	■	■		■			■	■					■			■			
Cornus florida	Flowering Dogwood	■	■		■			■	■			■	■				■		■	
Halesia carolina	Carolina Silverbell	■			■			■	■			■					■		■	
Ilex decidua	Possumhaw	■	■		■			■	■			■	■			■				
Ilex opaca	American Holly	■	■		■			■	■			■	■			■				
Ilex vomitoria	Yaupon Holly	■	■		■			■	■			■	■		■			■		
Lagerstroemia indica	Crape Myrtle		■		■			■	■			■					■		■	
Oxendrum arboreum	Sourwood	■	■		■			■	■			■	■				■	■	■	
Prunus caroliniana	Cherry Laurel	■			■			■	■			■						■		
Prunus yedoensis	Yoshino Cherry		■		■			■	■			■					■		■	
Vaccinium arboreum	Sparkleberry	■			■			■	■			■	■				■		■	

# Kennesaw State University Plant List

		Light			Soil				Ornamental Value											
		Native Plants	Ornamental	Shade Tree	Deciduous	Evergreen	Perennial	Specimen	Full Sun	Partial Shade	Shade	Dry Soil	Well-Drained	Moist Wooded Areas	Wet Soil	Wildlife	Flower	Leaf Color	Fall Color	Disease Resistance
<b>Shrubs</b>																				
Abelia grandiflora nana	Edward Goucher Ableia		■		■			■	■	■			■				■		■	■
Aesculus parviflora	Bottlebrush Buckeye				■				■	■			■				■		■	
Amelanchier canadensis	Shadblow Serviceberry	■	■		■				■	■			■	■		■	■		■	
Berberis thunbergi autro	Pigmy Barberry		■			■			■			■	■					■		■
Camelia sasangua	Sasangua Camelia		■			■			■	■			■				■			
Cephalotaxus harringtonia	Japanese Plum Yew				■				■	■		■								
Chaenomeles lagenaria	Texas Quince		■		■				■	■			■				■	■		
Forsythia suspensa	Forsythia				■				■	■			■	■			■	■	■	■
Fothergilla gardenii	Dwarf Fothergilla	■	■		■				■	■						■		■	■	■
Hosta species	Hosta		■				■			■			■	■			■	■		
Hydrangea quercifolia	Oakleaf Hydrangea				■			■	■	■			■	■			■	■		
Ilex carissa	Carissa Holly					■			■	■			■							
Ilex cassine	Cassine Holly					■			■	■			■	■	■					
Ilex glabra	Inkberry	■				■			■	■			■		■			■		
Ilex vomitoria 'Nana'	Dwarf Yaupon		■						■	■			■	■				■		
Itea virginica	Virginia sweetspire	■	■		■				■	■					■			■		
Mahonia aquifolium	Oregon Hollygrape	■	■			■			■	■				■			■	■		
Mahonia bealei	Leatherleaf Mahonia	■				■			■	■				■			■	■		
Rhododendron alabamense	Alabama Azalea	■			■				■	■				■				■		
Rhododendron canescens	Honeysuckle Azalea	■	■		■				■	■			■	■			■			
Spiraea prunifolia	Bridal Wreath Spirea				■			■	■	■			■				■			
Spiraea x bumalda	Bumald Spirea				■			■	■	■			■				■			
Viburnum burkwoodi	Burkwood Viburnum				■	■		■	■	■			■				■	■	■	■
Viburnum juddii	Judd Viburnum				■	■		■	■	■			■				■	■	■	■
Viburnum opulus	Cranberry Bush Viburnum				■	■		■	■	■			■				■	■	■	■
Viburnum pragense	Pragense Viburnum				■	■		■	■	■			■				■	■	■	■
Viburnum rhytidophyllum	Leatherleaf Viburnum				■	■		■	■	■			■				■	■	■	■
Yucca aloifolia	Spanish Bayonet	■				■			■	■			■	■						

## Ornamental Grasses

Festuca cinerea	April Gruen		■					■	■				■				■	■	■	
Imperata cylindrica	Red Baron		■					■	■	■			■				■	■	■	
Miscanthus floridulus	Giant miscanthus		■					■	■	■			■				■		■	
Miscanthus sinensis purpurascens	Flame Grass		■					■	■	■			■				■		■	
Pennisetum alopecuroides-Hameln	Dwarf fountain Grass		■					■	■	■			■				■		■	
Pennisetum alopecuroides-Moudry	Black-seeded fountain Grass		■					■	■	■			■				■		■	
Pennisetum caudatum	White-flowered fountain Grass		■					■	■	■			■				■		■	

## Groundcover/Vines

Hemerocallis spec	Daylillies	■	■				■		■	■			■				■			
Liriope muscari monroe	Big Blue		■			■			■	■			■	■						■
Trachelospermum asiaticum	Asiatic Jasmine		■					■	■	■			■	■				■	■	■

**APPENDIX 15 – EXTERIOR ACCESSORIES CUTSHEETS**

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Create a timeless moment.®



## DYN-36

Delicately shaped 1.5 in. (38 mm) vertical steel bars meticulously crafted and fitted to do justice to the classic vase form. Gracefully fits in virtually any décor, sized to unobtrusively serve its purpose, designed to solve the conflicting requirements of capacity, footprint, precision, ease of use and beauty. Standard tapered formed lid. 36 gal (136 L) capacity. Also available as model DYN-45: 45 gal (170 L) capacity.

Covered by one or more of the following: US Patents D573,766 S; D542,993 S; Canada Reg. Des 114394.

### STANDARD

All fabricated metal components are steel shot-blasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

Other standard features include formed lid attached to the frame, high-density plastic liner, and rubber-tipped leveling feet on the base.

Interior plastic liners for our litter receptacles offer substantial value

[RETURN TO STANDARD VIEW](#)

### FEATURES

**.25 x 1.5 in (6 x 38 mm) Bars**

### MATERIAL

**Recycled Solid Steel Bar**

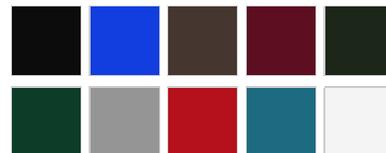
### COLORS

**Standard**

and are produced on molds that we designed and own. These plastic cans are reinforced, ribbed, and molded for durability, ease of use and greater capacity.

## OPTIONS

Dome lid (ashtrays available). Convex lid (self-close door available). Rain bonnet lid (ashtrays available). Recycle lids. Half-Moon liners. Custom decals.



### Optional RAL



## LIDS



## COORDINATING PRODUCTS



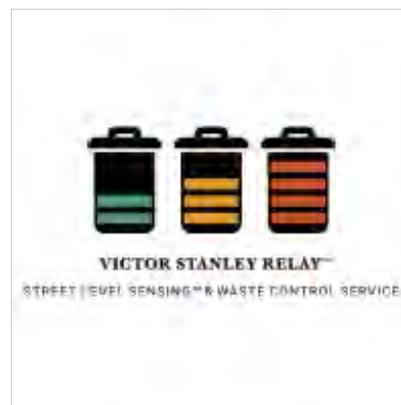
DYN-236

compare



RBW-28

compare



VS RELAY



Create a timeless moment.™



## DYN-342

An all-in-one solution for promoting recycling and litter containment. Top-loading with narrower, closely spaced 1 in (25 mm) wide vertical steel bars meticulously crafted and fitted to do justice to the classic vase form. Includes three 36 gallon (136 liter) liners and three lids in any combination: standard tapered formed lid, recycle lid and/or slotted lid. Shown with optional “standard decal package” including top band and lid decals.

Covered by one or more of the following: US Patent D595,916 S; Canada Reg. Des. 127429.

### STANDARD

All fabricated metal components are steel shot-blasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

Other standard features include formed lid attached to the frame, high-density plastic liners, and rubber-tipped leveling feet on the base.

Interior plastic liners for our litter receptacles offer substantial value

[RETURN TO STANDARD VIEW](#)

### MATERIAL

**Recycled Solid Steel Bar**

### CAPACITY

**Three 36 gal (136 L) Liners**

### FEATURES

**.25 x 1 in (6 x 25 mm) Bars**

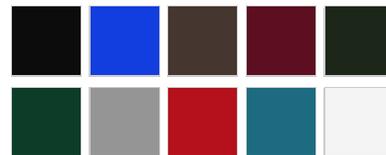
and are produced on molds that we designed and own. These plastic cans are reinforced, ribbed, and molded for durability, ease of use and greater capacity.

## OPTIONS

Dome lid (ashtrays available). Convex lid (self-close door available). Rain bonnet lid (ashtrays available). Spherical dome lid. Recycle lids. Standard decal package Galvanized steel liners (powder coat available). Half-Moon liners.

## COLORS

### Standard



### Optional RAL



## LIDS



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City Sites™

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Litter Receptacles

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#### Design Resources

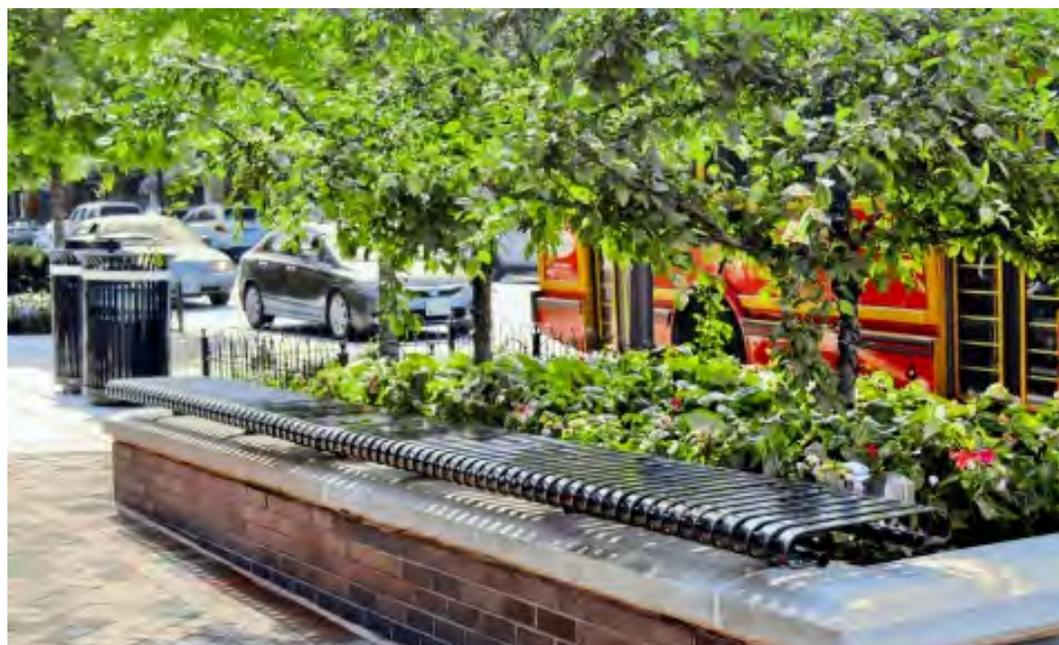
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Installations

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## FRB-6

This versatile backless steel bench can be used as a comfortable single straight bench or in combination with other FRB components to create larger seating configurations.

Steel scroll seating. 4, 6 or 8 ft (1.2, 1.8 or 2.4 m) length. Center leg standard with 8 ft (2.4 m) length.

### STANDARD

All fabricated metal components are steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

### OPTIONS

Surface mount. In-ground mount. Gull-wing mount. Wall-mount. Intermediate armrests (bolt-on). Junction braces for continuous configurations.

[RETURN TO STANDARD VIEW](#)

### FEATURES

**.25 x 1.5 in (6 x 38 mm) Bars**

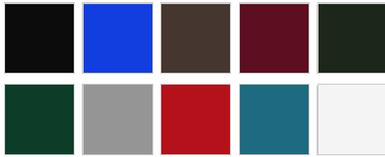
**Modular Seating**

### MATERIAL

**Recycled Solid Steel Bar**

### COLORS

**Standard**



**Optional RAL**



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Dynasty	Recycling Stations		LinkedIn	
Economy	Seats			
Fiberglass	Tables			
Framers Modern™				
Geometric				
GreenSites				
Homestead				
Ironsites®				
Parsons				
Perenne				
Production				



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## NRB-6

The versatile and very comfortable NRB-6 can be used as a straight bench or in combination with other straight or curved NRB bench sections to create larger seating areas. Curved sections (inside- and outside-facing) are also available to be used in conjunction with straight sections that enable maximum design latitude for square and rectangular benches or serpentine configurations.

Steel scroll seating. 4, 6 or 8 ft (1.2, 1.8 or 2.4 m) length. Custom lengths are available.

### STANDARD

All fabricated metal components are steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

### OPTIONS

Intermediate armrests (bolt-on). Surface mount. In-ground mount. Gull-wing mount. Wall-mount. Back-to-back mount. Junction

[RETURN TO STANDARD VIEW](#)

## FEATURES

**.25 x 1.5 in (6 x 38 mm) Bars**

**Modular Seating**

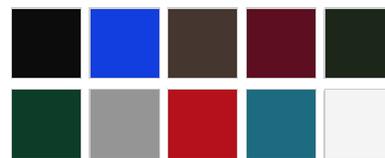
## MATERIAL

**Recycled Solid Steel Bar**

## COLORS

braces for continuous configurations.

**Standard**



**Optional RAL**



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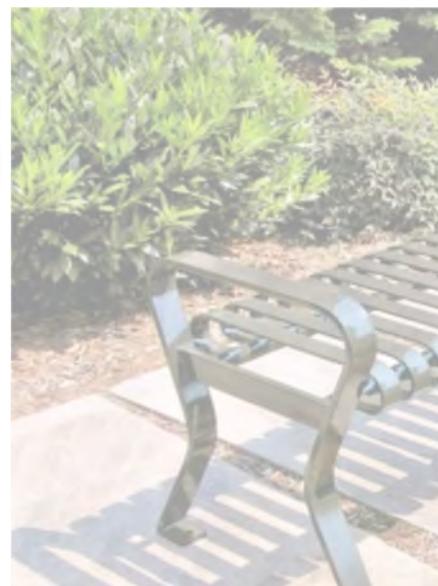


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Corridor	Litter Receptacles		E-news Sign-up	
Cycle Sentry™	Planters		Follow Us,	
Dynasty	Recycling Stations		Facebook   Twitter	
Economy	Seats		LinkedIn	
Fiberglass	Tables			
Framers Modern™				
Geometric				
GreenSites				
Homestead				
Ironsites®				
Parsons				
Perenne				
Production				



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RB-12

An elegant backless bench with superb construction and design similar to the Model RB-28. The quality and durability of this bench assures that it will stay beautiful for many years to come.

Twenty-seven .25 x 1.5 in (6.4 x 38 mm) steel seat slats.

Finished end sections are .5 x 2 in (13 x 51 mm) solid steel bar, welded and ground.

4, 6 or 8 ft (1.2, 1.8 or 2.4 m) lengths. 8 ft (2.4 m) length includes center leg. Steel scrolls. Surface mount tabs.

## STANDARD

All fabricated metal components are steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

## OPTIONS

Intermediate armrests. Center leg with armrest for 8 ft (2.4 m) length.

[RETURN TO STANDARD VIEW](#)

## MATERIAL

**Recycled Solid Steel Bar**

## LENGTH

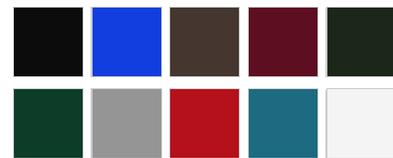
**4 ft (1.2 m)**

**6 ft (1.8 m)**

**8 ft (2.4 m)**

## COLORS

### Standard



### Optional RAL



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## RB-28

**Furniture-Quality Finish Joints:** The beautiful RB-28 bench is one of our most popular products. Its simple but elegant design enhances all site schemes. The quality and durability of this bench assures that it will stay beautiful for many years to come. Elaborate finishing detail of polished welds across exposed joints. Meticulous care is taken to determine the most comfortable configuration of components for these benches while paying rigorous attention to their structural integrity.

Front welds are ground and polished until they form a continuous surface from the top tubular section to each vertical steel slat.

Twenty-seven .25 x 1.5 in (6.4 x 38.1 mm) steel seat members gently reverse contoured for maximum comfort.

Finished end sections are .5 x 2 in (12.7 x 50.8 mm) solid steel bar, welded and ground.

Integral welded end armrests are standard.

Vertical steel scrolls. Surface mount tabs.

### STANDARD

[RETURN TO STANDARD VIEW](#)

All fabricated metal components are steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

## OPTIONS

Intermediate armrests (bolt-on).

## MATERIAL

**Recycled Solid Steel Bar**

---

## LENGTH

**4 ft (1.2 m)**

**6 ft (1.8 m)**

**8 ft (2.4 m)**

---

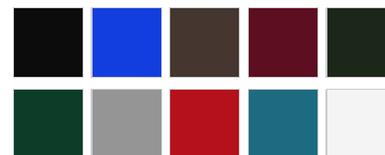
## FEATURES

**Polished Welds**

---

## COLORS

### Standard



### Optional RAL





Create a timeless moment.™



## RB-36

A 36 gal (136 L), tastefully flared litter receptacle. This beautifully tapered receptacle offers Ironsites® style and durability at an extraordinary value. Also available as models RB-24: 24 gal (90 L) and RB-45: 45 gal (170 L) capacities.

Standard tapered formed lid. Bottom recessed pedestal.

### STANDARD

All fabricated metal components are steel shotblasted, etched, phosphatized, preheated and electrostatically powder-coated with TGIC polyester powder coatings.

Other standard features include a formed lid attached to the frame with two vinyl-coated steel aircraft cables, a high-density plastic liner, and rubber-tipped leveling feet on the base.

Interior plastic liners for our litter receptacles offer substantial value and are produced on molds that we designed and own. These plastic cans are reinforced, ribbed, and molded for durability, ease of use, and greater capacity.

RETURN TO STANDARD VIEW

### FEATURES

#### Bottom Recessed Pedestal

**Tapered .375 x 1 in (10 x 25 mm)  
Bars**

### MATERIAL

#### Recycled Solid Steel Bar

### TOP BAND

**2-1/2 in (64 mm)**

## OPTIONS

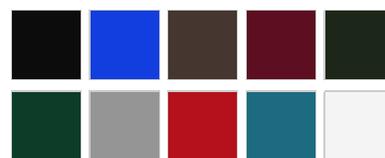
Victor Stanley Relay™ Sensor and Service available with dome, rain bonnet or spherical dome lids. Dome lid (ashtrays available). Convex lid (self-close door available). Rain bonnet lid (ashtrays available). Spherical dome lid (self-close door available). Recycle lids. Galvanized steel liner (powder coat available). Half-Moon liners. Custom decals and plaques.

## TOP RING

5/8 in (16 mm)

## COLORS

### Standard



### Optional RAL



## LIDS



## COORDINATING PRODUCTS



# DOWNTOWN RACK



## Security Is So Square

The Downtown Rack uses thick, square-tube construction that can't be cut with a pipe cutter. The extended width of the Downtown Rack makes for easy bike parking by giving the bike full support and multiple locking points for a u-style bike lock.



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# DOWNTOWN RACK

## YOUR LOGO HERE

Customize the Downtown Rack and brand your bike parking



## FINISH OPTIONS

Galvanized



Stainless

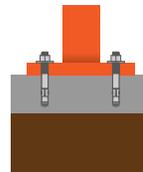


PVC Dip

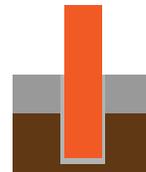


## MOUNT OPTIONS

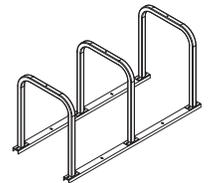
Surface



In-Ground



Rail



## Powder Coat

White	Black	Light Gray RAL 7042	Deep Red RAL 3003	Yellow RAL 1023
CNH Bright Yellow	Orange RAL 2004	Blue RAL 5005	Sky Blue RAL 5015	Hunter Green RAL 6005
Light Green RAL 6018	Green RAL 6016	Sepia Brown RAL 8014	Bronze	Silver 9007
Dark Purple	Flat Black	Wine Red RAL 3005	Beige RAL 1001	Iron Gray 7011

## Thermoplastic

Black	Green	Red	Blue	Gray	Brown
-------	-------	-----	------	------	-------



Optional Lean Bar

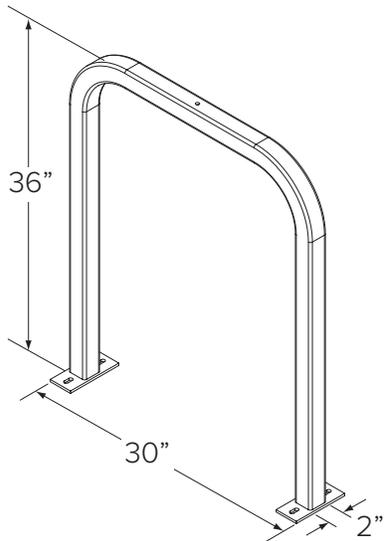
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# DOWNTOWN RACK

## Submittal Sheet

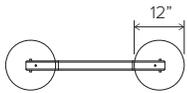


**CAPACITY** 2 Bikes

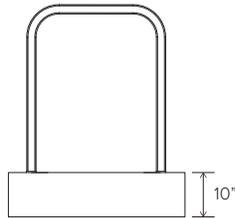
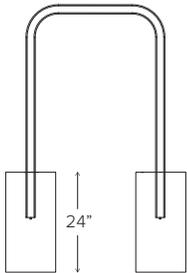
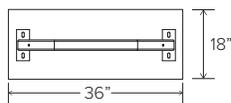
- MATERIALS**
- Standard**  
2" x 2" x .188" square tube - mild steel  
2" x 2" x .120" square tube - stainless steel
  - Lightweight**  
**\*Powder coat or galvanized only**  
2" x 2" x .083" square tube - mild steel

- FINISHES**
- Galvanized**  
An after fabrication hot dipped galvanized finish is our standard option.
  - Powder Coat**  
Our powder coat finish assures a high level of adhesion and durability by following these steps:  
1. Sandblast  
2. Epoxy primer electrostatically applied  
3. Final thick TGIC polyester powder coat

IN-GROUND MOUNT

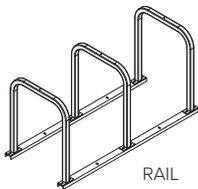


SURFACE MOUNT



**MOUNT OPTIONS**

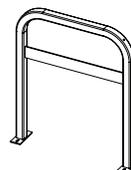
- Thermoplastic**  
In addition to an increased thickness (8-10mils), the thermoplastic finish covers a galvanized layer and offers superior impact resistance over powder coating.
- PVC Dip (plastisol)**  
Other colors available by special order (minimum orders apply)
- Stainless**  
Stainless Steel: 304 grade stainless steel material finished in either a high polished shine or a satin finish.
- In-ground**  
In ground mount is embedded into concrete base. Specify in ground mount for this option.
- Surface**  
Foot Mount has two 2.5"x6"x.25" feet with two anchors per foot. Specify foot mount for this option.
- Rail**  
Rail Mounted Downtown Racks are bolted to two parallel rails which can be left freestanding or anchored to the ground. Rails are heavy duty 3"x1.4"x3/16" thick galvanized mounting rails. Specify rail mount for this option.



RAIL

**OPTIONAL LEAN BAR**

- Add Lean Bar**



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# ANNAPOLIS

## Product Data Sheet



The Annapolis™ Bollard is a handsome sentinel that performs multiple maneuvers with style. Standard Bollard, Security Bollard and Smart Bollard share basic design and construction characteristics, specialize in their features and functions. Annapolis offers distinctive solutions in scope and detail for path making and wayfinding, safety and security in outdoor environments.

### Annapolis™ Standard Bollard

- Available in 6" and 12" diameter, with or without low-voltage LED lighting.
- A protective polyethylene sleeve is available in black or silver.
- Both sizes are designed to be securely embedded in concrete.
- For additional site flexibility, the 6" diameter is offered in a surface mount and a removable style; slides into supplied, embedded, galvanized steel socket.
- A keyed lock secures the bollard when in the socket.
- Upon removal, a cover plate fits flush with the surface; secured with a chain.
- Cover plate/chain stores within the bollard base when the bollard is in the socket.
- For the hardwired lit version, the following specifications apply:
  - LED rated life: 60,000 hrs
  - lumen output: 50 lumens
  - power consumption: approximately 3 watts
  - color temperature: 3500K
  - input voltage: 120-277 VAC
- All 6" styles, including 6" removable bollard may be fitted with the Smart bollard top to provide solar powered lighting.

### Annapolis™ Smart Bollard

- Embedded, removable, or surface mount bollard style.
- The monocrystalline solar panel collects energy from the sun and converts it to electrical current.
- Energy is stored in a sealed lead-acid rechargeable battery that delivers extremely reliable power output over a long period of time.
- The microprocessor-based charge controller turns lights on at dusk and off at dawn.
- 4 white LEDs (3500K) provide 360-degree visibility.
- For more detailed specifications, refer to Annapolis Smart Bollard technical chart on the following page.

### Annapolis™ Security Bollard

- Available in 6" and 12" diameter. 6" dia. security bollard may be specified with Smart solar-powered LED light.
- Security bollard is designed to be permanently embedded with a reinforced footing and internal concrete/steel reinforcement. Details for an optional security footing available on our website at [www.landscapeforms.com](http://www.landscapeforms.com)

	STYLE	DIAMETER	HEIGHT	PRODUCT WEIGHT
	6"	6"	33"	Surface Mount: 47lbs Embedded: 80lbs Removable: 107lbs
	12"	12"	33"	Embedded: 200lbs
	6" removable bollard			
	protective sleeve			
	lighted bollard top			

# ANNAPOLIS

## Product Data Sheet



### Finishes

- Metal is finished with Landscape Forms' proprietary Pangard II® polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling and fading.
- Call for standard color chart.

### To Specify

- Choose 6" or 12" diameter embedded style, 6" surface mount style, or 6" removable style.
- Specify black or silver protective polyethylene sleeve or without sleeve.
- Specify with or without lighting based on the following guidelines:
- 6" embedded and surface mount, available with hard wired or solar powered lighting; 6" removable only offered with solar lighting; 12" embedded only offered with hard wired lighting.

### Warranty

Landscape Forms, Inc. warrants all products (other than noted exceptions) to be free from defects in material and/or workmanship for a period of three years from date of invoice. Noted exceptions: LED lighting products are warranted for six years.

#### Designed by Brian Kane, IDSA

Annapolis Smart Bollard is protected by U.S. Patent Nos. D6,573,659; D6,013,985

#### SOLAR LIGHT SPECIFICATIONS:

Lamp	4 Nichia LEDs
Color Temp	3500K
LED Luminous Flux	76 lumens
LED Energy Consumption	.43 watt max
TM21 LED Lifespan	Up to 60,000 hours
Solar Top	tempered Borosilicate glass top with Mono-Crystalline PV cells
Diffused Lens	translucent acrylic
Protection Rating	IP66 for solar light assembly
Horizontal Output	360°
Average Direct Sunlight Exposure to Maintain Function	4 hours
Latitude Range	50° S to 50° N
Battery	valve regulated lead-acid
Nominal Battery Voltage	6 volts
Capacity	7.0 amp-hr at 20-hr discharge rate
Temperature Range	-40°F to 115°F
Maximum Operation	14 hours

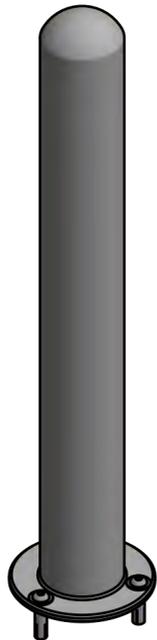
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# Bollard Post R-7902

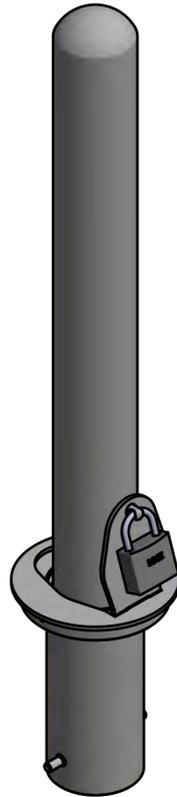
**Fixed Embedded Mount**  
(for detail, see sheet 2 of 7)



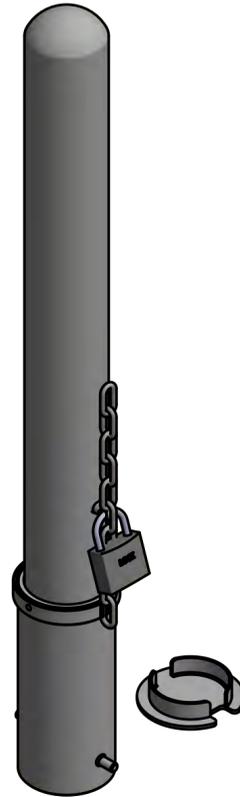
**Flanged Surface Mount**  
(for detail, see sheet 3 of 7)



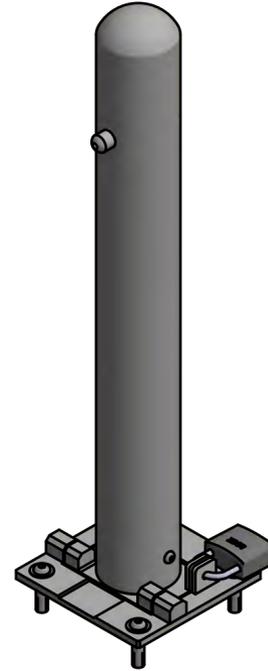
**Removable Receiver with Lid**  
(for detail, see sheet 4 of 7)



**Removable Receiver with Chain**  
(for detail, see sheet 5 of 7)

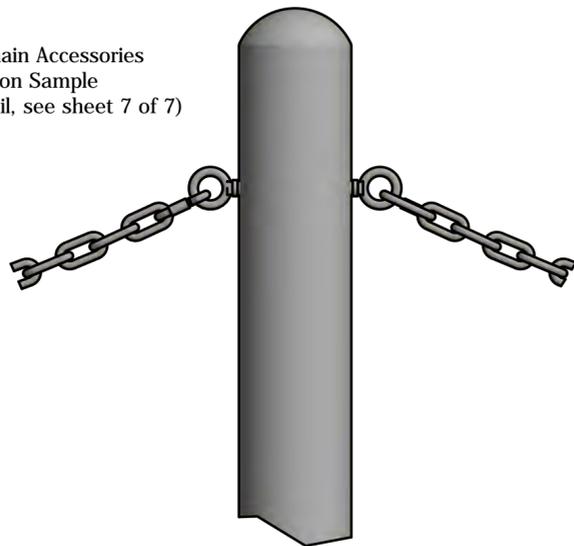


**Fold Down Mount**  
(for detail, see sheet 6 of 7)



## 5 Available Mounting Options

**5/16" Chain Accessories Installation Sample**  
(for detail, see sheet 7 of 7)



## Optional Chain Accessories Available



Chain Eye 3/8"  
(Powder Coated)



Quick Link Connector  
(Powder Coated)



Bollard Chain 5/16"  
(Powder Coated)

### General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

### Specifications:

Height: 36" ( Above Grade )  
Base Diameter: 4 3/8"  
Weight: 31 lbs ( Bollard Post Full Length )  
Material: Steel ( ASTM A36 )

### Finish Options:

⊙ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Installation Options:

- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

### Accessory Options:

- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

### Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)

**RELIANCE FOUNDRY**  
— SINCE 1925 —

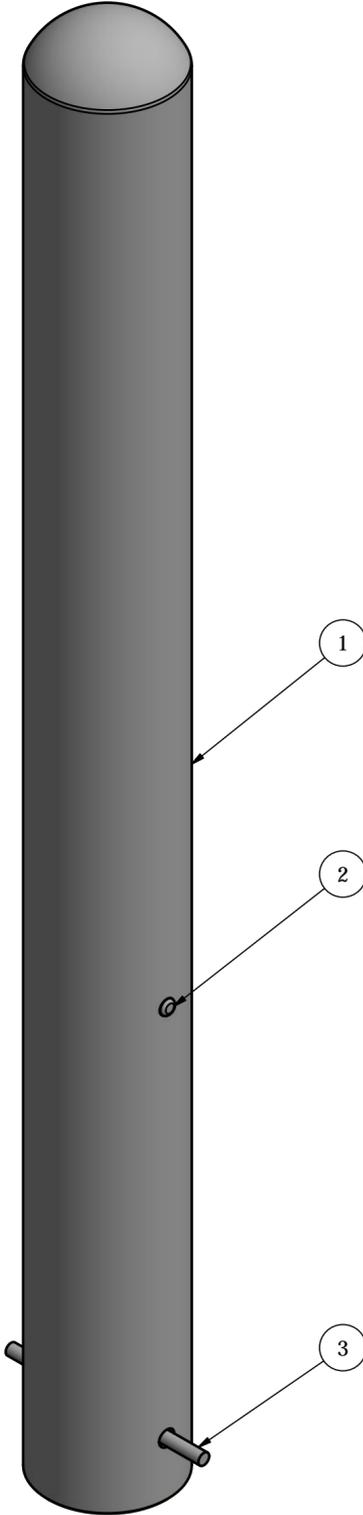
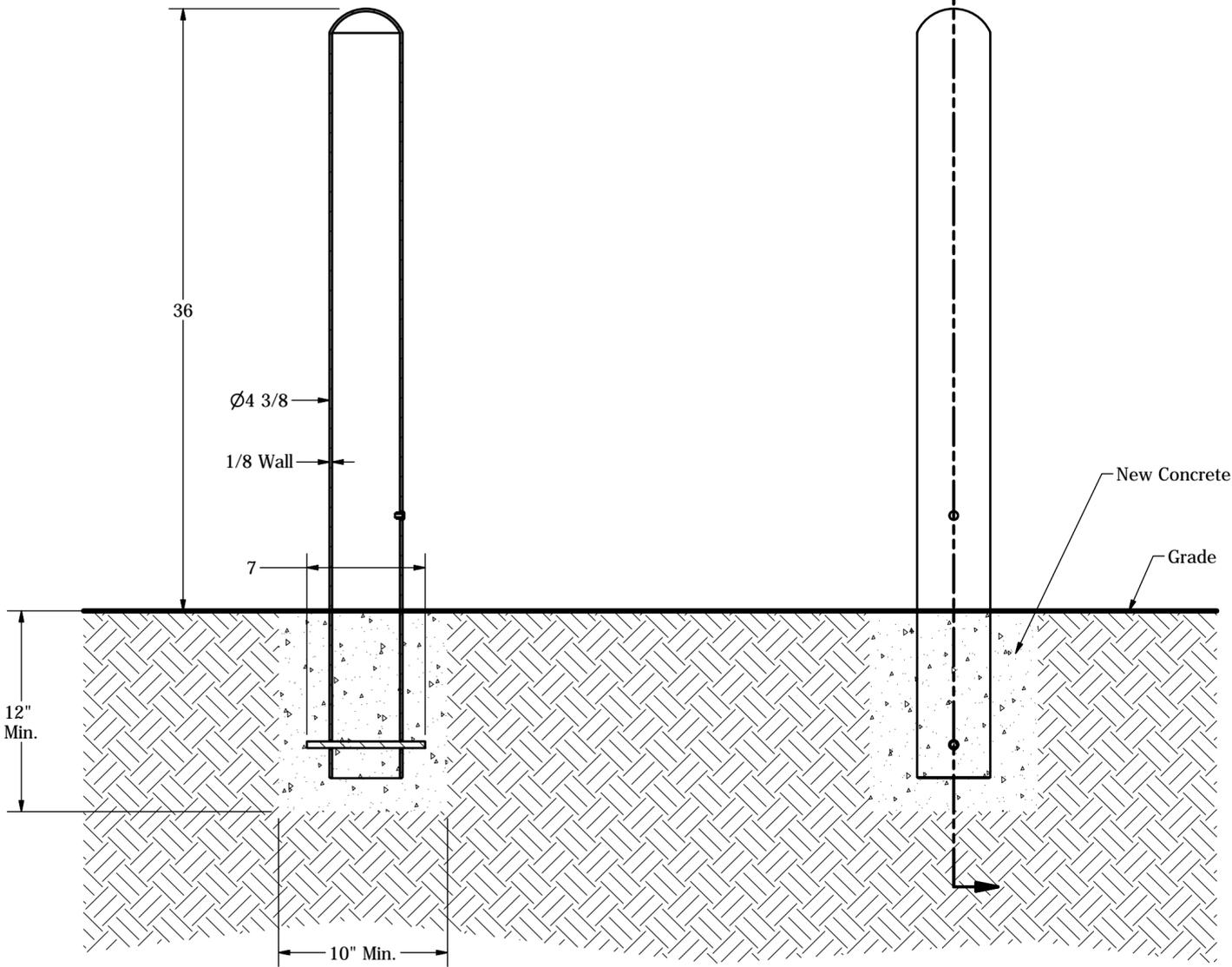
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1-877-789-3245 info@reliance-foundry.com  
[www.reliance-foundry.com](http://www.reliance-foundry.com)

TITLE

**Bollard Post R-7902**

SIZE	DWG NO	REV
C	R-7902	C1

# Bollard Post R-7902



## General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

## Specifications:

Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

## Finish Options:

☉ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

## Installation Options:

- ☉ Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

## Accessory Options:

- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

## Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)

### Notes:

- 1) Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 2) Bollard post is provided as shown. Concrete, foundation and/or installation ordered separately or provided by others.
- 3) Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 4) Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- 5) Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

### PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R7902 Fixed Bollard	R7902 Fixed Bollard Body	Steel Powder Coated	31 lbs
2	1	Polyethylene Plug 1/2"	Polyethylene Plug 1/2"	Polyethylene Plastic	
3	1	Steel Rebar	Steel Rebar 10 mm x 7"	Steel Epoxy Coated	3/8 lbs

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TITLE

**Bollard Post R-7902**

SIZE	DWG NO	REV
C	R-7902	C1

# Bollard Post R-7902

## General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

## Specifications:

Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

## Finish Options:

☉ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

## Installation Options:

- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- ☉ Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

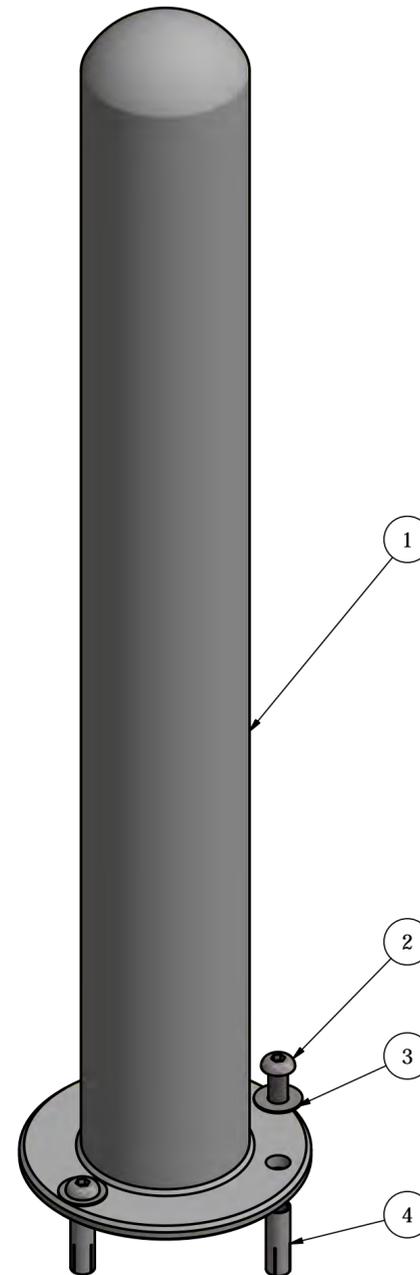
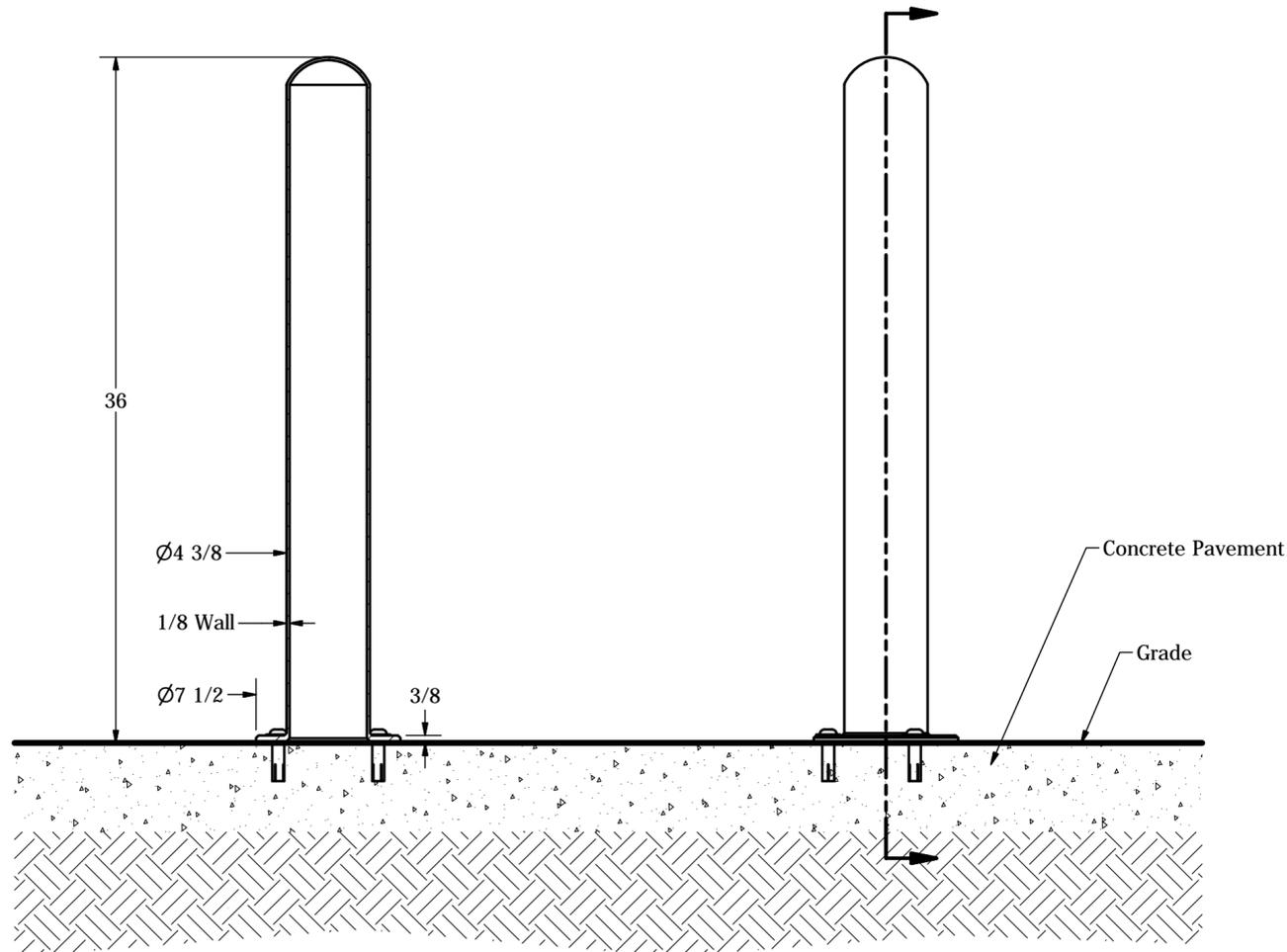
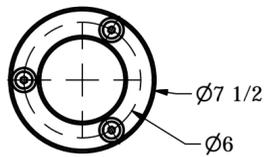
## Accessory Options:

- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

## Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)



### Notes:

- 1) Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 2) Bollard post is provided as shown. Concrete, foundation and/or installation ordered separately or provided by others.
- 3) Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 4) Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- 5) Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

### PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R7902 Flanged Bollard	R7902 Flanged Bollard Body	Steel Powder Coated	30 lbs
2	3	Button Head Bolt 1/2" x 1 1/4"	Hexagon Socket Button Head Cap Bolt 1/2" x 1 1/4" - requires 5/16" hex key	Stainless Steel	1/8 lbs
3	3	Stainless Steel Washer 1/2"	Stainless Steel Washer 1/2" OD 1 1/4" Thick .05"	Stainless Steel	
4	3	Drop-in Concrete Insert 1/2"	Drop-in Concrete Insert 1/2" - requires 5/8" x 2" hole (dia. x depth)	Steel Plated	1/8 lbs

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TITLE

**Bollard Post R-7902**

SIZE  
**C**

DWG NO  
**R-7902**

REV  
 C1

# Bollard Post R-7902

## General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

## Specifications:

Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

## Finish Options:

☉ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

## Installation Options:

- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- ☉ Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

## Accessory Options:

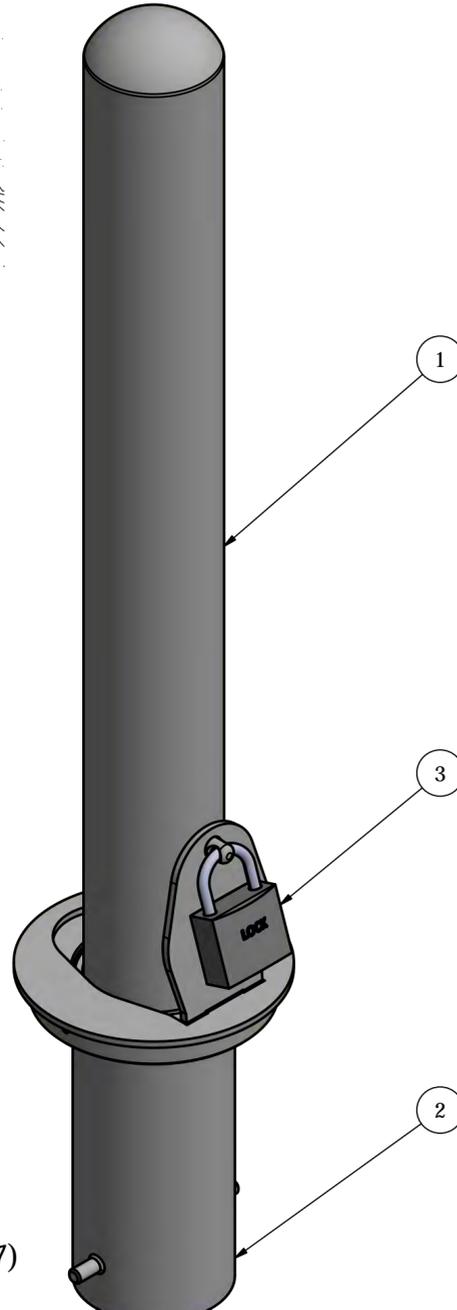
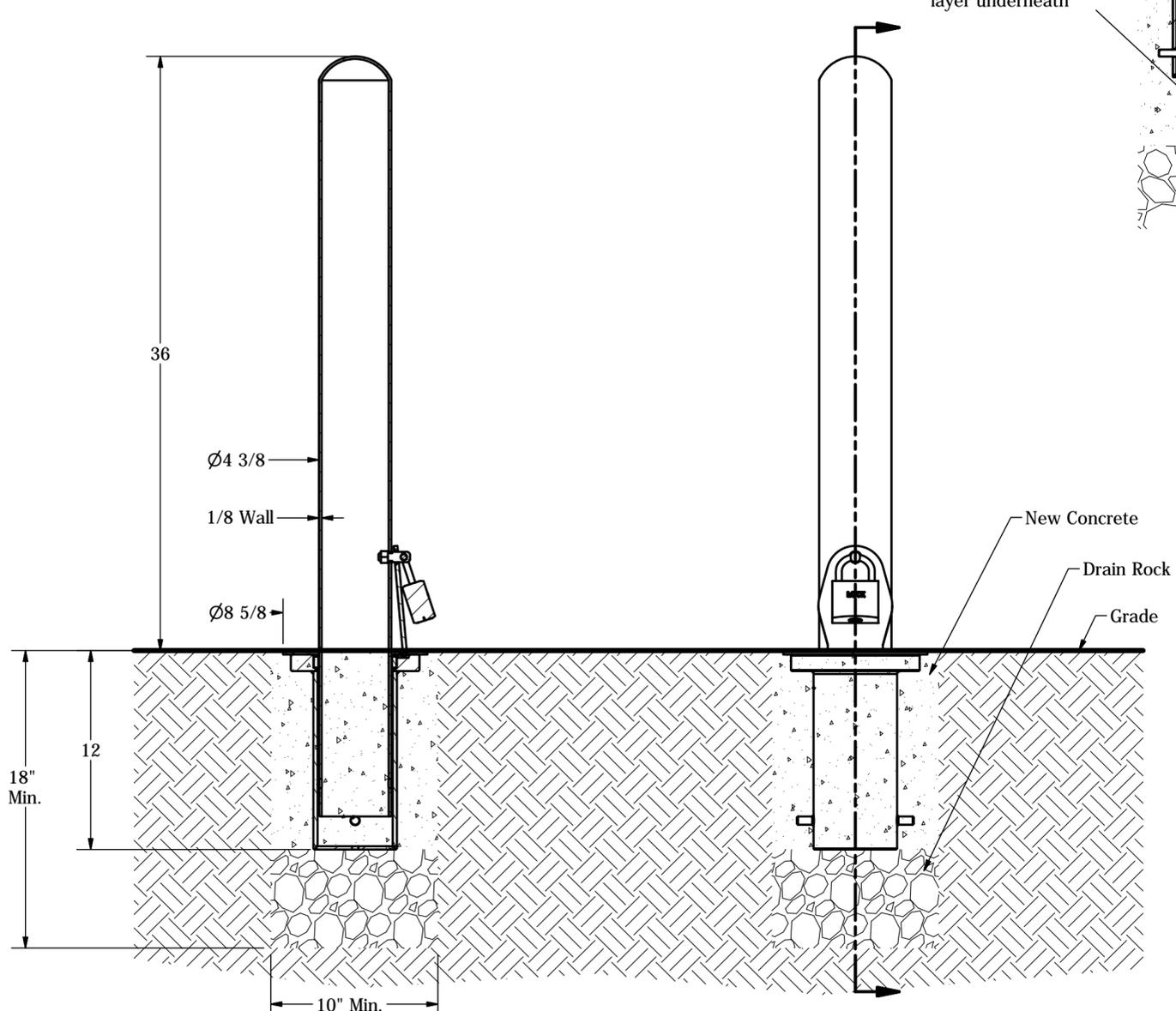
- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

## Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)

\* If local frost line exceeds 12" deep, provide adequate drainage by piping through concrete, connect to drain rock layer underneath



(For important detail regarding installation with OPTIONAL bollard chain accessories, refer to sheet 7 of 7)

### Notes:

- 1) Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 2) Bollard post is provided as shown. Concrete, foundation and/or installation ordered separately or provided by others.
- 3) Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- 4) Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- 5) Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

### PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R7902 Removable	Bollard R7902 Removable Assembly	Steel Powder Coated	31 lbs
2	1	R7901R Receiver	R7901R Receiver Assembly w/ Lid	Galvanized Steel w/ 316 Stainless Steel Cover	24 lbs
3	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs

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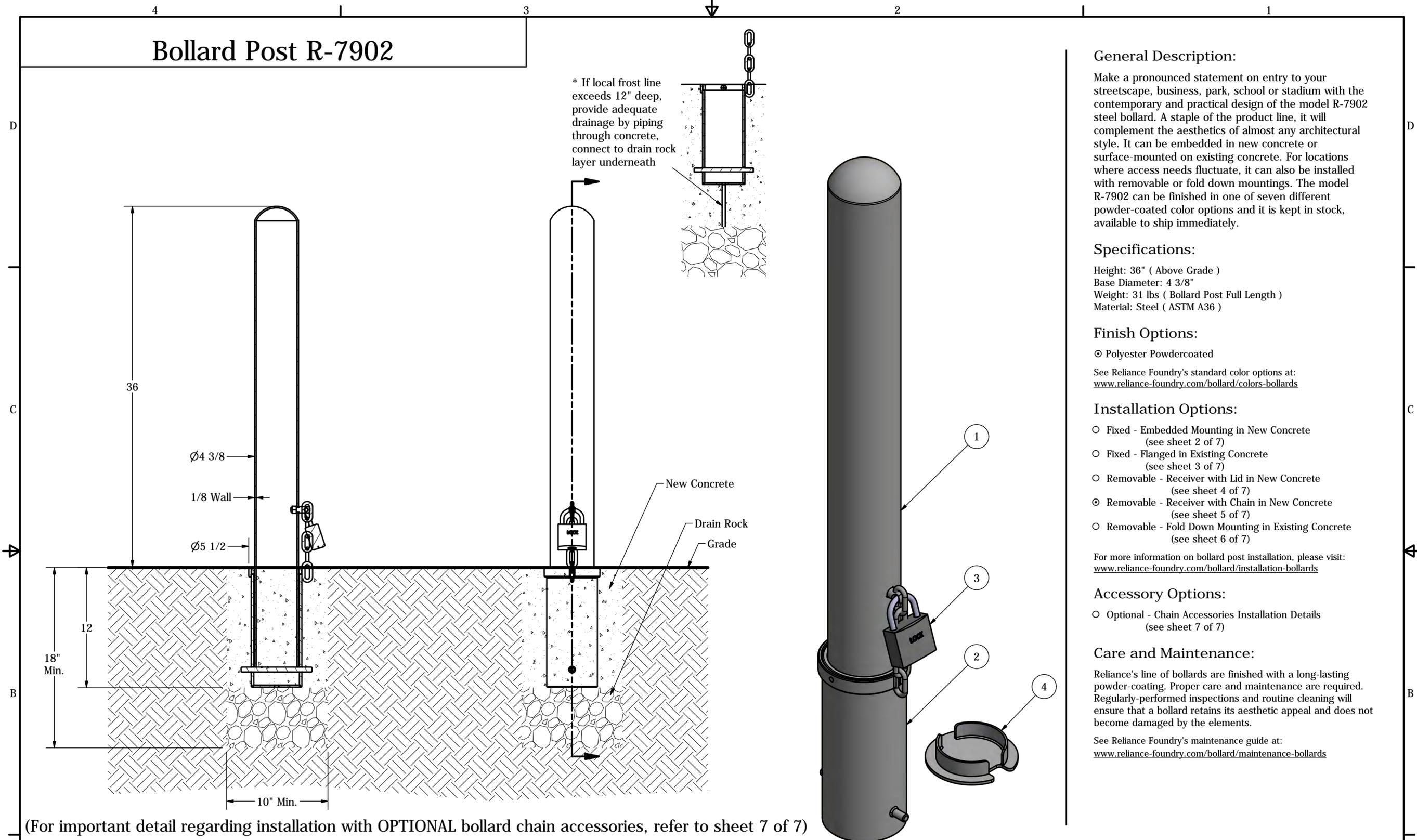
**Bollard Post R-7902**

SIZE  
**C**

DWG NO  
**R-7902**

REV  
**C1**

# Bollard Post R-7902



**General Description:**  
 Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

**Specifications:**  
 Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

**Finish Options:**  
 ☉ Polyester Powdercoated  
 See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

- Installation Options:**
- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
  - Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
  - Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
  - ☉ Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
  - Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

- Accessory Options:**
- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

**Care and Maintenance:**  
 Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.  
 See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)

(For important detail regarding installation with OPTIONAL bollard chain accessories, refer to sheet 7 of 7)

- Notes:**
- 1) Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
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  - 5) Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R7902 Removable	Bollard R7902 Removable Assembly	Steel Powder Coated	31 lbs
2	1	R7902R Receiver	R7902R Receiver Assembly	Galvanized Steel, w/ 304 Stainless Steel Chain	16 lbs
3	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs
4	1	R7902RC Receiver Cover (Optional)	Optional R7902RC Receiver Cover	304 Stainless Steel	2 lbs

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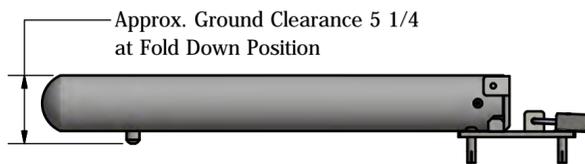
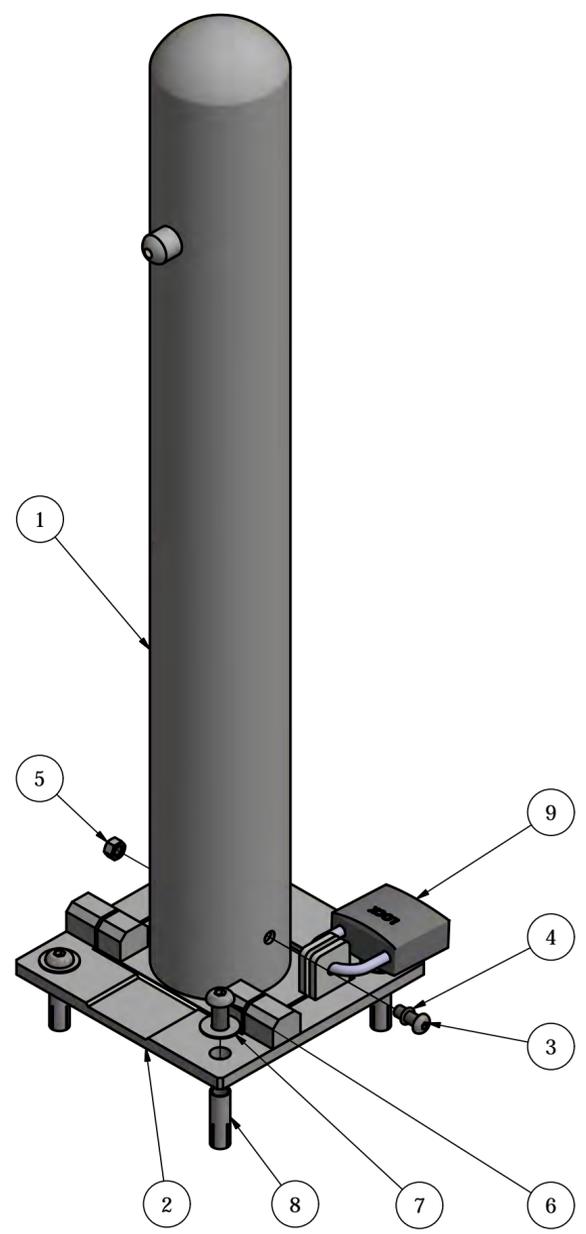
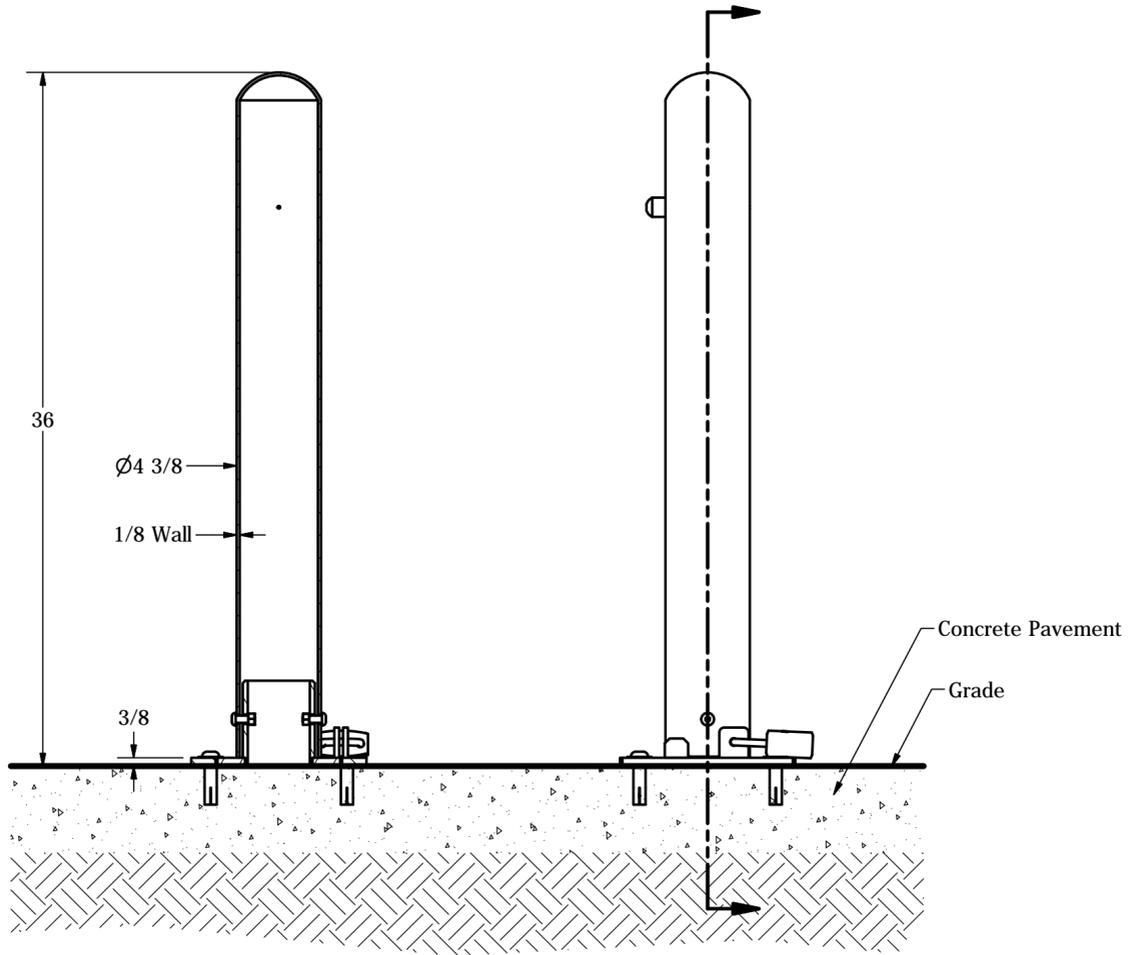
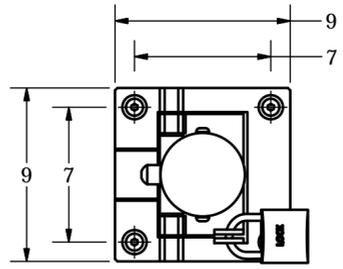
**Bollard Post R-7902**

SIZE <b>C</b>	DWG NO <b>R-7902</b>	REV C1
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NOT TO SCALE

SHEET 5 OF 7

# Bollard Post R-7902



## General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

## Specifications:

Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

## Finish Options:

☉ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

## Installation Options:

- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- ☉ Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

## Accessory Options:

- Optional - Chain Accessories Installation Details (see sheet 7 of 7)

## Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)

- Notes:
- 1) Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
  - 2) Bollard post is provided as shown. Concrete, foundation and/or installation ordered separately or provided by others.
  - 3) Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
  - 4) Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
  - 5) Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

### PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R7902 Fold Down Bollard	R7902 Fold Down Bollard Assembly	Steel Powder Coated	27 lbs
2	1	R7950A Fold Down Base	R7950A Fold Down Base Assembly	Steel HDG	15 lbs
3	2	Button Head Bolt 3/8" x 1"	Hexagon Socket Button Head Cap Bolt 3/8" x 1" - requires 7/32" hex key	Stainless Steel	
4	2	O-Ring 3/8"	Nitrile Rubber O-Ring 3/8"	Nitrile Rubber	
5	2	Hex Nut Nylon Lock 3/8"	Hex Nut Nylon Lock 3/8" - requires 9/16" wrench	Steel Plated Nylon Lock	
6	4	Button Head Bolt 1/2" x 1 1/4"	Hexagon Socket Button Head Cap Bolt 1/2" x 1 1/4" - requires 5/16" hex key	Stainless Steel	1/8 lbs
7	4	Stainless Steel Washer 1/2"	Stainless Steel Washer 1/2" OD 1 1/4" Thick .05"	Stainless Steel	
8	4	Drop-in Concrete Insert 1/2"	Drop-in Concrete Insert 1/2" - requires 5/8" x 2" hole (dia. x depth)	Steel Plated	1/8 lbs
9	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs

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## Bollard Post R-7902

SIZE	DWG NO	REV
C	R-7902	C1

# Bollard Post R-7902

## General Description:

Make a pronounced statement on entry to your streetscape, business, park, school or stadium with the contemporary and practical design of the model R-7902 steel bollard. A staple of the product line, it will complement the aesthetics of almost any architectural style. It can be embedded in new concrete or surface-mounted on existing concrete. For locations where access needs fluctuate, it can also be installed with removable or fold down mountings. The model R-7902 can be finished in one of seven different powder-coated color options and it is kept in stock, available to ship immediately.

## Specifications:

Height: 36" ( Above Grade )  
 Base Diameter: 4 3/8"  
 Weight: 31 lbs ( Bollard Post Full Length )  
 Material: Steel ( ASTM A36 )

## Finish Options:

☉ Polyester Powdercoated

See Reliance Foundry's standard color options at:  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

## Installation Options:

- Fixed - Embedded Mounting in New Concrete (see sheet 2 of 7)
- Fixed - Flanged in Existing Concrete (see sheet 3 of 7)
- Removable - Receiver with Lid in New Concrete (see sheet 4 of 7)
- Removable - Receiver with Chain in New Concrete (see sheet 5 of 7)
- Removable - Fold Down Mounting in Existing Concrete (see sheet 6 of 7)

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

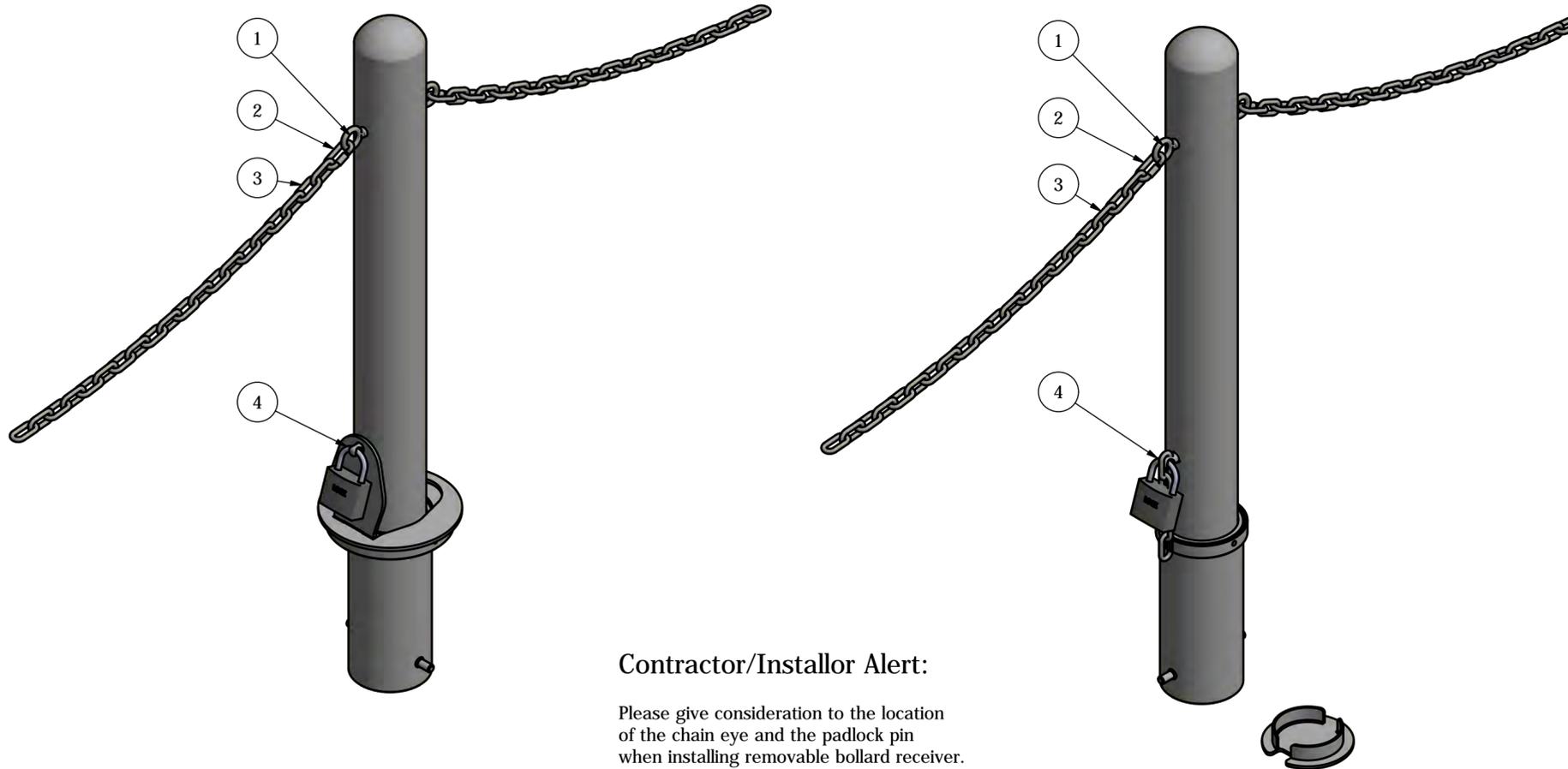
## Accessory Options:

- ☉ Optional - Chain Accessories Installation Details (see sheet 7 of 7)

## Care and Maintenance:

Reliance's line of bollards are finished with a long-lasting powder-coating. Proper care and maintenance are required. Regularly-performed inspections and routine cleaning will ensure that a bollard retains its aesthetic appeal and does not become damaged by the elements.

See Reliance Foundry's maintenance guide at:  
[www.reliance-foundry.com/bollard/maintenance-bollards](http://www.reliance-foundry.com/bollard/maintenance-bollards)



### Contractor/Installor Alert:

Please give consideration to the location of the chain eye and the padlock pin when installing removable bollard receiver. It is important that the removable bollard receiver padlock pin is oriented in the same direction as the chain is intended to flow.

## Optional Chain Accessories Installation Details

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TITLE

**Bollard Post R-7902**

SIZE  
**C**

DWG NO  
**R-7902**

REV  
**C1**

### PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	MATERIAL
1	Chain Eye 3/8" (Optional)	Optional Chain Eye 3/8"	Steel Powder Coated
2	Quick Link Connector (Optional)	Optional Quick Link Connector	Steel Powder Coated
3	Chain 5/16" (Optional)	Optional Chain 5/16" (Sold by Length)	Steel Powder Coated
4	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel

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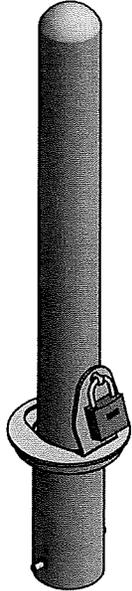
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SHEET 7 OF 7

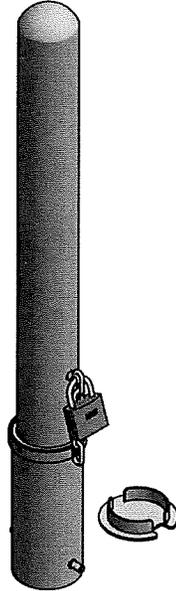
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# Bollard Post, Model R-8902

Removable Receiver with Lid  
(for detail, see sheet 2 of 7)



Removable Receiver with Chain  
(for detail, see sheet 3 of 7)



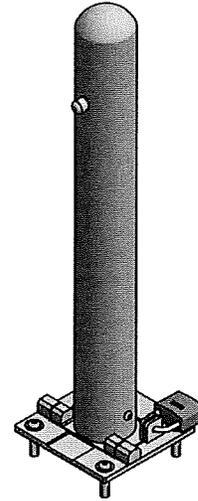
Fixed Embedded Mount  
(for detail, see sheet 4 of 7)



Flanged Surface Mount  
(for detail, see sheet 5 of 7)

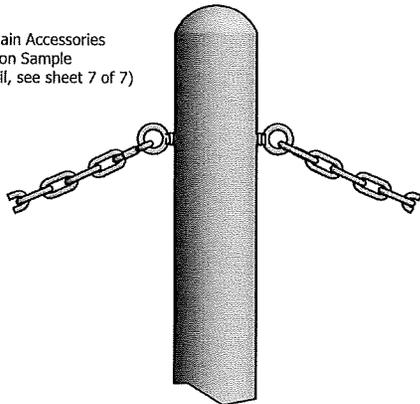


Fold Down Mount  
(for detail, see sheet 6 of 7)



## 5 Available Mounting Options

5/16" Chain Accessories Installation Sample  
(for detail, see sheet 7 of 7)



## Optional Chain Accessories Available



Chain Eye 3/8"  
(Powder Coated)



Quick Link Connector  
(Powder Coated)



Bollard Chain 5/16"  
(Powder Coated)

## General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit:  
[www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

## Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

### Finish Options:

- ⊙ Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at  
[www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

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TITLE

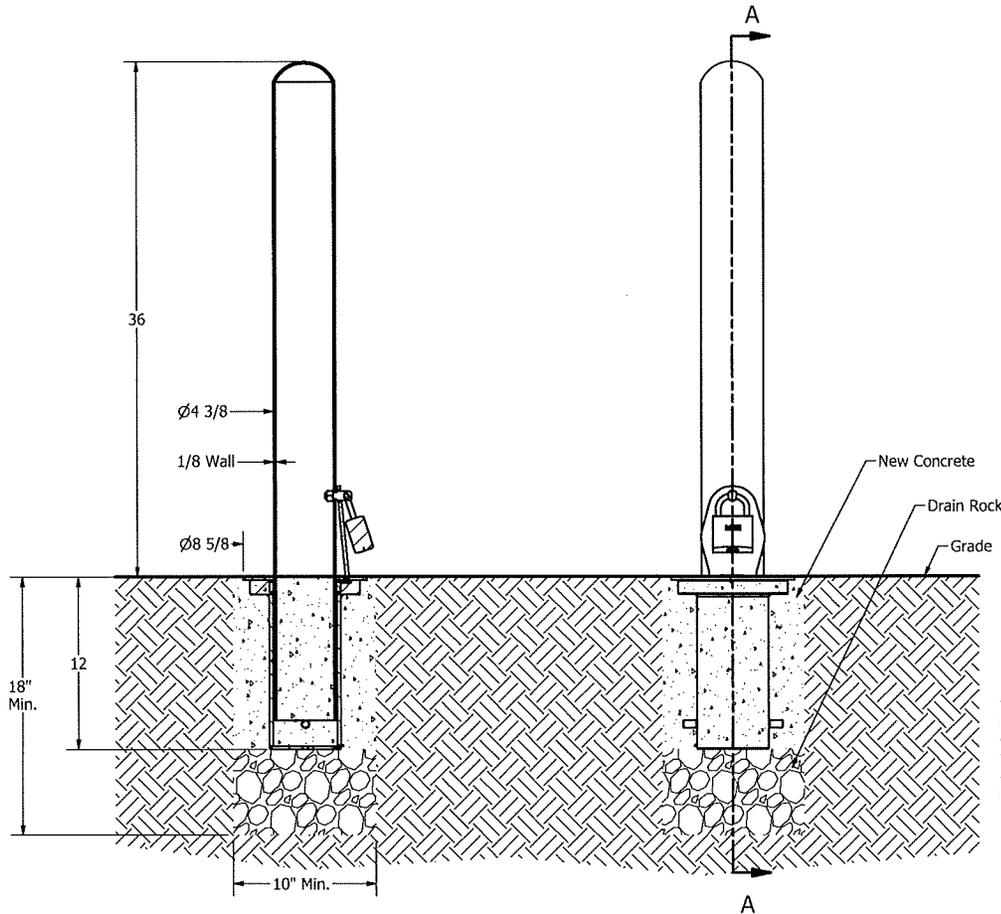
Bollard Post, Model R-8902

SIZE  
C

DWG NO  
R-8902

REV  
C1

# Bollard Post, Model R-8902



SECTION A-A

## Removable Receiver with Lid

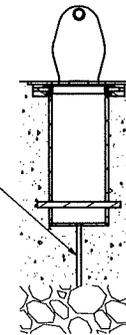
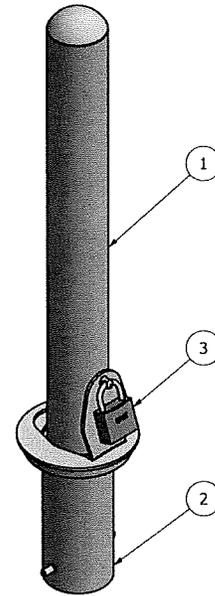
(For important detail regarding installation with OPTIONAL bollard chain accessories, refer to sheet 7 of 7)

### Notes:

- Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- Bollard post is provided as shown, with material detailed in legend below. Concrete, foundation and/or installation ordered separately or provided by others.
- This drawing is not drawn to scale. Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R8902 Removable	Bollard R8902 Removable Assembly	Stainless Steel 316	32 lbs
2	1	R8901R Receiver	R8901R Receiver Assembly w/ Lid	Stainless Steel 316	25 lbs
3	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs

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\* If local frost line exceeds 12" deep, provide adequate drainage by piping through concrete, connect to drain rock layer underneath

### General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

### Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

### Finish Options:

- Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Mount Options:

- ✓ Removable Receiver with Lid (see sheet 2 of 7)
- Removable Receiver with Chain (see sheet 3 of 7)
- Fixed Embedded Mount (see sheet 4 of 7)
- Flanged Surface Mount (see sheet 5 of 7)
- Fold Down Mount (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)

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TITLE

Bollard Post, Model R-8902

SIZE  
C

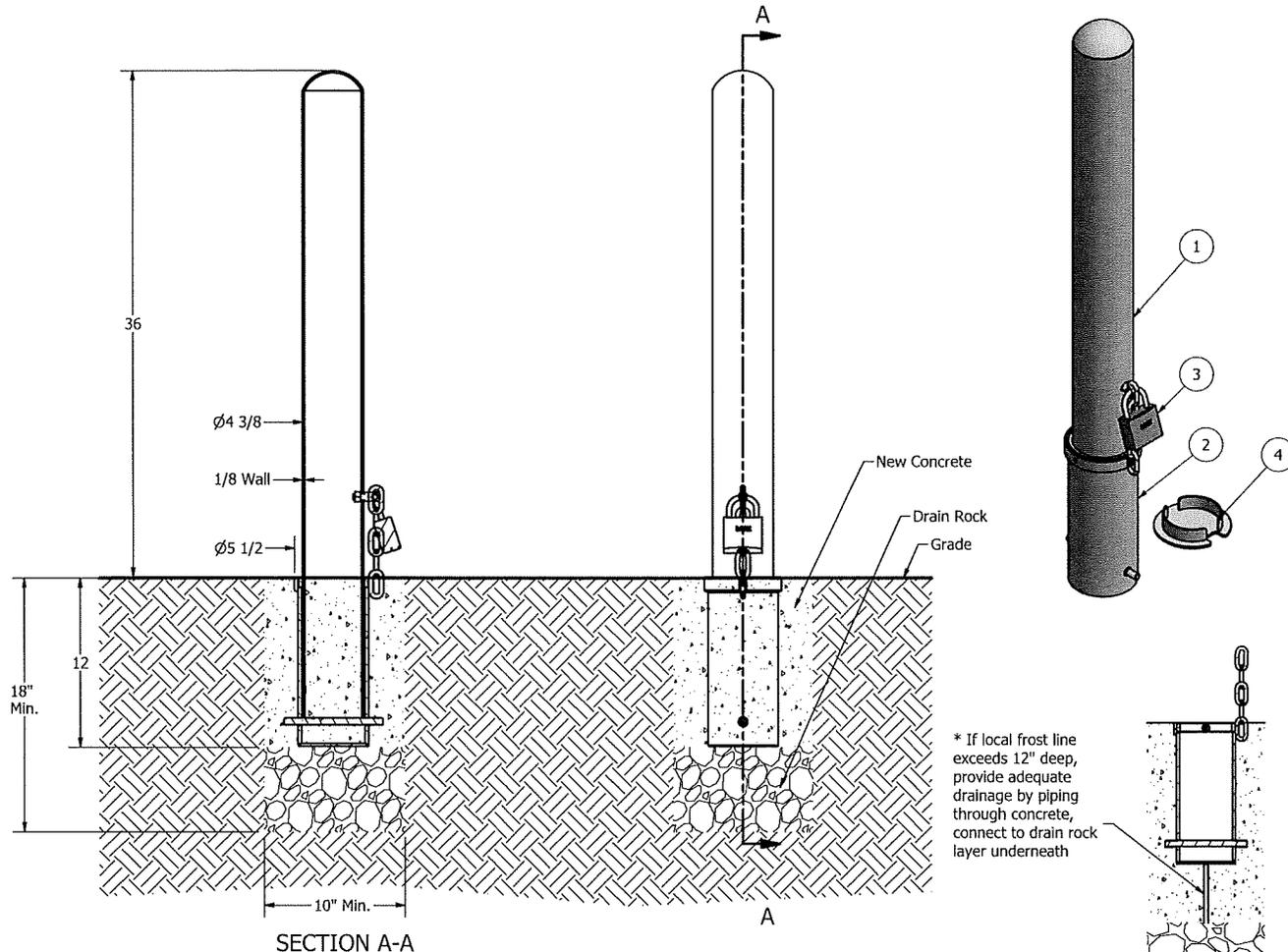
DWG NO  
R-8902

REV  
C1

NOT TO SCALE

SHEET 2 OF 7

# Bollard Post, Model R-8902



SECTION A-A

## Removable Receiver with Chain

(For important detail regarding installation with OPTIONAL bollard chain accessories, refer to sheet 7 of 7)

### Notes:

- Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- Bollard post is provided as shown, with material detailed in legend below. Concrete, foundation and/or installation ordered separately or provided by others.
- This drawing is not drawn to scale. Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

### General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/finstallation-bollards](http://www.reliance-foundry.com/bollard/finstallation-bollards)

### Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

### Finish Options:

- ⊙ Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Mount Options:

- Removable Receiver with Lid (see sheet 2 of 7)
- ✓ Removable Receiver with Chain (see sheet 3 of 7)
- Fixed Embedded Mount (see sheet 4 of 7)
- Flanged Surface Mount (see sheet 5 of 7)
- Fold Down Mount (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)

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TITLE

**Bollard Post, Model R-8902**

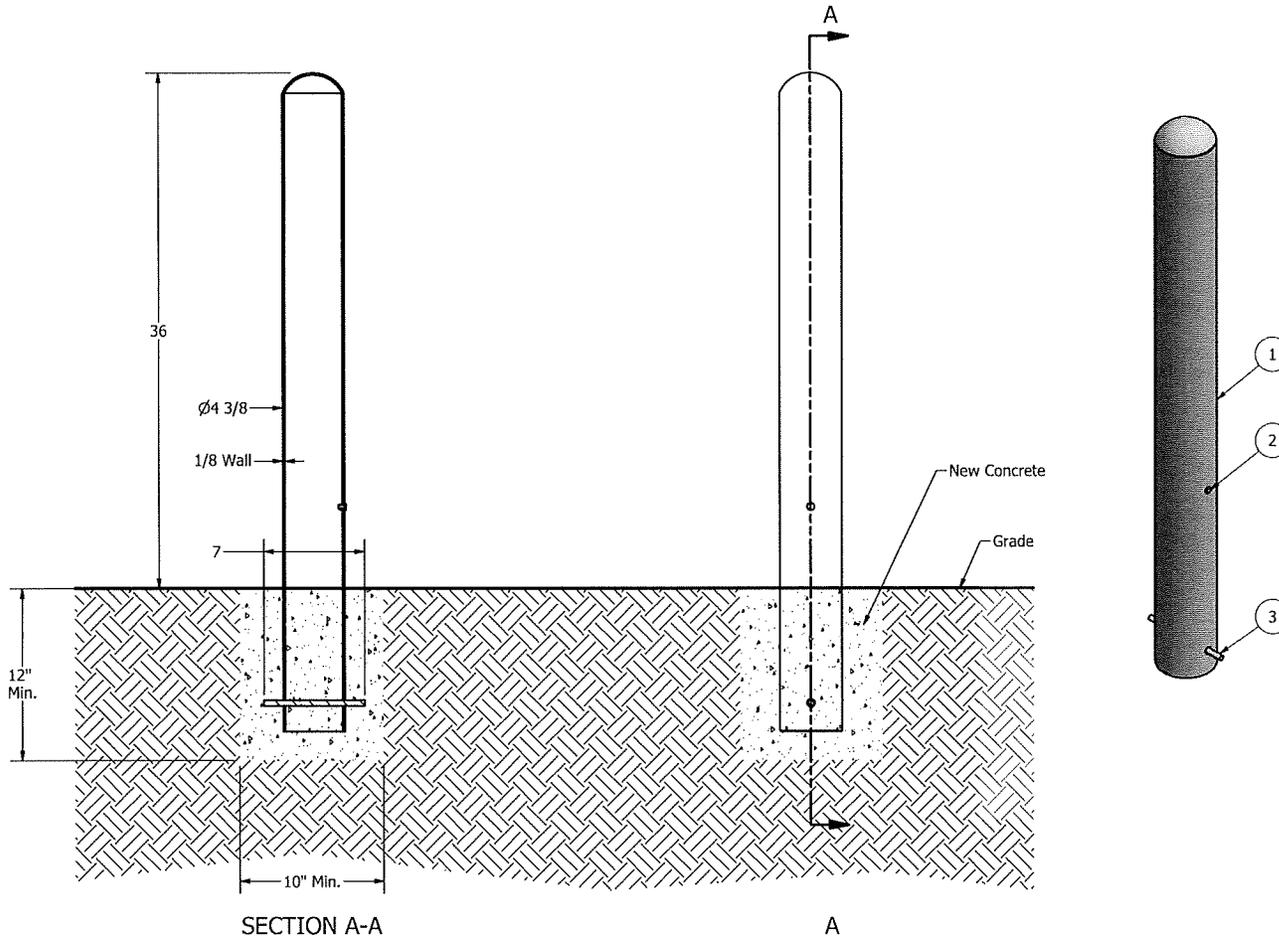
SIZE  
C

DWG NO  
R-8902

REV  
C1

PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R8902 Removable	Bollard R8902 Removable Assembly	Stainless Steel 316	32 lbs
2	1	R8902R Receiver	R8902R Receiver Assembly	Stainless Steel 316	17 lbs
3	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs
4	1	R8902RC Receiver Cover (Optional)	Optional R8902RC Receiver Cover	Stainless Steel 316	2 lbs

# Bollard Post, Model R-8902



## Fixed Installation in New Concrete

### Notes:

- Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- Bollard post is provided as shown, with material detailed in legend below. Concrete, foundation and/or installation ordered separately or provided by others.
- This drawing is not drawn to scale. Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R8902 Fixed Bollard	R8902 Fixed Bollard Body	Stainless Steel 316	32 lbs
2	1	Polyethylene Plug 1/2"	Polyethylene Plug 1/2"	Polyethylene Plastic	
3	1	Steel Rebar	Steel Rebar 10 mm x 7"	Steel Epoxy Coated	3/8 lbs

### General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

### Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

#### Finish Options:

- ⊙ Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Mount Options:

- Removable Receiver with Lid (see sheet 2 of 7)
- Removable Receiver with Chain (see sheet 3 of 7)
- ✓ Fixed Embedded Mount (see sheet 4 of 7)
- Flanged Surface Mount (see sheet 5 of 7)
- Fold Down Mount (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)

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TITLE

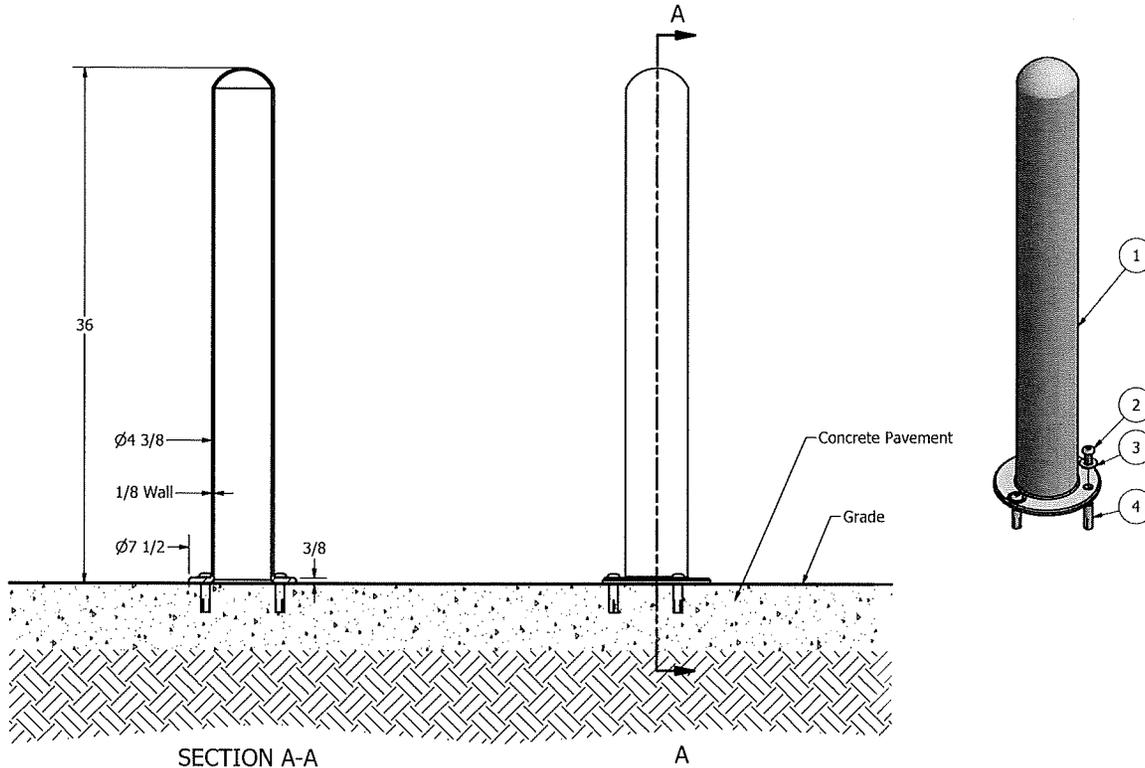
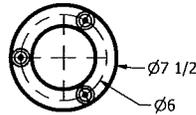
**Bollard Post, Model R-8902**

SIZE  
C

DWG NO  
R-8902

REV  
C1

# Bollard Post, Model R-8902



SECTION A-A

## Flanged / Surface Mount

### General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

### Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

### Finish Options:

- ⊙ Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Mount Options:

- Removable Receiver with Lid (see sheet 2 of 7)
- Removable Receiver with Chain (see sheet 3 of 7)
- Fixed Embedded Mount (see sheet 4 of 7)
- ✓ **Flanged Surface Mount** (see sheet 5 of 7)
- Fold Down Mount (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)

### Notes:

- Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- Bollard post is provided as shown, with material detailed in legend below. Concrete, foundation and/or installation ordered separately or provided by others.
- This drawing is not drawn to scale. Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

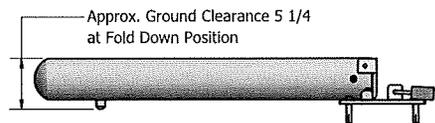
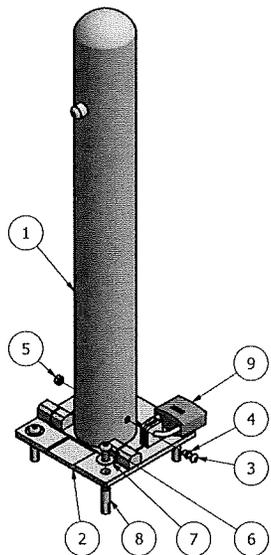
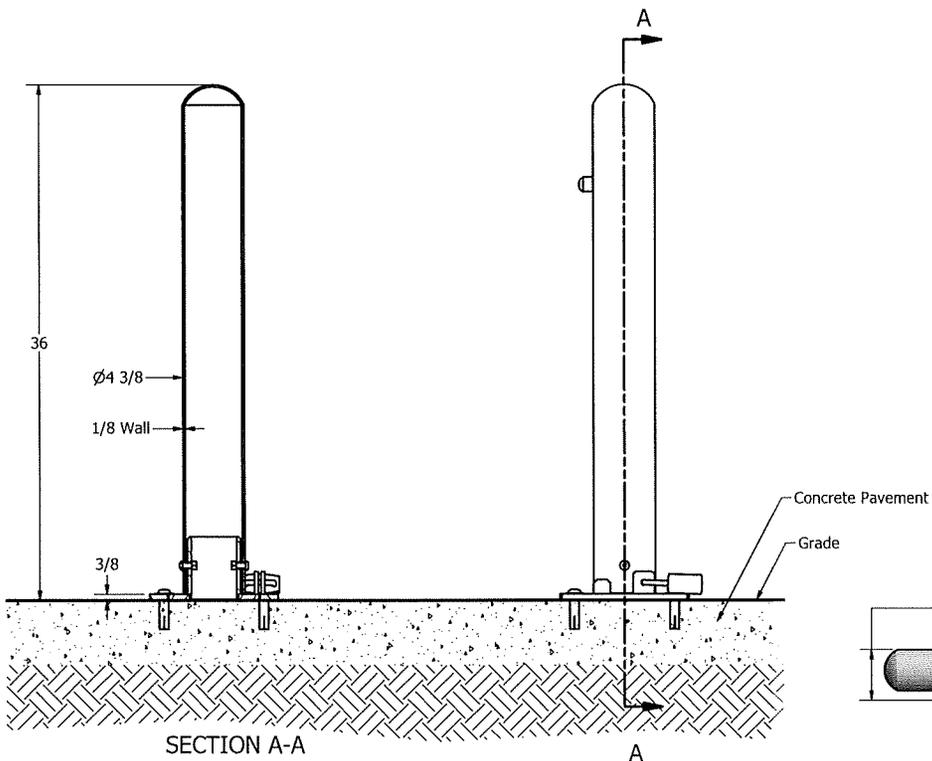
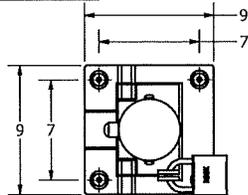
PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R8902 Flanged Bollard	R8902 Flanged Bollard Body	Stainless Steel 316	31 lbs
2	3	Button Head Bolt 1/2" x 1 1/4"	Hexagon Socket Button Head Cap Bolt 1/2" x 1 1/4" - requires 5/16" hex key	Stainless Steel	1/8 lbs
3	3	Stainless Steel Washer 1/2"	Stainless Steel Washer 1/2" OD 1 1/4" Thick .05"	Stainless Steel	
4	3	Drop-in Concrete Insert 1/2"	Drop-in Concrete Insert 1/2" - requires 5/8" x 2" hole (dia. x depth)	Steel Plated	1/8 lbs



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TITLE			
Bollard Post, Model R-8902			
SIZE	DWG NO	REV	
C	R-8902	C1	
NOT TO SCALE		SHEET 5 OF 7	

# Bollard Post, Model R-8902



Fold Down Mount

**Notes:**

- Embedment details are for reference illustration only. Minimum foundation sizes depend on local soil conditions, weather conditions, and engineering requirements.
- Bollard post is provided as shown, with material detailed in legend below. Concrete, foundation and/or installation ordered separately or provided by others.
- This drawing is not drawn to scale. Dimensions provided herein is for reference only. Please consult Reliance Foundry sales professionals if any dimension is critical to your particular installation.
- Reliance Foundry reserves the right to amend design and specifications without prior notice for product improvement.

PARTS LIST					
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	R8902 Fold Down Bollard	R8902 Fold Down Bollard Assembly	Stainless Steel 316	28 lbs
2	1	R7950A Fold Down Base	R7950A Fold Down Base Assembly	Steel HDG	15 lbs
3	2	Button Head Bolt 3/8" x 1"	Hexagon Socket Button Head Cap Bolt 3/8" x 1" - requires 7/32" hex key	Stainless Steel	
4	2	O-Ring 3/8"	Nitrile Rubber O-Ring 3/8"	Nitrile Rubber	
5	2	Hex Nut Nylon Lock 3/8"	Hex Nut Nylon Lock 3/8" - requires 9/16" wrench	Steel Plated Nylon Lock	
6	4	Button Head Bolt 1/2" x 1 1/4"	Hexagon Socket Button Head Cap Bolt 1/2" x 1 1/4" - requires 5/16" hex key	Stainless Steel	1/8 lbs
7	4	Stainless Steel Washer 1/2"	Stainless Steel Washer 1/2" OD 1 1/4" Thick .05"	Stainless Steel	
8	4	Drop-in Concrete Insert 1/2"	Drop-in Concrete Insert 1/2" - requires 5/8" x 2" hole (dia. x depth)	Steel Plated	1/8 lbs
9	1	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel	5/8 lbs

**General Description:**

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

**Specifications:**

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

**Finish Options:**

- Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

**Mount Options:**

- Removable Receiver with Lid (see sheet 2 of 7)
- Removable Receiver with Chain (see sheet 3 of 7)
- Fixed Embedded Mount (see sheet 4 of 7)
- Flanged Surface Mount (see sheet 5 of 7)
- ✓ **Fold Down Mount** (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)



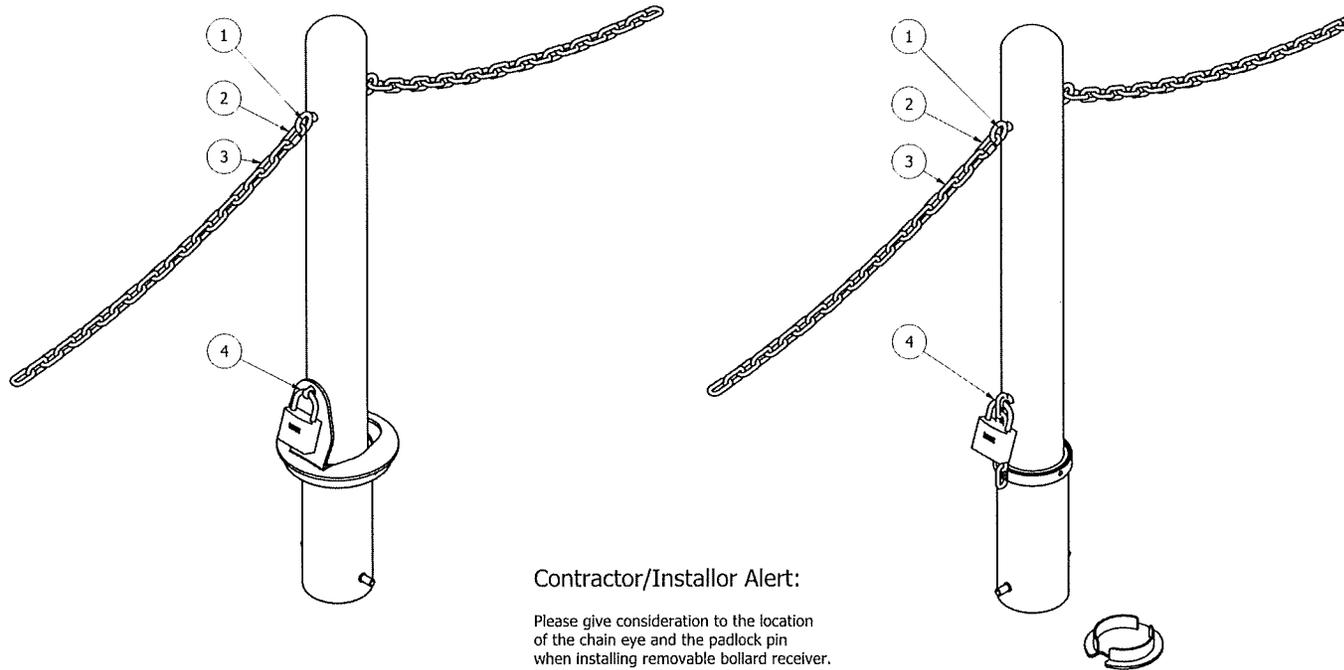
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TITLE: **Bollard Post, Model R-8902**

SIZE: C      DWG NO: R-8902      REV: C1

NOT TO SCALE      SHEET 6 OF 7

# Bollard Post, Model R-8902



### Contractor/Installer Alert:

Please give consideration to the location of the chain eye and the padlock pin when installing removable bollard receiver. It is important that the removable bollard receiver padlock pin is oriented in the same direction as the chain is intended to flow.

### General Description:

The R-8902 Stainless Steel Bollard features a clean, versatile design and a range of custom mounting options, making it suitable for any site location. R-8902 bollards are made from high-quality 316-grade stainless steel to withstand corrosive outdoor environments. Optional reflector stripes are available. Select from several fixed and removable mounting options: concrete embedment, bolt-down flange, removable receivers and fold-down mountings

For more information on bollard post installation, please visit: [www.reliance-foundry.com/bollard/installation-bollards](http://www.reliance-foundry.com/bollard/installation-bollards)

### Specifications:

Height: 36" ( Above Grade )

Base Diameter: 4 3/8"

Weight: 32 lbs ( Bollard Post Full Length )

Material: Stainless Steel 316

### Finish Options:

- Satin Surface Finish Buffed No. 6
  - Polyester Powder Coated ( Optional )
- See Reliance Foundry's standard color options at [www.reliance-foundry.com/bollard/colors-bollards](http://www.reliance-foundry.com/bollard/colors-bollards)

### Mount Options:

- Removable Receiver with Lid (see sheet 2 of 7)
- Removable Receiver with Chain (see sheet 3 of 7)
- Fixed Embedded Mount (see sheet 4 of 7)
- Flanged Surface Mount (see sheet 5 of 7)
- Fold Down Mount (see sheet 6 of 7)
- Optional Chain Accessory (see sheet 7 of 7)

## Optional Chain Accessories Installation Details

PARTS LIST			
ITEM	PART NUMBER	DESCRIPTION	MATERIAL
1	Chain Eye 3/8" (Optional)	Optional Chain Eye 3/8"	Steel Powder Coated
2	Quick Link Connector (Optional)	Optional Quick Link Connector	Steel Powder Coated
3	Chain 5/16" (Optional)	Optional Chain 5/16" (Sold by Length)	Steel Powder Coated
4	Padlock (Optional)	Optional Padlock (Brass or Stainless Steel)	Choice of Brass or Stainless Steel

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TITLE			
Bollard Post, Model R-8902			
SIZE	DWG NO	REV	
C	R-8902	C1	

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**APPENDIX 16 – CONSTRUCTION & DEMOLITION WASTE DIVERSION PROGRAM**

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## Kennesaw State University Construction & Demolition Waste Diversion Program

<p><b>Program Summary</b></p>	<p>Kennesaw State University (KSU) is committed to conserving natural resources and serving as a model for sustainability throughout the region. As part of that commitment, the Division of Facilities Services requires that all contractors bringing a dumpster on campus for construction and renovation projects comply with the following program requirements:</p> <ol style="list-style-type: none"> <li>1. Make every effort to reduce waste through their project planning and on-campus operations</li> <li>2. Recycle, salvage, or reuse surplus building materials from the KSU project to the maximum extent possible</li> <li>3. Submit a mandatory tonnage report documenting project waste generated and the method of disposal</li> </ol>
<p><b>Recycling Facilities – Partial List</b></p>	<p>KSU has compiled a partial list of local C&amp;D recycling facilities, below, as a resource for contractors. However, contractors and their haulers can select any C&amp;D recycling facilities, even those not appearing on the list below.</p> <ol style="list-style-type: none"> <li>1. <a href="#">Metro Green</a> – accepts concrete, metals, roofing shingles, shot rock, sheet rock, carpet, plastics, wood, cardboard, brick, drywall/acoustical ceiling tile, other C&amp;D</li> <li>2. <a href="#">Downey Trees</a> – accepts greenwaste (unwanted plants, and pruning and leaf material; no stumps and no dirt)</li> <li>3. <a href="#">Coward</a> – accepts whole trees, logs, limbs, stumps (additional fee), brush, pallets, other wood debris or yard waste, and clean wood chips</li> <li>4. <a href="#">Lifecycle Building Center</a> – accepts salvaged building components (lumber, cabinetry, doors, wire, select lighting fixtures, intact windows); provides free pick-up eligible material; provides deconstruction services at competitive rates.</li> </ol>
<p><b>Haulers – Partial List</b></p>	<p>KSU has compiled a partial list of local haulers with expertise in C&amp;D waste diversion. However, contractors can select any haulers, even those not appearing on the list below.</p> <ol style="list-style-type: none"> <li>1. <a href="#">Raintree Waste</a></li> <li>2. <a href="#">Patterson Services, Inc.</a></li> <li>3. <a href="#">Alternative Waste Solutions</a></li> <li>4. <a href="#">Lifecycle Building Center</a>* (will provide free pick-up for eligible material)</li> </ol>
<p><b>Mandatory tonnages report</b></p>	<p>The hauler is responsible for submitting a regular tonnages report documenting the amount of C&amp;D waste hauled from the project site as well as the disposal method. The contractor should submit the same report for any surplus material salvaged for re-use on campus.</p> <p>Mandatory C&amp;D waste reporting template:  <a href="https://facilities.kennesaw.edu/docs/TonnageReport_ConstructionDemolition.xlsx">https://facilities.kennesaw.edu/docs/TonnageReport_ConstructionDemolition.xlsx</a>          Email the report to your project manager and copy <a href="mailto:jwils316@kennesaw.edu">jwils316@kennesaw.edu</a>.</p>
<p><b>Questions</b></p>	<p>Contact Jennifer Wilson, Sustainability Coordinator, KSU at <a href="mailto:jwils316@kennesaw.edu">jwils316@kennesaw.edu</a> or (470) 578-3921.</p>

<b>To be completed by sub/contractor if they are bringing a dumpster on campus</b>	
Sub/contractor Firm Name	
Project Manager (PM) Name	
PM Email and Phone #	
Waste reduction and diversion strategy for project	
Which materials will be used for / generated from this project? List all significant materials.	

<b>To be completed by hauler</b>	
Name of Hauler	
Contact Name	
Contact Email and Phone #	

<b>Materials Recovery Facility Data (to be completed by hauler)</b>					
Name of facility used					
Date of Haul					
Tons recorded at drop-off					
Receipt #					

<b>Driver inspection report: approx % of material included in haul (based on visual inspection only)</b>					
<b>Date of haul (will auto-populate )</b>	12/7/2108	0	0	0	0
asphalt					
brick					
cardboard					
carpet					
concrete					
contamination					
dirt					
drywall/acoustical ceiling tile					
greenwaste					
metals					
plastics					
roofing shingles					
salvaged building components					
sheet rock					
shot rock					
wood					
other					
list other:					
<b>TOTAL</b>		<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>

**APPENDIX 17 – TOILET ACCESSORIES & WASTE RECEPTACLE CUTSHEETS**

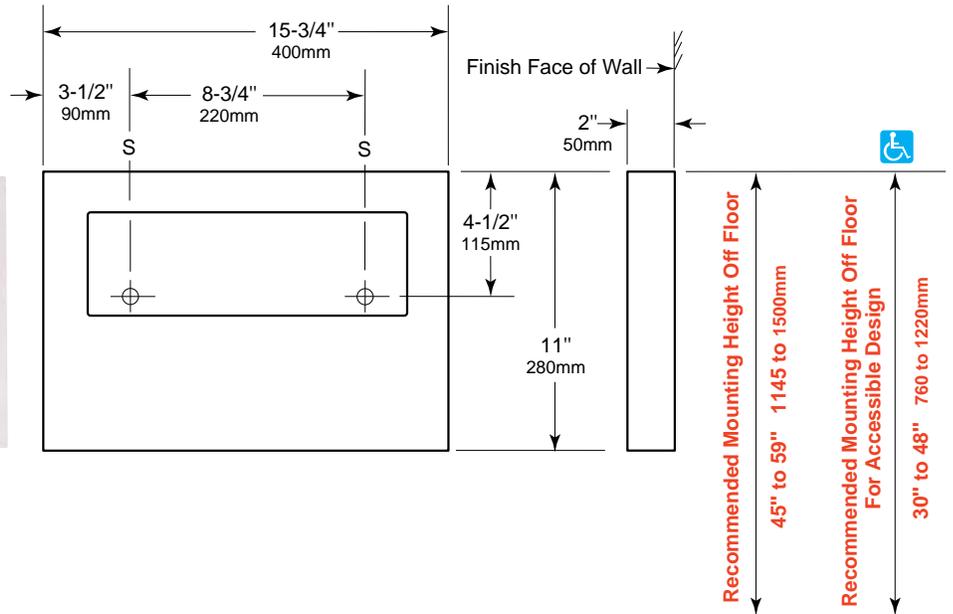
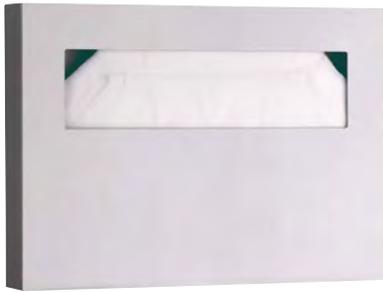
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Technical Data

# ClassicSeries® SURFACE-MOUNTED SEAT-COVER DISPENSER

# B-221



### MATERIALS:

18-8, type-304, 22-gauge (0.8mm) stainless steel with satin finish. All-welded construction with beveled opening.

### OPERATION:

Dispenses single- or half-fold paper toilet seat covers from beveled opening. Dispenser fills from bottom through concealed opening. Capacity: 250 toilet seat covers or one box.

### INSTALLATION:

Mount unit on wall or toilet partition with two flat-head screws, not furnished by manufacturer, at points indicated by an S. For plaster or dry wall construction, provide concealed backing that complies with local building codes, then secure unit with flat-head screws not furnished. For other wall surfaces, provide fiber plugs or expansion shields for use with screws, not furnished, or provide 1/8" (3mm) toggle bolts or expansion bolts.

**Note:** Provide a 5" (125mm) minimum clearance from bottom of dispenser to top of any horizontal projection to provide room for filling dispenser from bottom.

### SPECIFICATION:

Surface-mounted toilet-seat-cover dispenser shall be type-304, 22-gauge (0.8mm) stainless steel with all-welded construction; exposed surfaces shall have satin finish. Dispenser shall have a concealed opening in bottom for filling. Capacity shall be 250 paper toilet seat covers or one box.

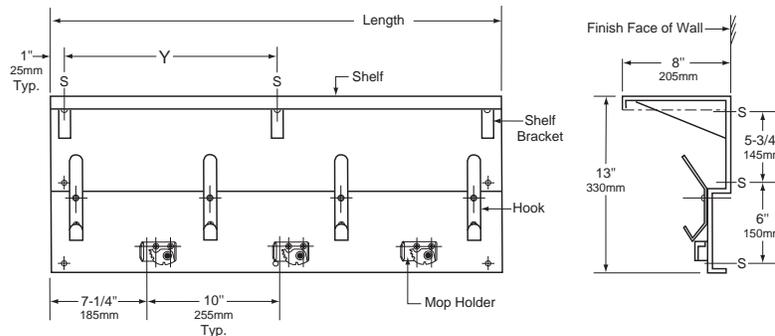
**Surface-Mounted Seat-Cover Dispenser shall be Model B-221 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.**



Technical Data

# UTILITY SHELF WITH MOP/BROOM HOLDERS AND RAG HOOKS

# B-239



### STANDARD STOCK SIZES

Model No.	Length	Dim. Y	Shelf Brackets	No. of Hooks	No. of Mtg. Holes	No. of Mop Holders
B-239 x 34	34" (865mm)	NA	2	4	6	3

### MATERIALS:

**Mounting Base and Shelf** — 18-8, type-304, 18-gauge (1.2mm) stainless steel with satin finish. All-welded construction. Shelf is 8" (205mm) deep with 3/4" (19mm) return edge on all three sides. Front edge is hemmed for safety.

**Shelf Support Brackets** — 18-8, type-304, 16-gauge (1.6mm) stainless steel with satin finish. Welded to mounting base and shelf.

**Mop/Broom Holders** — Spring-loaded rubber cams with anti-slip coating. Plated steel retainers.

**Hooks** — 18-8, type-304, 12-gauge (2.8mm) stainless steel with satin finish. Each hook attached to mounting strip with two rivets.

### OPERATION:

Utility shelf with holders is designed to keep mops and brooms away from wall. Spring-loaded rubber cam holders accommodate handles from 7/8" to 1-1/4" (22 to 30mm) diameter. Utility shelf above handle area provides clear access to stored materials.

### INSTALLATION:

Secure unit to wall with Phillips-head screws, furnished by manufacturer, at points indicated by an S. For plaster or dry wall construction, provide concealed backing to comply with local building codes, then secure unit with screws furnished. For other wall surfaces, provide fiber plugs or expansion shields for use with screws furnished, or provide 1/8" (3mm) toggle bolts or expansion bolts.

### SPECIFICATION:

Utility shelf with mop/broom holders and rag hooks shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Shelf shall be 18 gauge (1.2mm), 8" (205mm) deep with 3/4" (19mm) return edges, and shall have front edge hemmed for safety.

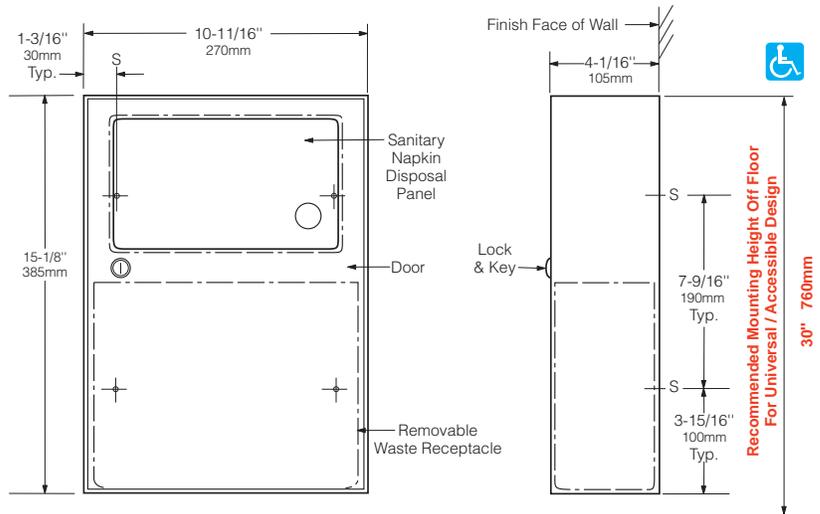
**Utility Shelf With Mop/Broom Holders And Rag Hooks shall be Model 239 x 34 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.**



Technical Data

# SURFACE-MOUNTED SANITARY NAPKIN DISPOSAL

# B-254



## MATERIALS:

**Cabinet** — 18-8, type-304, heavy-gauge stainless steel. All-welded construction. Exposed surfaces have satin finish.

**Door** — 18-8, type-304, 22-gauge (0.8mm) stainless steel with satin finish. Secured to cabinet with a full-length stainless steel piano-hinge. Equipped with a tumbler lock keyed like other Bobrick washroom accessories.

**Disposal Panels (2)** — 18-8, type-304, 22-gauge (0.8mm) stainless steel with satin finish. Bottom edges hemmed for safety. Secured to door and permanent panel with spring-loaded, full-length stainless steel piano-hinge. Equipped with international graphic symbol identifying sanitary napkin disposal.

**Waste Receptacle** — Leak-proof, rigid molded polyethylene. Removable for servicing. Capacity: 1.2-gal. (4.6-L).

## OPERATION:

Unit is equipped with a self-closing panel covering each disposal opening. Napkin disposal is emptied by opening door with furnished key and removing waste receptacle.

## INSTALLATION:

For partitions with particle-board or other solid core, secure with four #8 x 1-1/4" (4.2 x 32mm) sheet-metal screws (not furnished), or provide through-bolts, nuts, and washers.

For hollow-core metal partitions, provide solid backing into which sheet-metal screws can be secured. If two units are installed back-to-back, then provide threaded sleeves and machine screws for the full thickness of partition.

For plaster or dry wall construction, provide concealed backing to comply with local building coeds, then secure unit with #8 x 1-1/4" (4.2 x 32mm) sheet-metal screws.

For other wall surfaces, provide fiber plugs or expansion shields for use with #8 x 1-1/4" (4.2 x 32mm) sheet-metal screws, or provide 3/16" (5mm) toggle bolts or expansion bolts.

## SPECIFICATION:

Surface-mounted sanitary napkin disposal shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a tumbler lock keyed like other Bobrick washroom accessories. Unit shall have a self-closing panel covering each disposal opening. Panel shall have bottom edge hemmed for safety, be secured to door with spring-loaded, full-length stainless steel piano-hinge, and equipped with international graphic symbols identifying sanitary napkin disposal. Unit shall be furnished with a removable, leak-proof molded polyethylene receptacle. Receptacle shall have a capacity of 1.2-gal. (4.6-L).

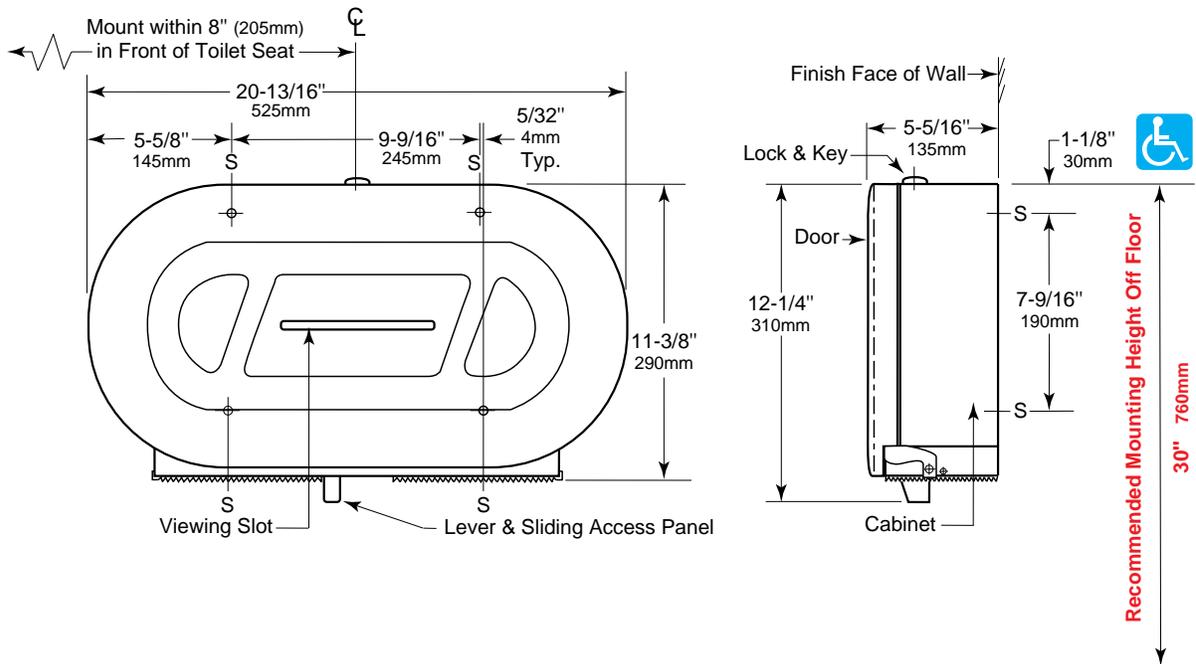
**Surface-Mounted Sanitary Napkin Disposal shall be Model B-254 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.**



Technical Data

# SURFACE-MOUNTED TWIN JUMBO-ROLL TOILET TISSUE DISPENSER

# B-2892



**Note:** Dispenser is ICC A117.1 - 2009 Standard for Accessibility compliant. Unit can be located below grab bar, in area 24" minimum to 42" maximum from rear wall, with outlet 18" minimum above floor.

### MATERIAL:

**Cabinet** — 18-8, Type-304, 20-gauge (1.0mm) stainless steel with satin-finish. Equipped with a tumbler lock keyed like other Bobrick washroom accessories.

**Door** — 18-8, Type-304, 18-gauge (1.2mm) stainless steel with satin-finish. Drawn, one-piece, seamless construction. Wide viewing slot reveals toilet tissue supply inside cabinet.

**Dispensing Mechanism** — High-impact ABS.

continued . . .



Skin Health and Hygiene Solutions from THE INVENTORS OF PURELL™

Home > 1919-01



**LTX-12™ Dispenser Overview**

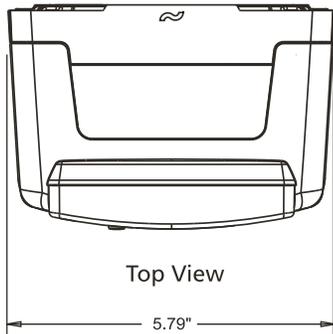


**Dispenser Installation**

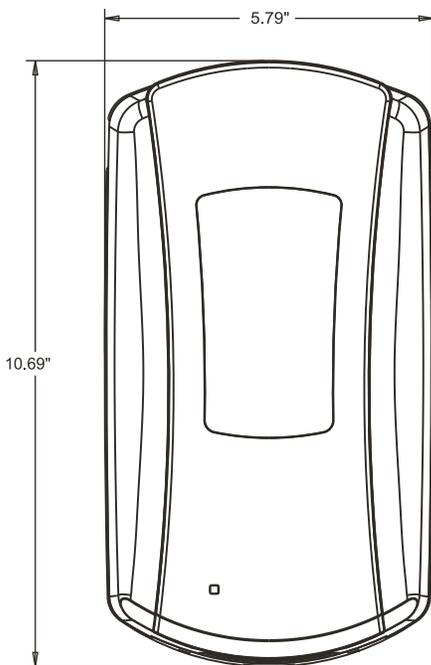


# GOJO LTX-12™ DISPENSER DIMENSIONS

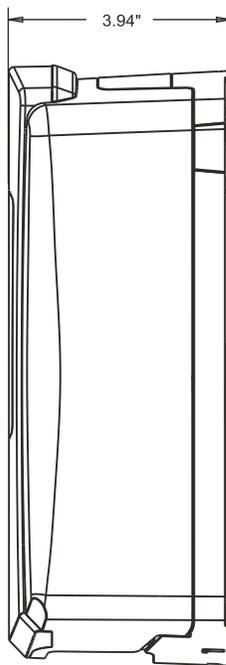
These dimensions apply to GOJO®, PURELL®, PROVON® and MICRELL® brand LTX-12 dispensers.



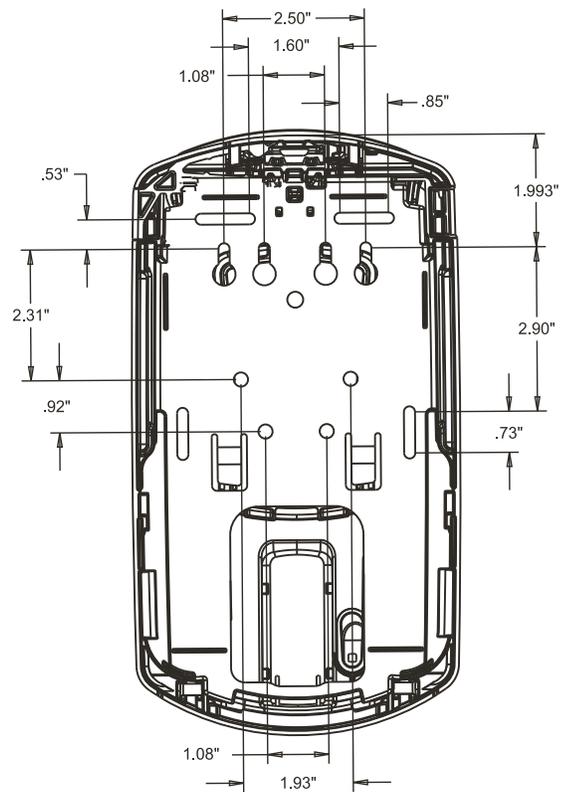
Use the dimensions provided to ensure adequate wall spacing and clearance for the unit.



Front View



Side View



Back View



GOJO Industries, Inc.  
One GOJO Plaza, Suite 500  
P.O. Box 991 • Akron, OH 44309-0991  
Tel: 1-330-255-6000 • Toll-free: 1-800-321-9647  
Fax: 1-800-FAX-GOJO

# optiSERV hybrid<sup>®</sup>

OptiServ Hybrid<sup>®</sup> Dual-Functionality Dispensing System



CONTROLLED-USE ROLL TOWEL DISPENSERS

No./ Translucent Color	Name	Dispenser Size (W" x H" x D")	Dispenser Weight	Case Size (W" x H" x D")	Dispenser Case Cube	Cases/Unit
87510   77510	 <b>optiSERV</b> hybrid*	12½ x 16⅜ x 9⅜	9.35 lbs.	16½ x 10½ x 12¼	1.21	100
*87530   *77530						
*87540   *77540						
*87550   *77550						
*87560   *77560						

\*Special order colors



**THROUGHOUT THE YEAR, THE WAUSAU PAPER BRANDS OF ARTISAN®, DUBLSOFT®, DUBLNATURE® AND ECOSOFT® ARE TRANSITIONING TO THE TORK QUALITY TIERS OF PREMIUM/ADVANCED/UNIVERSAL**

No.	Name	Color	Roll Width	Feet/Roll	Rolls/Case	Feet/Case
<b>CONTROLLED-USE ROLL TOWELS - FOR USE WITH 800 SERIES OPTISERV HYBRID®</b>						
31040	 DublNature®	White	8"	1,000	6	6,000
31000	 EcoSoft®	Natural	8"	1,000	6	6,000
38040	 DublNature®	White	8"	800	6	4,800
31400	 EcoSoft®	Natural White	8"	800	6	4,800
31300	 EcoSoft®	Natural	8"	800	6	4,800
30620	 Artisan®	White	8"	600	6	3,600
31900	EcoSoft®	White	8"	800	6	4,800
31600	EcoSoft®	White	8"	630	6	3,780
31500	EcoSoft®	Natural	8"	630	6	3,780

<b>CONTROLLED-USE ROLL TOWELS - FOR USE WITH 700 SERIES OPTISERV HYBRID®</b>						
71040	 DublNature®	White	7½"	1,000	6	6,000
171000	 EcoSoft®	Natural	7½"	1,000	6	6,000
78040	 DublNature®	White	7½"	800	6	4,800
71400	 EcoSoft®	Natural White	7½"	800	6	4,800
71300	 EcoSoft®	Natural	7½"	800	6	4,800
70620	 Artisan®	White	7½"	600	6	3,600
71900	EcoSoft®	White	7½"	800	6	4,800
71600	EcoSoft®	White	7½"	630	6	3,780



\*These products meet Green Seal™ Standard GS-1 based on chlorine-free processing, energy and water efficiency, and content of 100% recovered material with a minimum of 50% post-consumer material. GreenSeal.org.

SCA Care of life. Because our products make life easier for you and for millions of people around the world. Because our resources and the way we work are natural parts of the global lifecycle. And because we care.



Availability and specifications are subject to change.



Printed with soy ink on Green Seal™ and FSC-certified paper.

**SCA AfH Professional Hygiene**  
 1150 Industry Road, PO Box 189, Harrodsburg, KY 40330-0189  
 1-866-722-8675  
 torkusa.com · wausaupaper.com  
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BROCHURE-OSH-001/0517

## LOW VOLTAGE AND HIGH VOLTAGE TECHNICAL SPECIFICATION

### Electrical

Input voltage: Low voltage = 110-127 V, High voltage = 200-240 V  
 Frequency: 50 or 60 Hz, subject to voltage (85-115 V at 50 Hz); (85-130 V at 60 Hz); (200-240 V at 50 & 60 Hz)  
 Standby power consumption: Less than 0.5 W  
 Motor specification: 1,000 W digital brushless motor  
 Motor switching rate: 5,000 per second  
 Amp: Recommended dedicated 15 amp circuit. (110V ~10A; 120V ~8.33A; 220V ~4.55A; 240V ~4.17A)  
 Heater type: None

### Construction

Fascia: Polycarbonate  
 Antibacterial coating type:  
 HU02 (Sprayed Nickel) contains antibacterial additive in paint.  
 HU02 (White) contains antibacterial moulded additive.  
 Can help prevent the growth of bacteria.  
 Back plate mounting bracket: ABS/PBT Plastic  
 Exterior screw type: Anti-tamper 4 mm Pin-Hex  
 Water ingress protection to IP24

### Filter

HEPA filter (Glass fiber and fleece prelayer)  
 Removes 99.97% of bacteria as small as 0.3 microns

### Operation

Touch free capacitive sensor activation  
 Hand dry time measurement: 12 seconds  
 (Measurement based on NSF Protocol P.335)  
 Sound power level: 79 dB(A)  
 Sound pressure level @ 2 m: 63 dB(A)<sup>1</sup>  
 Operation lock-out period: 30 seconds  
 Airspeed at aperture: 675 km/h / 420 mph  
 Maximum altitude: 2,000 metres / 6,561 ft.  
 Operating airflow: up to 5.28 gal/sec & up to 42.38 CFM  
 Operating temperature range: 0°C-40°C / 32°F-104°F

### Logistics

Single unit order code:  
 Sprayed Nickel - Low voltage: 307174-01, High voltage: 307172-01  
 White - Low voltage: 307173-01, High voltage: 307171-01  
 Unit barcodes:  
 Sprayed Nickel - Low voltage: 885609009933, High voltage: 885609009797  
 White - Low voltage: 885609009896, High voltage: 885609009179  
 Net weight: 2.9 kg / 6.17 lbs  
 Packaged weight: 4.0 kg / 8.81 lbs  
 Packaged dimensions:  
 (H) 146 mm × (W) 454 mm × (D) 273 mm / (H) 5 3/4" × (W) 17 7/8" × (D) 10 3/4"

### Standard warranty

5 year parts and 5 year limited labor warranty

### Accreditations:

Carbon Trust  
 NSF International  
 Quiet Mark  
 Contributes to LEED certification  
 ADA compliant  
 UL Listed

<sup>1</sup>Sound pressure measured at 2 m distance, in a semi-anechoic chamber.



### Product range (Select one)

#### HU02 Sprayed Nickel

**Part number/SKU**  
 Low Voltage: 307174-01  
 High Voltage: 307172-01

#### HU02 White

**Part number/SKU**  
 Low Voltage: 307173-01  
 High Voltage: 307171-01

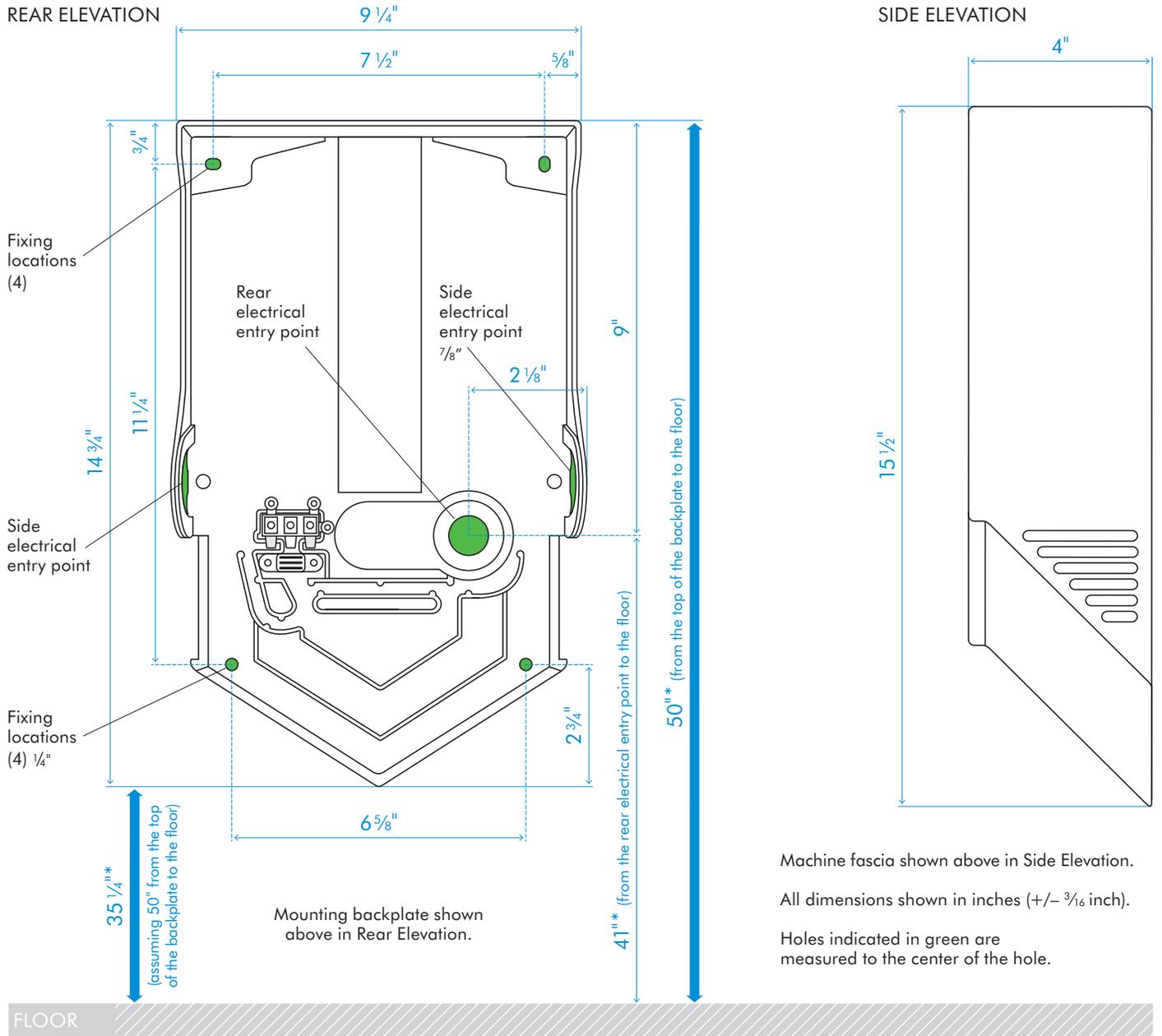


The Carbon label is a trademark of the Carbon Trust. The NSF logo is the registered trademark of NSF International. Quiet Mark is a registered trademark of the Noise Abatement Society.

For further information, please contact Dyson: 1-855-720-6169,  
[www.dyson.com/airblade](http://www.dyson.com/airblade)

## TECHNICAL SPECIFICATION

HU  
O2



<b>Machine dimensions</b>
Height $15\frac{1}{2}"$ Width $9\frac{7}{32}"$ Depth $4"$
<b>Minimum clearance</b>
$8\frac{11}{16}"$ clearance either side and $1\frac{3}{16}"$ above machine.

\*Please look into local guidelines for ADA compliance.  
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For further information, please contact Dyson: 1-855-720-6169,  
[www.dyson.com/airblade](http://www.dyson.com/airblade)

# XLERATOR® HAND DRYER



ORIGINAL. PATENTED. STILL THE BEST.

## NEW ENHANCED STANDARD FEATURES



Adjustable Speed and  
Sound Control



Multi-Voltage Options:  
110-120V Or 208-277V



Adjustable Heat Settings -  
High, Medium, Low & Off



Externally Visible  
Service LED

**8**

**SECONDS\***  
dry time

**95%**

**COST SAVINGS**  
versus paper towels

**80%**

**LESS ENERGY**  
than conventional dryers



# XLERATOR® HAND DRYER



MODELS: **XL - BW** **W** **GR** **C** **SB** **SI** **SP** OPTIONS: **-1.1N** (Noise Reduction Nozzle) **-H** (HEPA Filter) **-VOLTAGE** (See Chart)



**XL-BW**

White Thermoset Resin (BMC)



**XL-W**

White Epoxy Painted



**XL-GR**

Graphite Textured Painted



**XL-SP\*\***

Custom Special Paint



**XL-SI\*\*\***

Custom Special Image



**XL-C**

Chrome Plated



**XL-SB**

Brushed Stainless Steel

TESTED TO  
**PCR**  
GUIDELINES

**DRY TIME: 8 SECONDS\***

**ENERGY PER USE: 3.7 Wh**

## FEATURES & BENEFITS

- ✓ 80% Less Energy Than Conventional Hand Dryers
- ✓ 95% Cost Savings Vs. Paper Towels
- ✓ Made In USA Certified®
- ✓ 5-Year Limited Warranty
- ✓ Building Green Approved and Helps Qualify for several LEED® credits
- ✓ A Hygienic Hand Drying Solution

## OPTIONS

- ✓ **HEPA Filtration System:** Filters 99.97% of bacteria at 0.3 microns from the air stream.
- ✓ **1.1 Noise Reduction Nozzle:** Lowers decibel level 9 dB by reducing air deflection noise but increases dry time by approximately 3 seconds.

## ONLINE INFORMATION

- ▶ Product Videos
- 💰 Cost Savings & Carbon Footprint Calculator
- 📊 Life Cycle Assessment Study
- 📄 Specification Tools
- 📄 AIA/GBCI CEU Courses
- 📄 Case Studies

## DIMENSIONS

**Width** 11 3/4" (298 mm) **Height** 12 11/16" (322 mm) **Depth** 6 11/16" (170 mm)

## WEIGHT

**XL-BW:** 15 lbs. (6.8 kgs.) **XL-SB:** 16 lbs. (7.26 kgs.) **XL-W, GR, C, SI, SP:** 17 lbs. (7.71 kgs.)

## ELECTRICAL

VOLTS	AMPS	WATTS	NO HEAT AMPS	NO HEAT WATTS	HERTZ	
110-120V	11.3-12.2A	1240-1450W	4.3-4.5A	460-530W	50/60 Hz	cUL US
208-277V	5.6-6.2A	1160-1490W	2.0-2.2A	425-500W	50/60 Hz	cUL US
230V	6.1A	1410W	2.2A	500W	50 Hz	CE



RoHS



## ACTIVATION

**Automatic Sensor Operated**

## MOUNTING

**Surface Mounted**

## SUGGESTED MOUNTING HEIGHTS

**Men** 45" (114 cm) **Women** 43" (109 cm) **Accessible** 37" (94 cm)

Note: Heights measured from floor to bottom of dryer.

## ACCESSORIES

- ✓ Anti-Microbial Wall Guards
- ✓ XChanger Paper Towel Dispenser Retrofit Kit
- ✓ ADA-Compliant Recess Kit

**Width** 16 3/8" (416 mm) **Height** 26" (660 mm)  
**Depth** 3 3/8" (86 mm) **Weight** 11 lbs. (4.99 kgs.)



**Part # 40502**

\* Dry time and energy use testing performed by SGS International on standard XLERATOR Hand Dryer with 0.8" nozzle to 0.25g or less of residual moisture, pursuant to the UL Environment Global Product Category Rules (PCR) for Hand Dryers.

\*\* Special Paint powder-coated covers are available in many colors and textures.

\*\*\* Exclusive digital image technology allows for the addition of company, school or team logos with any color, design or a 'green message'.

TESTED TO  
**PCR**  
GUIDELINES

UL Environment published the first global Product Category Rules (PCR) for Hand Dryers and Excel Dryer is proud to have been selected to chair the project. The PCR created evaluation methods through industry consensus that compare products' environmental impact and performance. Third party testing results then enable specifiers and buyers to make a true apples-to-apples comparison of products and more informed decisions.



# TIME TO THROW IN THE TOWEL®

EXCEL DRYER INC • 1.800.255.9235 • EXCELDRYER.COM

JAN 2017

16XLS0001



# SILHOUETTES

## SQUARE OPEN TOP

The sleek Silhouettes decorative refuse container has a contemporary graphic pattern designed to seamlessly and beautifully blend with indoor modern environments.

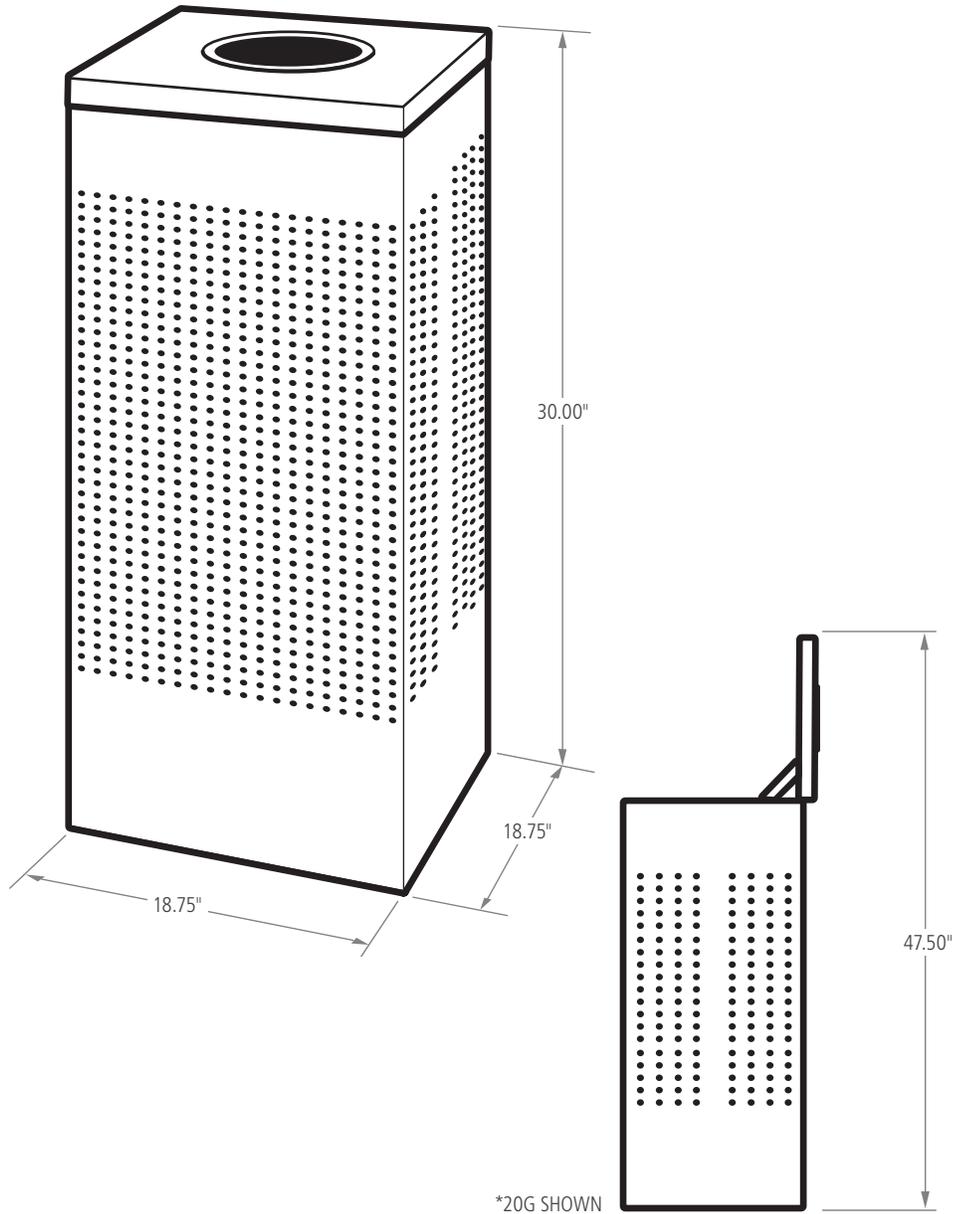
### FEATURES AND BENEFITS:

#### FEATURES

- ▶ Heavy-gauge, fire-safe steel
- ▶ Leak-proof rigid plastic liner included to help contain liquids and keep the surrounding area cleaner
- ▶ Retainer bands discreetly hold liner bags in place and out of sight
- ▶ Lid is fastened to receptacle for easy waste removal
- ▶ Adjustable leg levelers create stability on uneven surfaces
- ▶ Shipped fully assembled



ADA COMPLIANT



GALLONS	LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)	OPEN HEIGHT (in.)
6G, 10G	10.75	10.75	25.00	34.50
16G, 24G	14.75	14.75	30.00	43.80
20G* (SHOWN), 29G	18.75	18.75	30.00	47.50
40G, 50G	21.75	21.75	31.25	50.80

NOTE: VARYING CAPACITIES WITH THE SAME DIMENSIONS ARE DEPENDENT ON LINER SELECTION

build your own ▶ [rubbermaidcommercial.com/customize](http://rubbermaidcommercial.com/customize)



# SILHOUETTES

## SQUARE OPEN TOP

### STANDARD COLOR OPTIONS



SKU #	DESCRIPTION	LINER	COLOR	GALLONS	WEIGHT (lbs.)	LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)
FGSC10EPLSM	SILHOUETTES SQ OPEN TOP 22L/6G	PLASTIC	STARDUST SILVER METALLIC	6	21.00	10.75	10.75	25.00
FGSC10EPLTBK	SILHOUETTES SQ OPEN TOP 22L/6G	PLASTIC	TEXTURED BLACK	6	21.00	10.75	10.75	25.00
FGSC10ERBTBK	SILHOUETTES SQ OPEN TOP 37L/10G	RETAINER BANDS	TEXTURED BLACK	10	13.00	10.75	10.75	25.00
FGSC10SSPL	SILHOUETTES SQ OPEN TOP 22L/6G	PLASTIC	STAINLESS STEEL	6	19.00	10.75	10.75	25.00
FGSC10SSRB	SILHOUETTES SQ OPEN TOP 37L/10G	RETAINER BANDS	STAINLESS STEEL	10	15.00	10.75	10.75	25.00
FGSC14EPLDP	SILHOUETTES SQ OPEN TOP 60L/16G	PLASTIC	DESERT PEARL METALLIC	16	35.00	14.75	14.75	30.00
FGSC14EPLSM	SILHOUETTES SQ OPEN TOP 60L/16G	PLASTIC	STARDUST SILVER METALLIC	16	35.00	14.75	14.75	30.00
FGSC14EPLTBK	SILHOUETTES SQ OPEN TOP 60L/16G	PLASTIC	TEXTURED BLACK	16	35.00	14.75	14.75	30.00
FGSC14ERBDP	SILHOUETTES SQ OPEN TOP 90L/24G	RETAINER BANDS	DESERT PEARL METALLIC	24	29.00	14.75	14.75	30.00
FGSC14ERBSM	SILHOUETTES SQ OPEN TOP 90L/24G	RETAINER BANDS	STARDUST SILVER METALLIC	24	29.00	14.75	14.75	30.00
FGSC14ERBTBK	SILHOUETTES SQ OPEN TOP 90L/24G	RETAINER BANDS	TEXTURED BLACK	24	29.00	14.75	14.75	30.00
FGSC14SSPL	SILHOUETTES SQ OPEN TOP 60L/16G	PLASTIC	STAINLESS STEEL	16	33.00	14.75	14.75	30.00
FGSC14SSRB	SILHOUETTES SQ OPEN TOP 90L/24G	RETAINER BANDS	STAINLESS STEEL	24	27.00	14.75	14.75	30.00
FGSC18EPLDP	SILHOUETTES SQ OPEN TOP 75L/20G L	PLASTIC	DESERT PEARL METALLIC	20	46.00	18.75	18.75	30.00
FGSC18EPLSM	SILHOUETTES SQ OPEN TOP 75L/20G	PLASTIC	STARDUST SILVER METALLIC	20	46.00	18.75	18.75	30.00
FGSC18EPLTBK	SILHOUETTES SQ OPEN TOP 75L/20G	PLASTIC	TEXTURED BLACK	20	46.00	18.75	18.75	30.00
FGSC18ERBDP	SILHOUETTES SQ OPEN TOP 109L/29G	RETAINER BANDS	DESERT PEARL METALLIC	29	39.00	18.75	18.75	30.00
FGSC18ERBSM	SILHOUETTES SQ OPEN TOP 109L/29G	RETAINER BANDS	STARDUST SILVER METALLIC	29	39.00	18.75	18.75	30.00
FGSC18ERBTBK	SILHOUETTES SQ OPEN TOP 109L/29G	RETAINER BANDS	TEXTURED BLACK	29	39.00	18.75	18.75	30.00
FGSC18SSPL	SILHOUETTES SQ OPEN TOP 75L/20G	PLASTIC	STAINLESS STEEL	20	44.00	18.75	18.75	30.00
FGSC18SSRB	SILHOUETTES SQ OPEN TOP 109L/29G	RETAINER BANDS	STAINLESS STEEL	29	37.00	18.75	18.75	30.00
FGSC22EPLSM	SILHOUETTES SQ OPEN TOP 151L/40G	PLASTIC	STARDUST SILVER METALLIC	40	60.00	21.75	21.75	31.25
FGSC22EPLTBK	SILHOUETTES SQ OPEN TOP 151L/40G	PLASTIC	TEXTURED BLACK	40	60.00	21.75	21.75	31.25
FGSC22EPLDP	SILHOUETTES SQ OPEN TOP 151L/40G	PLASTIC	DESERT PEARL METALLIC	40	60.00	21.75	21.75	31.25
FGSC22SSPL	SILHOUETTES SQ OPEN TOP 151L/40G	PLASTIC	STAINLESS STEEL	40	66.00	21.75	21.75	31.25
FGSC22SSRB	SILHOUETTES SQ OPEN TOP 189L/50G	RETAINER BANDS	STAINLESS STEEL	50	57.00	21.75	21.75	31.25
FGSC22ERBDP	SILHOUETTES SQ OPEN TOP 189L/50G	RETAINER BANDS	DESERT PEARL METALLIC	50	51.00	21.75	21.75	31.25
FGSC22ERBSM	SILHOUETTES SQ OPEN TOP 189L/50G	RETAINER BANDS	STARDUST SILVER METALLIC	50	51.00	21.75	21.75	31.25
FGSC22ERBTBK	SILHOUETTES SQ OPEN TOP 189L/50G	RETAINER BANDS	TEXTURED BLACK	50	51.00	21.75	21.75	31.25

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# SILHOUETTES

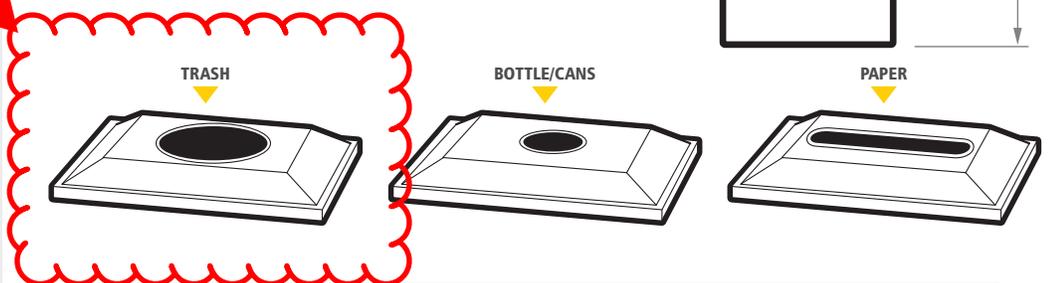
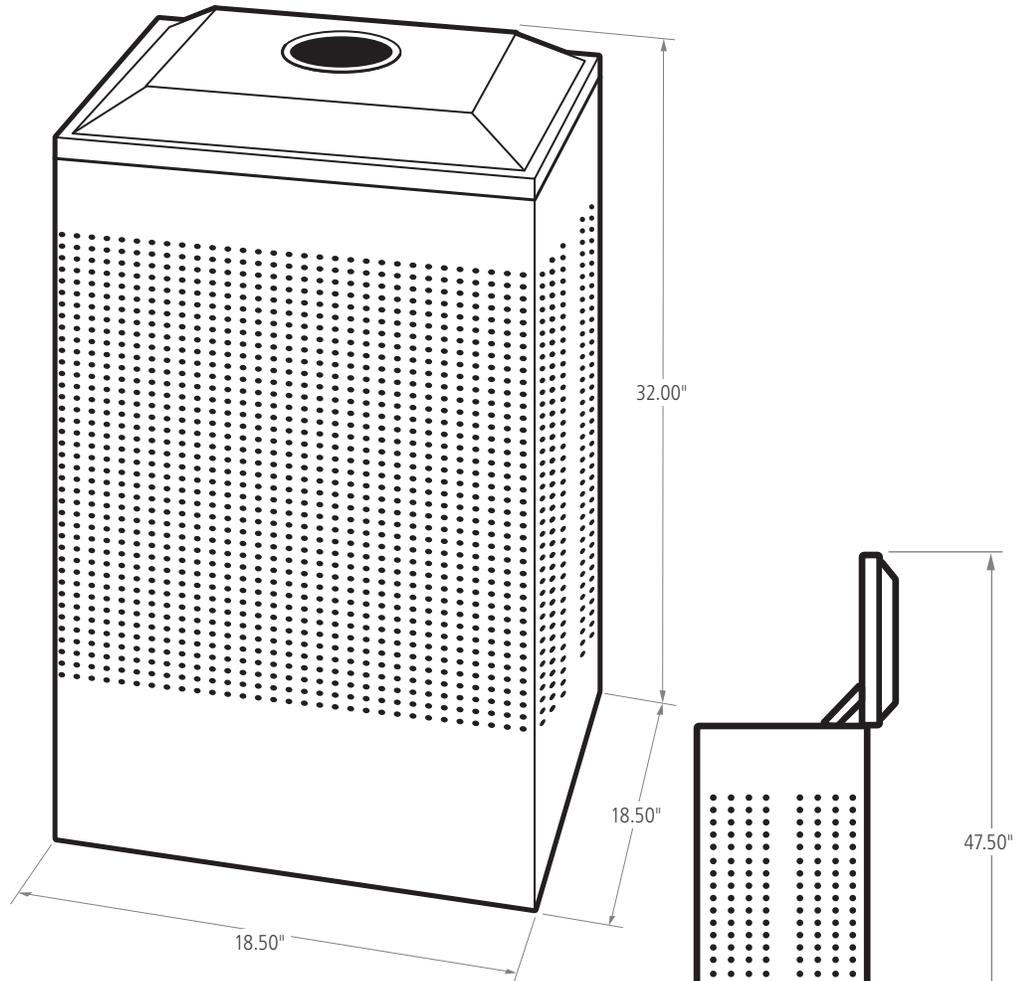
## SQUARE RECYCLING TOP

The sleek Silhouettes decorative refuse container has a contemporary graphic pattern designed to seamlessly and beautifully blend with indoor modern environments.

### FEATURES AND BENEFITS:

#### FEATURES

- ▶ Stream identification and lid openings for recycling compliance
- ▶ Heavy-gauge, fire-safe steel
- ▶ Leak-proof rigid plastic liner included to help contain liquids and keep the surrounding area cleaner
- ▶ Retainer bands discreetly hold liner bags in place and out of sight
- ▶ Lid is fastened to receptacle for easy waste removal
- ▶ Adjustable leg levelers create stability on uneven surfaces
- ▶ Shipped fully assembled



GALLONS	LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)	OPEN HEIGHT (in.)
29G	18.50	18.50	32.00	47.50

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# SILHOUETTES

## SQUARE RECYCLING TOP

### STANDARD COLOR OPTIONS



SKU #	DESCRIPTION	LINER	COLOR	GALLONS	WEIGHT (lbs.)	LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)
FGDCR24CDP	SILHOUETTES SQ RCYCL CAN LID 109L/29G	PLASTIC	DESERT PEARL METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24CSM	SILHOUETTES SQ RCYCL CAN LID 109L/29G	PLASTIC	STARDUST SILVER METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24CSS	SILHOUETTES SQ RCYCL CAN LID109L/29G	PLASTIC	STAINLESS STEEL	29	47.50	18.50	18.50	32.00
FGDCR24CTBK	SILHOUETTES SQ RCYCL CAN LID109L/29G	PLASTIC	TEXTURED BLACK	29	47.50	18.50	18.50	32.00
FGDCR24PDP	SILHOUETTES SQ RCYCL PAPER LID 109L/29G	PLASTIC	DESERT PEARL METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24PSM	SILHOUETTES SQ RCYCL PAPER LID 109L/29G	PLASTIC	STARDUST SILVER METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24PSS	SILHOUETTES SQ RCYCL PAPER LID 109L/29G	PLASTIC	STAINLESS STEEL	29	47.50	18.50	18.50	32.00
FGDCR24PTBK	SILHOUETTES SQ RCYCL PAPER LID 109L/29G	PLASTIC	TEXTURED BLACK	29	47.50	18.50	18.50	32.00
FGDCR24TDP	SILHOUETTES SQ RCYCL TRASH LID 109L/29G	PLASTIC	DESERT PEARL METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24TSM	SILHOUETTES SQ RCYCL TRASH LID 109L/29G	PLASTIC	STARDUST SILVER METALLIC	29	47.50	18.50	18.50	32.00
FGDCR24TSS	SILHOUETTES SQ RCYCL TRASH LID 109L/29G	PLASTIC	STAINLESS STEEL	29	47.50	18.50	18.50	32.00
FGDCR24TTBK	SILHOUETTES SQ RCYCL TRASH LID 109L/29G	PLASTIC	TEXTURED BLACK	29	47.50	18.50	18.50	32.00

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## Waste > Recycling Waste

### 2955-73 Deskside Recycling Container, Small with Universal Recycle Symbol



An easy and effective way to recycle paper.



- Designed to be used in systems with existing office containers and accessories.
- Placed beside traditional wastebaskets, Rubbermaid's Deskside Recycling Containers make it easy to separate waste paper.
- Contains Post Consumer Recycled Resin (PCR) exceeding EPA guidelines.

#### SUSTAINABLE PRODUCTS



This product has the following sustainable attributes:  
**LEED Credits For Recycling Recycled Content**

#### AVAILABLE COLORS

Order #	Color	Product UPC/ UCC Code
FG295573 BLUE	BLUE	086876194166 / 10086876194163



Blue  
BLUE

#### SPECIFICATIONS

	U.S.	Metric
Length:	11.4 in	28.9 cm
Width:	8.2 in	21.0 cm
Height:	12.1 in	30.8 cm
Volume Capacity [Nom]:	13 5/8 qt	12.9 L
Volume Capacity [Max]:		
Volume Capacity [Min]:		
Carton Length:	11.7 in	29.7 cm
Carton Width:	8.5 in	21.6 cm

<b>Carton Height:</b>	25.9 in	65.7 cm
<b>Certification [Deskside Recycling Containers]:</b>	PCR	
<b>Carton Cube:</b>	1.49 ft3	
<b>Ship Weight/Carton:</b>	15.60 lb	7.08 kg
<b>Pack Quantity:</b>	12	
<b>Cartons Per Pallet:</b>	32	

**ADDITIONAL INFORMATION:**

**Product Sell Sheets:** RCP\_SM731\_RecyclingFamilyUpdate.pdf  
**Chemical Resistance Guide:** chem.pdf

**Products in Deskside Recycling Containers**

Item #	Description	Length	Width	Height	Volume Capacity
2955-73	Deskside Recycling Container, Small with Universal Recycle Symbol	11.4 in	8.25 in	12.1 in	13 5/8 qt
2956-06	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.4 in	10.25 in	15.0 in	28 1/8 qt
2956-73	Deskside Recycling Container, Medium with Universal Recycle Symbol	14.4 in	10.25 in	15.0 in	28 1/8 qt
2957-73	Deskside Recycling Container, Large with Universal Recycle Symbol	15.2 in	11.00 in	19.9 in	41 1/4 qt



**Rubbermaid Commercial Products, LLC**  
 3124 Valley Avenue, Winchester, VA 22601  
[www.rcpworksmarter.com](http://www.rcpworksmarter.com)



# SlimJim®

The Slim Jim® container delivers the durability needed for commercial environments combined with brand new innovation to increase worker productivity. New product features and accessories deliver the most efficient solution for collection, transportation, and disposal of multi-stream waste and recyclables.

## Features and Benefits:

- Venting channels make removing liners up to 80% easier, improving productivity and reducing the risk of worker injury
- Four bag cinches secure liners around the rim of the container and allow for quick, knot-free liner changes
- Handles at the base and rim of the container improve grip and control while lifting and emptying full containers
- Rim with rib-strengthened design increases strength and resists crushing
- Build a recycling station with a variety of dolly and lid options to meet any facility need

## COLORS AVAILABLE

Blue, Green, Black, Beige, Brown, Gray, Yellow\*, Red\*

\* 23-gallon only

## Material Composition:

Injection molded with a high-quality resin blend.

## Accessories:

### STAINLESS STEEL DOLLIES

- Slim Jim® Single Dolly
- Slim Jim® Double Dolly
- Slim Jim® Triple Dolly
- Slim Jim® Quadruple Dolly

### RESIN DOLLY

- Slim Jim® Trainable Dolly

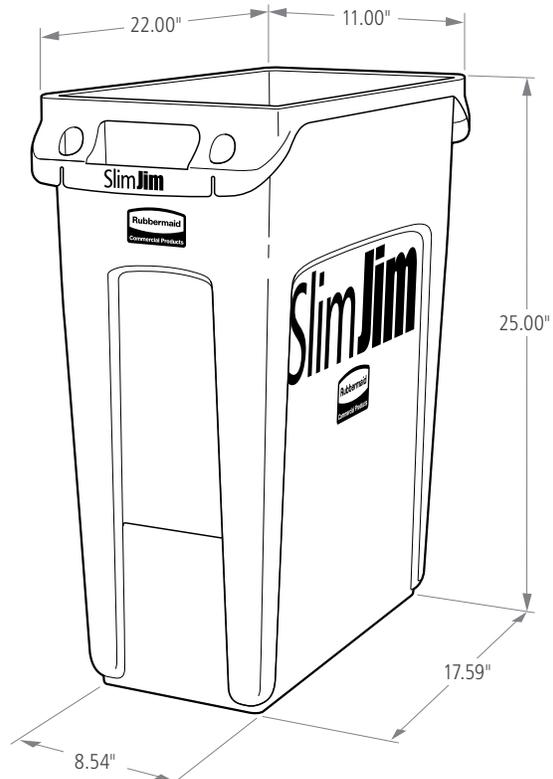
### LIDS

- Bottles and Cans Lid
- Paper Lid
- Mixed Recycling Lid
- Hinged Lid
- Swing Lid

# SLIM JIM® CONTAINERS



23-Gallon Slim Jim® Container



16-Gallon Slim Jim® Container

# SLIM JIM® CONTAINERS

SKU #	DESCRIPTION	COLOR	CAPACITY		LENGTH		WIDTH		HEIGHT		PACK SIZE
			GAL	L	IN	CM	IN	CM	IN	CM	
1971258	SLIM JIM® CONTAINER	GRAY	16	61	22"	55.88	11"	27.94	25"	63.50	4
1955959	SLIM JIM® CONTAINER	BLACK	16	61	22"	55.88	11"	27.94	25"	63.50	4
1971259	SLIM JIM® CONTAINER	BEIGE	16	61	22"	55.88	11"	27.94	25"	63.50	4
1956181	SLIM JIM® CONTAINER	BROWN	16	61	22"	55.88	11"	27.94	25"	63.50	4
1971257	SLIM JIM® CONTAINER	BLUE	16	61	22"	55.88	11"	27.94	25"	63.50	4
1955960	SLIM JIM® CONTAINER	GREEN	16	61	22"	55.88	11"	27.94	25"	63.50	4
FG354060GRAY	SLIM JIM® CONTAINER	GRAY	23	87	22"	55.88	11"	27.94	30"	76.20	4
FG354060BLA	SLIM JIM® CONTAINER	BLACK	23	87	22"	55.88	11"	27.94	30"	76.20	4
FG354060BEIG	SLIM JIM® CONTAINER	BEIGE	23	87	22"	55.88	11"	27.94	30"	76.20	4
1956187	SLIM JIM® CONTAINER	BROWN	23	87	22"	55.88	11"	27.94	30"	76.20	4
1956185	SLIM JIM® CONTAINER	BLUE	23	87	22"	55.88	11"	27.94	30"	76.20	4
1956186	SLIM JIM® CONTAINER	GREEN	23	87	22"	55.88	11"	27.94	30"	76.20	4
1956188	SLIM JIM® CONTAINER	YELLOW	23	87	22"	55.88	11"	27.94	30"	76.20	4
1956189	SLIM JIM® CONTAINER	RED	23	87	22"	55.88	11"	27.94	30"	76.20	4
FG354007BLUE	SLIM JIM® CONTAINER	BLUE (RECYCLING)	23	87	22"	55.88	11"	27.94	30"	76.20	4
FG354007GRN	SLIM JIM® CONTAINER	GREEN (RECYCLING)	23	87	22"	55.88	11"	27.94	30"	76.20	4

