Florida State University Design Guidelines

August 2012

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PROJECT CLOSE-OUT DOCUMENTATION

1. **"Project Closeout" documents** shall include as a minimum:

   a) Complete As-Built Drawings.
   b) Complete Set of Technical Specifications
   c) Operations & Maintenance Manuals in electronic format
   d) Warranties.
   e) Project submittals and shop drawings.
   f) Commissioning and systems testing reports.
   g) Threshold Inspection reports.
   h) Executed Substantial/Final Completion forms.
   i) LEED documentation.
   j) Test & Balance Report.
   k) Other as requested by the University Project Manager.

2. **As Built Drawings:** Drawings shall provide an accurate visual representation of the installed materials and equipment. Drawings shall be in AutoDesk or approved equivalent format and PFA or PDF/A file formats provided on archival quality CDs and/or DVDs. Records shall be included for all work, including Life Safety, Civil, Structural, Utilities, Architectural, Mechanical, Electrical, Fire Protection, Plumbing, Telecommunications, Interior Design, and other as needed.

   a) As Built CAD DWG files, pen setting, and plot configurations or approved design documents that meet the most current National CAD standard as published when the project is constructed. CAD files shall be delivered in an edition no older than three years prior to submission. In addition, site plans shall be geo-referenced to NAD 83, Florida State Planes, Northzone, US Foot for all civil design drawings.

   b) All other design documents shall be provided be in AutoDesk or approved equivalent format with bound xrefs.

3. **MEP Schedules:** 1 (one) electronic version of MEP schedules that include at minimum: as-built information, unit designation and location, manufacturer, serial identification number, capacity, voltage and electrical requirements in Excel Spreadsheet format.

4. **Other project completion documents:** 1 (one) electronic version of all construction documents, technical specifications, closeout documents, operational and maintenance manuals, warranty manuals and submittals/shop drawings in a clean format with the following standards and caveats:
   a) All scanned documents will be scanned into PDF or PDF/A compatible format optimized for web-viewing compiled by Adobe 8.0.
   b) Clean shall be defined as readable text, non-interrupted lines in that "no loss of distinct lines, including hairlines, profiles, skylines, horizons, etc., that are a

result of a lack of dithering or too light a scan," no loss of features for included images, skewing less than 3%, no text or lines are cut off, a lack of extraneous lines and hazy inclusions, and the pages are not deckled in any way.

c) Florida State University Facilities personnel reserve the right to rename, and/or otherwise administer any scanned document as they see fit.

5. Facilities Archives reserves the right to refuse any documents which do not comply with the aforementioned standards.

END OF SECTION

Acoustical Treatment

General Requirements

Proper control of sound is essential to the function of an educational environment such as FSU. Pursuant to this fact, the Design Professional shall determine, in conjunction with University representatives, appropriate sound control characteristics on a space by space basis and provide acoustical privacy from space-to-space consisting of, but not limited to, (1) partitions full height up to the underside of structure above (not up to suspended or dropped ceilings), (2) carpeting, acoustical ceilings and other sound absorptive surfaces as appropriate to the use and maintenance of the space, (3) protection of openings such as solid core wood stave doors with sound seals, (4) control of ambient noise and (5) other measures required to accomplish sound control goals for each space, as set forth by University representatives and these guidelines.

Specific spaces that will always require sound control measures shall be, but are not limited to, the following: offices, interview rooms, conference rooms, classrooms, seminar rooms, and lecture halls. Consideration shall be give at the early planning stages of a project to the location of sound sensitive spaces in relation to spaces that are sources of ambient noise, such as mechanical rooms, lobbies, break rooms, food service areas, loading docks, elevator shafts, restrooms, trash disposal areas, outdoor areas where people gather, high traffic outdoors areas, and nearby noise producing equipment such as generators. Where site conditions and other planning considerations make it necessary to locate sound generating functions near those with sensitive sound control requirements, special consideration shall be given to the separation of these functions with effective sound transmission barriers.

Acoustical Treatments for Classrooms

1. To prevent noise transmission, there should not be a common wall or ceiling between any classroom or lecture hall and the restrooms. If that is unavoidable, then additional measures must be taken to prevent noise transmission.
2. Classrooms shall be located away from sources of high noise levels (e.g., mechanical rooms, elevator shafts) as noted above.
3. Structural columns and other obstructions shall not be placed within the seating areas of classrooms and lecture halls, so as not to obscure sightlines to the instructor or projected images. In renovations, the Design Professional should avoid laying out classrooms such that structural columns are within the seating area. If that is absolutely unavoidable, then the Design Professional should consult with University representatives on ways to minimize the impact of such columns.
4. Corridor walls (or common walls with other unsecured rooms) shall run from floor to underside of structure above. Special consideration should be given to wall or partition construction above the ceiling lines on the corridor side of the room.
5. Walls in classrooms and lecture halls should have a minimum sound transmission class (STC) rating of 50. All walls must extend to the floor above or to the roof construction, and not stop at the ceiling. (This reduces noise transmission as well as improves security.)
6. Higher STC ratings and special wall-construction details must be included whenever classrooms are located adjacent to, above, or below restrooms, mechanical rooms, elevator shafts, bus stops, athletic facilities, or other sources of high noise levels, or where the

classroom function generates a significant amount of noise (e.g., a music classroom).

7. The mechanical system supporting general-purpose classrooms should generate a background noise level of no more than NC 35 (preferably designed to NC 30), and should provide at least six changes of air per hour with an NC (Noise Criterion) rating less than 30. Ducts need to be sized large enough to permit low air velocities. Select diffusers with NC ratings below 25. Design longer duct runs to reduce mechanical noise and reduce the transmission of sound between classrooms. Locate mechanical equipment away from classrooms. Other suggestions may be found at www.ashrae.com. Ambient sound levels measured at 48" AFF at all points throughout the room should have a Noise Criterion (NC) rating of no more than 35 (preferably 30). Background noise should not exceed 45dB-C. Although the space should be designed to an NC of 30-35, it does not have to be certified. (FSU reserves the right to certify a random sample of rooms to ensure that this standard was met.)
8. See also "General Classroom Design" included in these Guidelines.

END OF SECTION

Accessibility Guidelines

1. All renovations and new work shall meet the requirements for the physically disabled as described in Section 255.21, Florida Statutes, American with Disabilities Act, OSHA, and ANSI.
2. The presence of many visually and physically disabled students on campus must be taken into consideration in preparing construction documents.
3. Outside stairways shall have railings as required by OSHA and as modified by the latest ANSI standards for the handicapped.
4. Any raised platforms shall have railings, toe-boards, labeling, and painting and shall conform to OSHA requirements as modified by ANSI standards for the handicapped.
5. Should the A/E team recommend a design solution which requires an accessibility waiver from any public agency, the A/E shall be responsible for preparation and presentation of all related documents.
6. All new buildings shall include provisions for at least one accessible push button door operator. This operator should be located at the main building entry and accessed by an accessible route. If a card reader entry system is provided, this door shall include hardware coordinated to provide both accessible and secure entry.
7. All tactile warning devices should be fabricated integral to the construction materials. All warning materials should be of contrasting colors. Cementitious materials are preferred at curb cuts. Provide warning materials constructed of 8000 psi concrete to prevent chipping at corners and edges. No mechanically fastened mats will be allowed. Color for tactile warning material at curb cuts shall be equal to U4008ADA as manufactured by Wausau Tile Inc. Contrasting border materials should be provided to aid visual discrimination. Contrasting color shall be equal to U-1008ADA also by Wausau Tile, Inc.

DESIGN CRITERIA AND REQUIREMENTS FOR CUSTODIAL CLOSETS

PART 1 - GENERAL

1.01 Summary

A. Provide a minimum of one custodial closet with sink on each floor. Minimum floor space shall be 6'-0" x 8'-0".

B. Provide a central custodial/storage area on the ground floor with one sink. The area of this space should be approximately 225 square feet and easily accessible from the building central delivery point.

C. All closets shall designed to comply with current code requirements, including the latest NFPA Life Safety Code.

D. The use of the Custodial Closets will be restricted to FSU Building Services personnel and, therefore, the design must comply with applicable OSHA requirements.

E. Custodial Closets should be designed to promote indoor air quality such that fumes from cleaning products use/storage are controlled.

F. Custodial Closets shall not share space with other building services such as building mechanical, plumbing, electrical, or telecommunications. Neither shall they be accessed by passing through any other building service space. All custodial closets shall be accessed directly from a corridor.

PART 2 – SPECIFIC DESIGN REQUIREMENTS

2.01 Room Finishes

A. Provide wall splash protection in areas adjacent to sink.

B. Flooring should be water resistant.

2.02 Furnishings/Equipment Needs

A. Provide 18'-0" of 12" deep shelving mounted minimum 4'-0" AFF. Provide additional shelving in central closet located on ground floor.

B. Provide one built-in locker 2'-0" x 4'-0" x 7'-0" with hasp for Owner supplied padlock.

C. Provide tool holders mounted above the sinks for hanging of wet mops.

2.03 Additional Plumbing

A. Provide hose connection at sink.

B. Provide hot water at custodial sinks as required by OSHA.

END OF SECTION

DESIGN CRITERIA AND REQUIREMENTS FOR CLASSROOMS

PART 1 - General

1.0 This guideline is intended to guide the Offices of Facilities Planning, Facilities Design and Construction, and/or the Design Professional in specifying equipment for the various types and sizes of general purpose classrooms. Different types of classrooms are identified, but these are not intended to restrict architectural development or engineering. In recognition of rapid changes in technology, design professionals should verify specific technology to be incorporated. Further special departmental needs beyond these basic guidelines (e.g., laboratory classrooms, special purpose classrooms) should be delineated in the Facilities Program and specific needs verified during the design phase.

1.1 Audio Visual Issues

A. All new classrooms should be designed to provide, at a minimum, front wall space for 9 (units high) x16 (units wide) format projection screens.

B. The height of the projected image is determined by taking the distance of the farthest student from the projection screen and dividing it by 6. Therefore, ceiling height at the front of the room should allow for that height image plus 4'. This guideline is based on locating the instructor console at the side of the room. Placement of the instructor console in the center of the lecture area is not recommended for smaller classrooms. See General Guidelines for Lecture Halls for guidelines related to placement of console in center of lecture area.

C. Projection screens mounted above the marker board must clear the board's marker (chalk) tray. Typically, provide 6"-8" clear from the face of the marker board to the back of the screen. The projection screen in its lowered position must not cover light switches and outlets.

D. Ceiling-mounted projectors or wall-mounted projection screens should not conflict with the lighting fixtures or access to lighting fixtures for changing lamps.

1.2 Owner Provided Equipment

A. Furniture and equipment not included in the construction cost, but provided and installed by FSU may include:

1) Standard marker boards
2) Instructor console
3) LCD projector and bracket
4) Electronic marker board
5) ENO board
6) Voice lift system or PA system including speakers, unless specifically noted in the Facilities Program to be provided as part of the construction cost.
7) Security access card reader.

In some cases, it may be desirable for the contractor to supply and install certain items (e.g., marker boards, projection screens, instructor consoles (if custom cabinetry)), or to install certain owner-provided equipment (e.g., projector mounts, marker boards). Such situations should be discussed with the FSU project manager and the Assistant Director of Instructional Technology prior to the finalization of the construction documents.

PART 2 – Standard Space Types

2.1 Class I Classroom: Up to 49 students, electronically equipped, non-tiered

2.1a Area and Affiliated Spaces

1) Classroom Area: Min. 20 NSF/Student, max. 24 NSF/Student
2) Number of Accessible Seating Spaces: One
3) Lectern Area: Included with student area
4) Electronic Equipment Room: None

2.1b Furnishings and Equipment

1) Seating: Standard student desks with fixed arm tablets.
2) Accessible Seating: Desks and loose chair for accessibility-impaired students: One station
3) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Table top desk and chair
   - Marker Board: 4' ht. X 16' length (typical)
   - Projection Screen: Electric, matte white screen, typically 84"W x 84"H; recessed mounting not required, mounted on front wall of classroom. Switch is to be located adjacent to the instructor console.
   - LCD Projector: A ceiling-suspended LCD projector bracket centered on the projection screen and located between 12'-0" and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projector is to be made only by ACNS.
   - Instructor console, approximately 30"(d) x 66"(w) x 37"(h), containing a computer, VCR, DVD player, video switching equipment, amplifier, laptop interface, and document camera. The instructor console shall be located with approximately 3'-6" clear distance between the front wall and the rear face of the instructor console.
   - Speakers (mounted within 2x2 ceiling grid)

2.1c Architectural Features

1) Room Shape: traditional rectilinear, 2:3 ratio oriented to instructional area at front of room.
2) Ceiling Height: Min. 10 feet.
3) Doors: Min.one, with narrow door light, located at front of the room
4) Floors: Vinyl tile, carpet preferred

5) Walls: Light color, min. 85% reflectivity.
6) Ceilings: 2 x 2 acoustical panels and grid, white.
7) Additional Acoustical Treatment: As required.

2.1d Lighting

1) Recessed 2 x 4 fluorescent, parabolic, controlled by Lutron dimming system. Ballasts shall be dimming ballasts made by Lutron Electronics Company.
2) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lock out the other nor change the preset controls of the dimming system.
3) There shall be two dimming zones – Zone 1 for the front row of light fixtures above the seating area, and Zone 2 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls shall be by "Lutron Electronics Company."
4) General lighting (full on / full off) shall be located at the Classroom entrance.
5) In renovation projects where the budget will not support the installation of a dimming system, "inboard/outboard" switching should be used, and the row of lights at the front of the room should be switched separately.
6) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.

2.1e Power Outlets

1) Quadraplex adjacent to each communications outlet, standard duplex receptacles other walls.

2.1f Special Equipment Power Requirements

1) LCD Projector Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for the LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (<u>must</u> be on same phase). Depending on the anticipated load from the projector and the equipment in the instructor console, two dedicated circuits may be required. A "kill switch" located adjacent to the instructor console should be provided that will interrupt power to the receptacle that supplies power to the LCD projector. This switch may be located adjacent to the dimmer controls. This switch should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle on the wall beside the instructor console.

2.1g Data/Communications Outlets and Infrastructure

1) One RJ45 outlet at front and rear walls.
2) One RJ45 data outlet with 4 data circuits shall be provided on the wall beside the instructor console.
3) Provide one concealed 2” diameter conduit (with pull string) running from the LCD Projection Bracket to a junction box beside the instructor console. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be “communication sweeps”, and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
4) Provide one concealed ¾” conduit (with pull string) running from the motorized projection screen to the junction box beside the instructor console (for low-voltage control of projection screen).
5) Provide one concealed ¾” conduit (with pull string) from dimming control system bus to the junction box beside the instructor console (for AV interface to dimming system).

2.1h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Type 1 Classroom(s) on Campus

Bellamy 003, Bellamy 11

2.2 Class II Classroom: 50 to 99 students, electronically equipped, non-tiered

2.2a Area and Affiliated Spaces

1) Classroom Area: Min. 20 NSF/Student, max. 24 NSF/Student
2) Number of Accessible Seating Spaces: Two
3) Lectern Area: Included with student area
4) Electronic Equipment Room: None

2.2b Furnishings and Equipment

1) Seating: Standard student desks with fixed arm tablets. For larger rooms, tables and chairs may be considered, along with fixed seating (see specifications for Class III classrooms)
2) Accessible Seating: Desks and loose chairs for accessibility-impaired students: Four stations (if fixed seating is used).
3) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Table top desk and chair
   - Marker Board: 4' ht. X 24' length (typical)

- Projection Screen: Electric, matte white screen, typically 96"W x 96"H; recessed mounting not required, mounted on front wall of classroom. Switch is to be located adjacent to the instructor console. For larger rooms, an electric screen sufficient to yield an image height of 1/6th the distance of the farthest student from the projection screen, with recessed mounting, should be considered.
- LCD Projector: A ceiling-suspended LCD projector bracket centered on the projection screen and located between 12’-0” and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projector is to be made only by ACNS.
- Instructor console, approximately 30"(d) x 66"(w) x 37"(h), containing a computer, VCR, DVD player, video switching equipment, amplifier, laptop interface, and document camera. The instructor console shall be located with approximately 3'-6” clear distance between the front wall and the rear face of the instructor console.
- Speakers (mounted within 2x2 ceiling grid)

2.2c Architectural Features

1) Room Shape: traditional rectilinear, 2:3 ratio oriented to instructional area at front of room.
2) Ceiling Height: Min. 10 feet.
3) Doors: Two, with narrow door lights. Main entry is located at front of the room
4) Floors: Vinyl tile, carpet preferred
5) Walls: Light color, min. 85% reflectivity.
6) Ceilings: 2 x 2 acoustical panels and grid, white.
7) Additional Acoustical Treatment: As required.

2.2d Lighting

1) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lock out the other nor change the preset controls of the dimming system.
2) There shall be two - three dimming zones – Zone 1 for the front row of light fixtures above the seating area, Zone 2 for the middle set of light fixtures, and Zone 3 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls shall be by "Lutron Electronics Company."
3) General lighting (full on / full off) shall be located at the Classroom entrance.
4) In renovation projects where the budget will not support the installation of a dimming system, "inboard/outboard" switching should be used, and the row of lights at the front of the room should be switched separately.
5) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire

whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.

2.2e Power Outlets

1) Quadraplex adjacent to each communications outlet, standard duplex receptacles other walls.

2.2f Special Equipment Power Requirements

1) LCD Projector Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for the LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (<u>must</u> be on same phase). Depending on the anticipated load from the projector and the equipment in the instructor console, two dedicated circuits may be required. A "kill switch" located adjacent to the instructor console should be provided that will interrupt power to the receptacle that supplies power to the LCD projector. This switch may be located adjacent to the dimmer controls. This switch should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle on the wall beside the instructor console.

2.2g Data/Communications Outlets and Infrastructure

1) One RJ45 outlet at front and rear walls.
2) One RJ45 data outlet with 4 data circuits shall be provided on the wall beside the instructor console.
3) Provide one concealed 2" diameter conduit (with pull string) running from the LCD Projection Bracket to a junction box beside the instructor console. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be "communication sweeps", and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
4) Provide one concealed ¾" conduit (with pull string) running from the motorized projection screen to the junction box beside the instructor console (for low-voltage control of projection screen).
5) Provide one concealed ¾" conduit (with pull string) from dimming control system bus to the junction box beside the instructor console (for AV interface to dimming system).

2.2h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

Bellamy 023, Carothers 303, Grover Rogers (OSB) 108

2.3 – Lecture Halls--- Design Issues and General Guidelines for All Lecture Halls

2.3a To provide good sight lines and acoustics, lecture halls should be a modified fan-shaped design. Student seating can be arranged up to 45 degrees off the center axis of the room to provide good viewing angles from all seats. In no case shall a student be required to view a projected image from a line-of-sight angle more acute than 30 degrees. The depth of the room should be no greater than 1.5 times the width of the room, measured at the midpoint of the seating area. Balconies should be avoided.

2.3b Placement of aisles should be sufficient such that an instructor may walk around in the seating area during an exam and proctor the exam (i.e., can easily see each and every seat).

2.3c Ceilings in smaller lecture halls should be at least 15 feet high at the front of the room and, even with tiered seating, at least 9 feet high at the rear. Ceilings in larger halls should be at least 20 feet high at the front and at least 10 feet high at the back. Consider that in larger lecture halls, it will be highly desirable to place the bottom of the projected image at the top of the marker board (7' AFF) so that the instructor will not walk in front of the projected image. Remember, the height of the projected image is 1/6th the distance of the farthest student from the projection screen (e.g., if the farthest student is 60' from the projection screen, the height of the projected image is 10' making the ceiling height at the front of the room at least 17') which will determine the height of the ceiling.

2.3d Acoustics are one of the most important features in good lecture hall design. All surfaces in the room should be studied, shaped, and tested integrally with the design of the floor plan so that amplified voice systems will augment, not replace, the natural voice volume. ACNS strongly recommends that an acoustical consultant be retained when constructing new lecture halls, or making a major renovation of an existing lecture hall.

2.3e The ceiling is the most critical element in insuring that the sound in the lecture hall is distributed evenly and at appropriate loudness to all portions of the seating area. The ceiling should act as a sound mirror, reflecting sound downward to blend with the sound from the speaker system. To achieve this, the ceiling should be sloped or stepped, and the majority of the ceiling should be a hard surface. If the ceiling has too much sound absorbent material, the loudness will diminish at the back of the room. To enhance the instructor's voice projection, the ceiling should be hard-surfaced nearest the instructor, and tilted at an angle from the ceiling to the front wall, similar to the ceiling of an orchestra shell.

2.3f Since lecture halls generally do not have windows, extra care must be given to the use of interior finishes, colors, and décor to provide visual interest to the room. The use of side-wall dimming fixtures should also be considered.

2.3g If theater-style fixed seating is used, the vast majority of the seats (>90%) should have a minimum seat width of 21 inches.

2.4 Class III Classroom: 100+ students, tiered seating, Standard Lecture Hall

2.4a Area and Affiliated Spaces

1) Classroom Seating Area: Min. 17 NSF/Student, max. 19 NSF/Student. (Area includes aisle ways within seating area.)
2) Number of Accessible Seating Spaces: Five for 101 to 125 persons
3) Lectern/Podium: Minimum of 8' from front wall for the width of the front wall.
4) Electronic Equipment Closet: 25 NSF for single stacked rack of equipment. Will require HVAC supply.
5) Projection Room (optional): approximately 200 NSF, depending on configuration. Will require HVAC supply.
6) Foyer (optional): To accommodate students waiting on change of classes. This area may contain rest rooms. Sound isolation is important.

2.4b Furnishings and Equipment

1) Seating: Fixed continuous desktop with pedestal mounted swing-out chairs. Accessible seating shall have continuous desktop surface for wheelchair access. Provide one loose chair per accessible station matching pedestal chairs. Desktops may be equipped with power/data modules (ports) for each seating station. If so, modules shall consist of one duplex receptacle and two ports for data connectors. Each module shall be equipped with a cord with a three-prong plug for connecting into the wiring harness. The power wiring harness shall be enclosed in a wire trough below the countertop with a metal divider to separate power from data cables. Theater-style fixed seating may also be used in larger lecture halls. At least 90% of the seats should have a minimum seat width of 21 inches. Seats must include large or over-sized tablet arms.
2) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Table top desk and chair
   - Marker Board: 4' ht. X 24' length (typical)
   - Projection Screens: Two electric screens, with recessed mounting. Switch is to be located adjacent to the instructor console. Use of two fixed, aluminum framed, stretched vinyl screens, should be considered. Viewing angles should not be worse than 30 degrees for the seats on the side to the farthest edge of the projected images.
   - LCD Projectors: Two ceiling-suspended LCD projector brackets centered on the appropriate projection screen and located between 12'-0" and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projectors is to be made only by ACNS. Depending on the size of the room and the height of the ceiling, a projection room may be necessary to house the LCD projectors.
   - Instructor console, approximately 30"(d) x 72"(w) x 40"(h), containing a computer, VCR, DVD player, AMX control system, video switching equipment,

laptop interface, and two document cameras. The instructor console shall be located with a minimum of 4' clear distance between the front wall and the rear face of the instructor console.

- Speakers, mounted at the edges of the front wall. May be recessed into front wall.
- Equipment rack, located in Electronic Equipment Closet, containing audio equipment.
- (Optional) Electronic Marker Board, approximately 4' x 8', mounted on front wall.

2.4c Architectural Features

1) Room Configuration: Modified fan-shaped design. Straight rowed tiered risers or curved risers oriented to front of the room. 45-degree orientation to the front corner of the room may also be considered if room shape is rectilinear. Placement of instructional furniture and equipment and specifically the instructor console shall not conflict with student seating sightlines to the marker board(s) and projection screens.
2) Ceiling Height: Min.9 feet at rear of room; min. 15 feet at front of room at projection screen. For large rooms (~200 seats), would prefer ceiling height of 20' at front of room.
3) Doors: Min. two, each with narrow door light.
4) General non-seating floors: Vinyl tile, prefer carpet
5) Tiered Risers: Carpeted with vinyl nosings and risers
6) Walls: Light color, min. 85% reflectivity.
7) Ceilings: 2 x 2 acoustical panels and grid, white.
8) Additional Acoustical Treatment: Voice projection system or PA system should augment the natural voice volume. Some wall treatment should be considered.
9) Electronic Equipment Closet: This space shall only open into the main classroom. No exterior doorways are permitted.
10) (Optional) Projection Room: This space shall open into a corridor or foyer.

2.4d Lighting

1) Recessed 2 x 4 fluorescent, parabolic, controlled by an approved dimming system to include dimming ballasts and occupancy sensors . Refer to Electrical requirements included in Division 16 of these Guidelines.
2) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lockout the other nor change the preset controls of the dimming system.
3) There shall be a minimum of three dimming zones – Zone 1 for the front two rows of light fixtures above the seating area, Zone 2 for the middle two rows of light fixtures and Zone 3 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls must be compatible with the approved dimming system.
4) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard.

The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.

5) Special lighting to illuminate maps or charts may be required. Such lighting shall be zoned separately to allow control via the AMX control system.
6) For larger rooms, aisle lighting should be considered.

2.4e Power Outlets

1) In additional to outlets for the seating system, provide general room perimeter outlets.

2.4f Special Equipment Power Requirements

1) LCD Projectors Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for each LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (it must be on the same phase). Depending on the anticipated load from the projectors and the equipment in the instructor console, two dedicated circuits may be required. A "kill switch" should be provided that will interrupt power to the receptacle the LCD projector is plugged into. This switch should be located in the Electronic Equipment Closet or the Projection Room, and should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle in the floor at the location of the instructor console.
3) Provide duplex receptacle for electronic marker board at appropriate wall elevation.
4) Provide one quad power receptacle in the Electronic Equipment Closet.
5) Provide one quad power receptacle in the Projection Room in the vicinity of the projectors.

2.4g Data/Communications Outlets and Infrastructure

1) Provide one concealed 2” diameter conduit (with pull string) running from each LCD Projection Bracket to a floor located junction box at the instructor console. May be part of the path from the instructor's console to the Electronic Equipment Closet or Projection Room. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be “communication sweeps”, and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
2) Provide one concealed ¾” conduit (with pull string) running from the motorized projection screen to the junction box beside the instructor console (for low-voltage control of projection screen).
3) Provide one concealed ¾” conduit (with pull string) from dimming control system bus to the junction box beside the instructor console (for AV interface to dimming system).
4) Instructor console data circuits: Specify five Category 5 data circuits and receptacle at the instructor console.
5) Provide one (1) 1" conduit and pull string from electronic marker board to instructor console.
6) Provide four (4) 2" conduits and pull strings from the instructor's console to the Electronic Equipment Closet or Projection Room.
7) Provide one (1) 1" conduit from Electronic Equipment Closet to each speaker.

2.4h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

Example 45-degree room orientation: Bellamy Building Room 021, 100 seats
Example Straight row orientation: Bellamy 102
Example Curved riser orientation: Rovetta 101

2.5 Class IV Classroom: 100+ students, Combination Lecture/Demonstration

2.5a Area and Affiliated Spaces

1) Classroom Seating Area: Min. 17 NSF/Student, max. 19 NSF/Student. (Area includes aisle ways within seating area.)
2) Number of Accessible Seating Spaces: Five for 101 to 125 persons OR as required per code. Review location with FSU project manager and FSU Building Code Official.
3) Lectern/Podium/Demonstation: Minimum of 8' from front wall for the width of the front wall.
4) Electronic Equipment Closet: 25 NSF for single stacked rack of equipment. Will require HVAC supply.
5) Projection Room (optional): approximately 200 NSF, depending on configuration. Will require HVAC supply.
6) Preparation Room: approximately 200 - 300 NSF, depending on materials stored.
7) Foyer (optional): To accommodate students waiting on change of classes. This area may contain rest rooms. Sound isolation is important.

2.5b Furnishings and Equipment

1) Seating: Fixed continuous desktop with pedestal mounted swing-out chairs. Accessible seating shall have continuous desktop surface for wheelchair access. Provide one loose chair per accessible station matching pedestal chairs. Desktops may be equipped with power/data modules (ports) for each seating station. If so, modules shall consist of one duplex receptacle and two ports for data connectors. Each module shall be equipped with a cord with a three-prong plug for connecting into the wiring harness. The power wiring harness shall be enclosed in a wire trough below the countertop with a metal divider to separate power from data cables. Theater-style fixed seating may also be used in larger lecture halls. At least 90% of the seats should have a minimum seat width of 21 inches. Seats must include large or over-sized tablet arms.

2) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Table top desk and chair

- Marker Board: 4' ht. X 24' length (typical)
- Projection Screens: Two electric screens, with recessed mounting. Switch is to be located adjacent to the instructor console. Use of two fixed, aluminum framed, stretched vinyl screens, should be considered. Viewing angles should not be worse than 30 degrees for the seats on the side to the farthest edge of the projected images.
- LCD Projectors: Two ceiling-suspended LCD projector brackets centered on the appropriate projection screen and located between 12’-0” and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary, and are to be used only for planning purposes. Final determination of the exact location of the projectors is to be made only by ACNS. Depending on the size of the room and the height of the ceiling, a projection room may be necessary to house the LCD projectors.
- Instructor console, approximately 30"(d) x 72"(w) x 40"(h), containing a computer, VCR, DVD player, AMX control system, video switching equipment, laptop interface, and two document cameras. The instructor console shall be located with a minimum of 4' clear distance between the front wall and the rear face of the instructor console.
- Speakers, mounted at the edges of the front wall. May be recessed into front wall.
- Equipment rack, located in Electronic Equipment Closet, containing audio equipment.
- (Optional) Electronic Marker Board, approximately 4' x 8', mounted on front wall.

3) Demonstration Bench:
   - Sink (may require special waste line)
   - Air supply and Gas supply
   - GFI electrical outlets
   - (Optional) Exhaust system
   - Camera that is connected to AMX control system and video switching equipment.

2.5c Architectural Features

1) Room Configuration: Modified fan-shaped. Straight rowed tiered risers or curved risers oriented to front of the room. 45-degree orientation to the front corner of the room may also be considered if room shape is rectilinear. Placement of instructional furniture and equipment and specifically the instructor console shall not conflict with student seating sight lines to the marker board(s) and projection screens.
2) Ceiling Height: Min.9 feet at rear of room; min. 15 feet at front of room at projection screen. For large rooms (~200 seats), would prefer ceiling height of 20' at front of room.
3) Doors: Min. two, each with narrow door light.
4) General non-seating floors: Vinyl tile, prefer carpet
5) Tiered Risers: Carpeted with vinyl nosings and risers
6) Walls: Light color, min. 85% reflectivity. Consider the use of an accent wall (usually the rear wall)
7) Ceilings: 2 x 2 acoustical panels and grid, white.
8) Additional Acoustical Treatment: Voice projection system or PA system should augment the natural voice volume. Some wall treatment should be considered.

9) Electronic Equipment Closet: This space shall only open into the main classroom. No exterior doorways are permitted.
10) (Optional) Projection Room: This space shall open into a corridor or foyer.
11) (Optional) Preparation Room: This space shall open into a corridor or to the exterior. It may require an exhaust system, or special storage (e.g., hazardous materials).

2.5d Lighting

1) Recessed 2 x 4 fluorescent, parabolic, controlled by dimming system. Ballasts shall be dimming ballasts compatible with the approved dimming system and occupancy sensors. Refer to Electrical requirements in Division 16 of this Guideline.
2) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lockout the other nor change the preset controls of the dimming system.
3) There shall be a minimum of three dimming zones – Zone 1 for the front two rows of light fixtures above the seating area, Zone 2 for the middle two rows of light fixtures and Zone 3 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls must be compatible with the approved dimming system.
4) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.
5) Special lighting to illuminate maps or charts may be required. Such lighting shall be zoned separately to allow control via the AMX control system.
6) Special lighting to illuminate demonstration area may be required. Such lighting shall be zoned separately to allow control via the AMX control system.
7) For larger rooms, aisle lighting should be considered.

2.5e Power Outlets

1) In additional to outlets for the seating system, provide general room perimeter outlets.

2.5f Special Equipment Power Requirements

1) LCD Projectors Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for each LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (it must be on the same phase). Depending on the anticipated load from the projectors and the equipment in the instructor console, two dedicated circuits may be required. A "kill switch" should be provided that will interrupt power to the receptacle the LCD projector is plugged into. This switch should be located in the Electronic Equipment Closet or the Projection Room, and should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle in the floor at the location of the instructor console.
3) Provide duplex receptacle for electronic marker board at appropriate wall elevation.
4) Provide one quad power receptacle in the Electronic Equipment Closet.

5) Provide one quad power receptacle in the Projection Room in the vicinity of the projectors.
6) Provide a minimum of one GFI quad power receptacle in the demonstration bench.

2.5g Data/Communications Outlets and Infrastructure

1) Provide one concealed 2” diameter conduit (with pull string) running from each LCD Projection Bracket to a floor located junction box at the instructor console. May be part of the path from the instructor's console to the Electronic Equipment Closet or Projection Room. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be “communication sweeps”, and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
2) Provide one concealed ¾” conduit (with pull string) running from the motorized projection screen to the junction box beside the instructor console (for low-voltage control of projection screen).
3) Provide one concealed ¾” conduit (with pull string) from dimming control system bus to the junction box beside the instructor console (for AV interface to dimming system).
4) Instructor console data circuits: Specify five Category 5 data circuits and receptacle at the instructor console.
5) Provide one (1) 1" conduit and pull string from electronic marker board to instructor console.
6) Provide four (4) 2" conduits and pull strings from the instructor's console to the Electronic Equipment Closet or Projection Room.
7) Provide one (1) 1" conduit from Electronic Equipment Closet to each speaker.
8) Provide two (2) 1" conduits (or chase) from demonstration bench to instructor console.

2.5h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

Example Straight row orientation: Fisher Lecture Hall, Carraway 101

2.6 Class V Classroom: 100+ students, Combination Lecture/Performance Venue

2.6a Area and Affiliated Spaces

1) <u>Classroom Seating Area</u>: Min. 17 NSF/Student, max. 19 NSF/Student. (Area includes aisle ways within seating area.)

2) <u>Number of Accessible Seating Spaces:</u> Five for 101 to 125 persons OR as per code requirements.

3) Lectern/Podium: Minimum of 8' from front wall for the width of the front wall. ADA access (for instructors) must be maintained for this area.
4) Performance Stage: Consult with Individual Department.
5) Electronic Equipment Closet: 25 NSF for single stacked rack of equipment. Will require HVAC supply.
6) Projection Room (optional): approximately 200 NSF, depending on configuration. Will require HVAC supply.
7) Ticket Office: approximately 200 NSF.
8) Foyer (optional): To accommodate students waiting on change of classes. This area may contain rest rooms. Sound isolation is important.

2.6b Furnishings and Equipment

1) Seating: Fixed auditorium seating with large or over-sized folding tablet arms. Accessible seating shall have continuous desktop surface for wheelchair access. Provide one loose chair per accessible station matching auditorium seats.
2) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Table top desk and chair
   - Marker Board: 4' ht. X 8' length, portable (typical)
   - Projection Screens: Two electric screens, with recessed mounting. Switch is to be located adjacent to the instructor console. Viewing angles should not be worse than 30 degrees for the seats on the side to the farthest edge of the projected images.
   - LCD Projectors: Recessed projector lifts centered on the appropriate projection screen and located between 12'-0" and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projectors is to be made only by ACNS. A projection room may be considered to house the LCD projectors.
   - Instructor console, approximately 30"(d) x 72"(w) x 40"(h), containing a computer, VCR, DVD player, AMX control system, video switching equipment, laptop interface, and two document cameras. The instructor console shall be located with a minimum of 4' clear distance between the front wall and the rear face of the instructor console. Easily accessible storage for this console must be provided.
   - Speakers, mounted at the edges of the front wall. May be recessed into front wall.
   - Equipment rack, located in Electronic Equipment Closet, containing audio equipment.
   - Voice amplification system used for instructional purposes should be separate from system used for performances.

2.6c Architectural Features

1) Acoustics: ACNS strongly recommends that the design professional retain an acoustical engineer to assist with the design of the room, along with the specification of any voice amplification system to be used for performance purposes.
2) Room Configuration: Traditional auditorium orientation, sloped or tiered floor.
3) Screen. For large rooms (~200 seats), would prefer ceiling height of 20' at front of room. Performance considerations may call for even higher ceiling heights.

4) Doors: Min. two, each with narrow door light.
5) General non-seating floors: Carpet
6) Tiered Risers: Carpeted with vinyl nosings and risers
3) Walls: Light color, min. 85% reflectivity. Consider the use of an accent wall (usually the rear wall)
4) Ceilings: 2 x 2 acoustical panels and grid, white.
5) Additional Acoustical Treatment: Voice projection system or PA system should augment the natural voice volume. Wall treatment must be considered.
10) Electronic Equipment Closet: This space shall only open into the main classroom. No exterior doorways are permitted.
11) (Optional) Projection Room: This space shall open into a corridor or foyer.

2.6d Lighting

1) Classroom and performance lighting should be separated, with separate controls and capable of being programmed separately. Refer to Division 16 for further requirements related to occupancy sensors.
2) Classroom and general-purpose house lighting (e.g., aisle lights): Prefer recessed 2 x 4 fluorescent, parabolic, controlled by approved dimming system. Ballasts shall be dimming ballasts compatible w/approved dimming system.
3) Performance: Requirements determined by Department, in consultation with ACNS.
4) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lockout the other nor change the preset controls of the dimming system. Classroom and general-purpose house lighting shall also be controlled from the control booth.
5) There shall be a minimum of three dimming zones – Zone 1 for the front two rows of light fixtures above the seating area, Zone 2 for the middle two rows of light fixtures and Zone 3 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls shall be by "Lutron Electronics Company."
6) If the room will contain permanently-installed whiteboards, to completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.
7) Aisle lighting shall be provided.

2.6e Power Outlets

1) In additional to outlets for the seating system, provide general room perimeter outlets.

2.6f Special Equipment Power Requirements

1) LCD Projectors Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for each LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (it

must be on the same phase). Depending on the anticipated load from the projectors and the equipment in the instructor console, two dedicated circuits may be required. A "kill switch" should be provided that will interrupt power to the receptacle the LCD projector is plugged into. This switch should be located in the Electronic Equipment Closet or the Projection Room, and should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).

2) Provide one quad power receptacle in the floor at the location of the instructor console.
3) Provide duplex receptacle for electronic marker board at appropriate wall elevation.
4) Provide one quad power receptacle in the Electronic Equipment Closet.
5) Provide one quad power receptacle in the Projection Room in the vicinity of the projectors.
6) Provide a minimum of one GFI quad power receptacle in the demonstration bench.

2.6g Data/Communications Outlets and Infrastructure

1) Provide one concealed 2" diameter conduit (with pull string) running from each LCD Projection Bracket to a floor located junction box at the instructor console. May be part of the path from the instructor's console to the Electronic Equipment Closet or Projection Room. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be "communication sweeps", and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
2) Provide one concealed ¾" conduit (with pull string) running from the motorized projection screen to the junction box at the instructor console (for low-voltage control of projection screen).
3) Provide one concealed ¾" conduit (with pull string) from dimming control system bus to the junction box at the instructor console (for AV interface to dimming system).
4) Instructor console data circuits: Specify five Category 5 data circuits and receptacle at the instructor console.
5) Provide one (1) 1" conduit and pull string from electronic marker board to instructor console.
6) Provide four (4) 2" conduits and pull strings from the instructor's console to the Electronic Equipment Closet or Projection Room.
7) Provide one (1) 1" conduit from Electronic Equipment Closet to each speaker.
8) Provide two (2) 1" conduits (or chase) from demonstration bench to instructor console.

2.6h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

Example: Williams 123 (Conradi Theater)

2.7 Class VI Classroom: Computer Classroom, 24-32 Students

2.7a Area and Affiliated Spaces

1) Classroom Area: Min. 24 NSF/Student, max. 28 NSF/Student
2) Number of Accessible Seating Spaces: One
3) Lectern Area: Included with student area
4) Network Equipment/File Server Room: approximately 100 NSF (will require HVAC supply)

2.7b Furnishings and Equipment

1) Seating: Tables (minimum of 60" x 30") and task chairs.
2) Accessible Seating: Desks and loose chair for accessibility-impaired students: One station
3) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Marker Board: 4' ht. X 16' length (typical)
   - Projection Screen: Electric, matte white screen, typically 84"W x 84"H; recessed mounting not required, mounted on front wall of classroom. Switch is to be located adjacent to the instructor console.
   - LCD Projector: A ceiling-suspended LCD projector bracket centered on the projection screen and located between 12'-0" and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projectors is to be made only by ACNS.
   - Instructor console, approximately 30"(d) x 66"(w) x 37"(h), containing a computer, VCR, DVD player, video switching equipment, amplifier, laptop interface, and document camera. The instructor console shall be located with approximately 3'-6" clear distance between the front wall and the rear face of the instructor console.
   - Speakers (mounted within 2x2 ceiling grid)
   - One computer per student.

2.7c Architectural Features

1) Room Shape: traditional rectilinear, 2:3 ratio oriented to instructional area at front of room.
2) Ceiling Height: Min. 10 feet.
3) Doors: Min.one, with narrow door light, located at front of the room
4) Floors: Carpet
5) Walls: Light color, min. 85% reflectivity.
6) Ceilings: 2 x 2 acoustical panels and grid, white.
7) Additional Acoustical Treatment: As required.

2.7d Lighting

1) Recessed 2 x 4 fluorescent, parabolic, controlled by Lutron dimming system. Ballasts shall be dimming ballasts made by Lutron Electronics Company.
2) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lock out the other nor change the preset controls of the dimming system.
3) There shall be two dimming zones – Zone 1 for the front row of light fixtures above the seating area, and Zone 2 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls shall be by "Lutron Electronics Company."
4) General lighting (full on / full off) shall be located at the Classroom entrance.
5) If lighting is not dimmable, then "inboard/outboard" switching should be used, and row of lights at front of room should be switched separately.
6) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.

2.7e Power Outlets

1) Quadraplex adjacent to each communications outlet, standard duplex receptacles other walls.

2.7f Special Equipment Power Requirements

1) LCD Projector Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for the LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (<u>must</u> be on same phase). A "kill switch" located adjacent to the instructor console should be provided that will interrupt power to the receptacle that supplies power to the LCD projector. This switch may be located adjacent to the dimmer controls. This switch should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle on the wall beside the instructor console.
3) Provide one quad power receptacle on wall at the end of each "finger" of tables. Typically, each "finger" will have 4 computers.
4) In some cases, tables with built-in power and data will be used.

2.7g Data/Communications Outlets and Infrastructure

1) One RJ45 data outlet with 4 data circuits shall be provided on the wall beside the instructor console.
2) One RJ45 data outlet per "finger" of tables (typically, 4 computers per "finger"), with sufficient data circuits for the number of computers. Because of the number of data circuits involved, the design professional is strongly encouraged to

investigate the use of data raceways, and wire trays (above ceiling) instead of the standard method of one 1" home-run conduit per outlet. If raceway is chosen, please consult with ACNS for specifications.

3) Provide one concealed 2” diameter conduit (with pull string) running from the LCD Projection Bracket to a junction box beside the instructor console. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be “communication sweeps”, and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
4) Provide one concealed ¾” conduit (with pull string) running from the motorized projection screen to the junction box at the instructor console (for low-voltage control of projection screen).
5) Provide one concealed ¾” conduit (with pull string) from dimming control system bus to the junction box at the instructor console (for AV interface to dimming system).

2.7h Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

Hoffman 104, Carothers 315A

2.8 Class VII Classroom: Distance Learning Classroom, 24-32 Students

2.8a Area and Affiliated Spaces

1) Classroom Area: Min. 24 NSF/Student, max. 28 NSF/Student
2) Number of Accessible Seating Spaces: One
3) Lectern Area: Included with student area
4) Additional space for peripherals (e.g., fax machines) should be provided. Extra storage and work counters may also be needed.
5) (Optional) Equipment Room: approximately 100 NSF (will require HVAC supply)

2.8b Furnishings and Equipment

1) Seating: Tables and Chairs are preferred. Tables should be 18” deep by 60” wide. For some rooms, standard student desks with fixed arm tablets may be considered.
2) Accessible Seating: Desks and loose chair for accessibility-impaired students: One station
3) Instructional Furniture and Equipment:
   - Portable stand-up lectern
   - Marker Board: 4' ht. X 16' length (typical) [Should be light gray in color.]

- Projection Screen: Electric, matte white screen, typically 84"W x 84"H; recessed mounting not required, mounted on front wall of classroom. Switch is to be located adjacent to the instructor console.
- LCD Projector: A ceiling-suspended LCD projector bracket centered on the projection screen and located between 12’-0” and 18'-0" from the center of the bracket to the face of the projection screen, depending on the size of the projected image. These distances are preliminary and are to be used only for planning purposes. Final determination of the exact location of the projectors is to be made only by ACNS.
- Instructor console, approximately 30"(d) x 66"(w) x 37"(h), containing a computer, VCR, DVD player, video switching equipment, amplifier, laptop interface, and document camera. The instructor console shall be located with approximately 3'-6” clear distance between the front wall and the rear face of the instructor console.
- Fax machine.
- Videoconferencing equipment, including cameras.
- Speakers (mounted within 2x2 ceiling grid)
- Additional video monitors or LCD projectors as necessary to display people at remote location.

2.8c Architectural Features

1) Room Shape: traditional rectilinear, 2:3 ratio oriented to instructional area at front of room.
2) Ceiling Height: Min. 10 feet.
3) Doors: Min.one, with narrow door light, located at front of the room.
4) Windows: No windows.
5) Floors: Carpet
6) Walls: Light color, min. 85% reflectivity. The front wall should be painted a light gray.
7) Ceilings: 2 x 2 acoustical panels and grid, white.
8) Additional Acoustical Treatment: As required.

2.8d Lighting

1) In order to obtain a quality video image of the instructor and students, additional lighting sufficient to generate 90 – 100 foot-candles should be installed.
2) Recessed 2 x 4 fluorescent, parabolic, controlled by an approved dimming system. Ballasts shall be dimming ballasts shall be compatible with the approved dimming system..
3) Lighting shall be controlled at the room's entrances and adjacent to the instructor console. Lighting shall be such that no one location can lock out the other nor change the preset controls of the dimming system.
4) There shall be two dimming zones – Zone 1 for the front row of light fixtures, and Zone 2 for the remaining light fixtures. Dimming controls shall be located near the instructor console. Dimmer controls shall be compatible with an approve dimming system.
5) General lighting (full on / full off) shall be located at the Classroom entrance.

6) If lighting is not dimmable, then "inboard/outboard" switching should be used, and row of lights at front of room should be switched separately.
7) To provide adequate illumination of the instructor, one or more additional fixtures specifically designed for videoconferencing may be required.
8) To completely illuminate the whiteboard and the instructor area, we prefer a continuous, end-to-end row of 2 x 4 fluorescent fixtures, installed parallel to and running the length of the whiteboard. The fixtures shall be located at a distance from the whiteboard such that the light is evenly dispersed across the entire whiteboard. The fixtures shall be equipped with white, flat diffuser inserts. This row shall be separately switched as either full-ON or full-OFF.

2.8e Power Outlets

1) Quadraplex adjacent to each communications outlet, standard duplex receptacles other walls.

2.8f Special Equipment Power Requirements

1) LCD Projector Power: A duplex receptacle shall be provided above ceiling (in the vicinity of the projector bracket) for each LCD projector. The receptacle should be circuited on the same dedicated circuit as the power for the instructor console (<u>must</u> be on same phase). A "kill switch" located adjacent to the instructor console should be provided that will interrupt power to the receptacle that supplies power to the LCD projector. This switch may be located adjacent to the dimmer controls. This switch should be a keyed switch (e.g., Hubbell Lock-type switch, #1221L).
2) Provide one quad power receptacle on the wall beside the instructor console.

2.8g Data/Communications Outlets and Infrastructure

1) One RJ45 data outlet with 5 data circuits and one analog telephone circuit shall be provided on the wall beside the instructor console.
2) Provide one concealed 2” diameter conduit (with pull string) running from the LCD Projection Bracket to a junction box beside the instructor console. The conduit shall be fitted with a plastic bushing ring at the projector location. All 90-degree elbows shall be “communication sweeps”, and there shall be no more than three such sweeps per conduit run between the projector and the junction box at the instructor console.
3) Provide one concealed ¾” conduit (with pull string) running from the motorized projection screen to the junction box at the instructor console (for low-voltage control of projection screen).
4) Provide one concealed ¾” conduit (with pull string) from dimming control system bus to the junction box at the instructor console (for AV interface to dimming system).
5) Additional conduit may be required for camera locations and video monitor (or LCD projector) locations.

2.8g Room Security

1) In addition to keyed lever latchsets and closers, provide card access system (low voltage) entry to the selected main entry door. All doors accessing the room shall have door security contacts wired to the security system. Provide wall and/or ceiling mounted motion sensors in the room.

Example of Satisfactory Classroom(s) on Campus

BEL 008

END OF SECTION

STORMWATER DRAINAGE GUIDELINES

1. Follow these considerations when preparing the design of site storm water drainage and related facilities: Comply with flood plain management criteria.
2. Determine the impact that the proposed facility has on the current drainage system and plan accordingly.
3. Building floor elevations shall be set to minimum standards above 100-year flood plain elevation, but in no case lower than two feet above the 100 YFP.
4. Overland flow capacities from the 100-year storm event available for all flow in excess of capacity of underground and open channel conveyance systems.
5. No floodwater from the 25-year storm event greater than six (6) inches deep on local roads, parking lots or other non-street vehicular use areas.
6. No flood waters from the 25-year storm event in one driving lane each direction of collector streets.
7. No floodwater from the 25-year storm event in two driving lanes each direction of arterial streets.
8. Where open channel conveyances are to be constructed, storm event in excess of capacity of underground conveyance system, or for full 25-year storm flow if no underground system exists.
9. The rate of off-site discharge shall not exceed the pre-development rate of discharge.
10. No floodwater from a 5 or 10-year storm event in one driving lane of local roads.
11. No floodwater from a 5 or 10-year storm event in the driving lanes of any other road than a local road.
12. Underground conveyances not overflowing from a 5 or 10-year storm event.
13. Storm Drainage System. Provide catch basin or inlets of precast or cast-in-place concrete? Grates and frames shall be cast iron or galvanized steel. Drainage pipe to be concrete, corrugated metal pipe or helicoidal metal pipe (bituminous coated or aluminum).
14. The Construction Manager shall be responsible for obtaining and managing the NPDES Stormwater permit during construction.

UTILITIES PROCUREMENT PROCEDURES

It is the intent of these procedures to provide a consistent, methodical path of communications for organizations to obtain utilities for either temporary or permanent use.

Temporary use generally addresses utilities, i.e. electricity, water, etc., used during construction, including such utilities to the job site trailer. Permanent is for an in-place structure or device requiring utilities for an extended period of time.

There are predominantly two scenarios: (1) Temporary or Permanent Utilities from a Campus System (electric); (2) Temporary or Permanent Utilities from the COT or other utility provider. Each scenario would first require an approved street address from the City of Tallahassee's (COT) Growth Management Department (Ph: 891-7110). ***Utility service will not be provided without an approved City of Tallahassee street address.*** To avoid potential utility service delays, please plan ahead and resolve address issues well in advance of project begin date.

Temporary or Permanent need for Electric Service from the Campus System:

1) As part of the Design Development phase, through the FSU Project Manager (FPM), contact must be made to FSU Utilities Representative (FUR) with the plans, intentions, and estimated utilities needed. Address issues should be resolved at this stage.
2) As coordinated through the FPM, prior to utilities being connected, the area to be serviced must be reviewed and approved by the FSU Building Code Administration Office (BCA).
3) Copy of the approved inspection report provided directly from BCA to the FSU Utilities Section.
4) As coordinated through the FPM, the contractor must provide FUR with the appropriate contact name and billing information for applicable utilities. At this point, contact will be made through FUR to the Facilities Central Utilities Plant (CUP) for the connection of the electric service.

Temporary or Permanent need for Utilities from the City of Tallahassee:

1) A predevelopment meeting inclusive of representatives from the COT, FUR, the Design Professionals, the FPM, and anyone else deemed necessary, will be scheduled as soon as practical after the start of the design phase and the utility demands are fairly well defined. This meeting will cover such things as type of service, estimated time required to be available, length of service (if temporary), etc. It must also include items such as meter size, water line size, gas line size, required BTU's, etc. Address issues should be resolved through the COT.
2) The results of the meeting must be clearly documented on the construction documents so that accommodations for connections and metering are made at the onset.
3) The contractor must provide FUR documentation containing the contact name and billing information for the applicable utilities. The COT will invoice the contractor directly for the utility charges until the building is turned over to FSU. Any correspondence to the COT concerning utility issues must be done through the FUR and the FSU Utilities Accounting Section.
4) After all documentation and financial commitments are in order, the FSU Utilites Accounting section will make the request to the COT, or in some cases, other utility providers such as Talquin Electric, Gulf Power, etc., for the connection of the requested utilities.

University departments who need utilities for an off-campus location will receive them through "commercial" meters, i.e. they will be conventional metered services that are read and invoiced monthly to the FUA by the Utility Provider. The requesting department will need to include the delivery address and the account number for billing. If the utilities are though the COT, the delivery address must agree with the listing used at the COT zoning department.

Any questions regarding the preceding procedures should be directed to, the FSU Utilities Representative (FUR) at 644-4878. Accounting questions should be directed to the FUA office, 645-8707.

Florida State University
Phase II, MS4 Permit Inspection Report Form
Inspections must occur monthly

Project Name:____ Number: FS-_______

Location (attach site plan, if necessary)	Type of control (see below)	Date installed / modified	Current Condition (see below)	Corrective Action / Other Remarks

Condition Code:

G = Good M = Marginal, needs maintenance or replacement soon P = Poor, needs immediate maintenance or replacement

C = Needs to be cleaned O = Other

Control Type Codes

1. Silt Fence	10. Storm drain inlet protection	19. Reinforced soil retaining system	28. Tree protection
2. Earth dikes	11. Vegetative buffer strip	20. Gabion	29. Detention pond
3. Structural diversion	12. Vegetative preservation area	21. Sediment Basin	30. Retention pond
4. Swale	13. Retention Pond	22. Temporary seed / sod	31. Waste disposal / housekeeping
5. Sediment Trap	14. Construction entrance stabilization	23. Permanent seed / sod	32. Dam
6. Check dam	15. Perimeter ditch	24. Mulch	33. Sand Bag
7. Subsurface drain	16. Curb and gutter	25. Hay Bales	34. Other
8. Pipe slope drain	17. Paved road surface	26. Geotextile	
9. Level spreaders	18. Rock outlet protection	27. Rip-rap	

Additional notes: ____

____

____

____

Inspection conducted by:

_________________________ ____ __________

Owner or Agent Name Type/Print Name & Title Date

MS4-PIR:07/21/06

DESIGN CRITERIA AND REQUIREMENTS FOR IRRIGATION

1.1 General Irrigation Criteria

A. New irrigation system components must be fully compatible with FSU Irrigation Dep.'s currently used components and must communicate with FSU central irrigation control via telecommunications pathways.

B. All new irrigation systems must use SCH 40 pvc piping for main and laterals. No exceptions.

C. Provide 2 year manufacturer's warranty on irrigation system controller and all components.

D. New irrigation system must have head to head coverage and provide separate zones for trees, shrubs, palms, groundcovers, and turf.

E. New irrigation system must minimize overspray onto adjacent sidewalks, roadways and buildings.

F. Locate controller for convenient access to the building main telecommunications room.

G. New irrigation system main, must be pressure tested for leaks prior to Substantial Completion.

H. The Contractor shall review existing irrigation systems located adjacent to new construction and shall discuss any anticipated impacts with the Grounds Department. The Contractor will be responsible for the continued operation of adjacent systems should adjustments be required to keep existing systems operational during construction. Operation of adjusted existing systems is required to be demonstrated prior to beginning and at end of construction activity. An acceptable asbuilt drawing of the landscape and irrigation construction must be submitted and approved by FSU Grounds prior to final payment being issued to the contractor.

1.2 General Landscape Design Criteria

A. FSU Grounds will provide design review comments to the FSU project manager pertaining to grading/drainage, landscape, and irrigation. Landscape and irrigation plans shall show existing above and below grade utilities and proposed contours along with the proposed site improvements.

B. A tree inventory, salvage, removal, and protection plan must be included in all construction document submittals and will be forwarded by the FSU project manager for review by the Grounds Dept.

C. An approved tree protection plan must be implemented prior to any other activity on site. Refer to attachment in these guidelines.

D. No construction activity should occur within the tree protection area. This includes: vehicular traffic, materials storage, waste discharge/storage, and other detrimental activities.

E. Damage to existing landscape areas or trees designated to remain shall be the responsibility of the contractor. Repair shall return the damaged area to its original condition, or better. Damaged trees shall be replaced with like species of the same size. Repair/replacement of damaged materials shall be at no cost to the University.

F. Plant material must comply with Florida Friendly Standards and be Florida Nursery Grade#1 or better. Plants must be selected to comply with the climatic conditions of the University. Prior to installation, an FSU Grounds representative will inspect the plants for compliance with University requirements for quality and condition. Plants must be warranted for 1 year.

G. Provide new trees of minimum size = 100 gal.

H. The contractor shall cut a minimum 4” edge between all turf and planter areas. Slope edge into planter prior to any planting activity.

I. Planting beds must be graded to a smooth finish prior to installation of plant material as well as after the completion of the installation and prior to placement of pre-emergent and mulch. All construction debris shall be removed from the planting beds along with any other material 1” in diameter and larger prior and post planting activity. Ensure that new backfill mix is, also, free of clods and stones over 1” diameter.

J. Apply pre-emergent weed control in all planting areas other than turf, including areas to receive mulch or rock cover. Solution shall be applied at manufacturer’s recommended rates.

K. All trenching shall be water settled to prevent future settling.

L. No planting activity shall occur prior to the irrigation system being installed and tested.

M. Backflow preventors, if installed by the contractor, must be tested and pass. Provide test results for review.

N. All turf areas are to be graded to a smooth finish prior to installation of sod.

SECTION 015639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 Summary

A. Protection of existing vegetation during construction: Extents and methods of tree and plant protection shall be coordinated with and approved by the Grounds Section through the Project Manager.

B. Vegetation which requires protection includes but is not limited to: existing trees to remain in place during construction, existing landscape areas scheduled to remain, newly planted landscape areas adjacent to construction activities.

C. Clearing operations: Extents of clearing shall be indicated on the construction documents and approved by the Grounds Section through the Project Manager. Approved protection systems including fencing and other barriers shall be installed prior to clearing to protect existing vegetation. See Division 1—General Requirements for guidelines relating to Tree Removal.

D. Replacement of trees and plants damaged during work: Repair construction damaged areas to match original condition or approved equal condition as directed by the Grounds Section.

E. Related specifications are included in Division 1-General Requirements, Division 2-Sitework, and Section 329210 Plant Salvage.

1.2 Performance Requirements

A. Identification, requirements/means of protection, and maintenance of existing vegetation within protected areas shall be included in the construction documents and reviewed by the Grounds Section during Design Development. Include ALL existing vegetation to be protected in the Plant Salvage Plan required by Section 32910.

B. Clearing operations, heavy equipment operation, materials storage, and other site operations around protected vegetation shall employ practices which do not disturb or damage trees or plants within the protected area.

C. New landscape areas planted prior to the completion of construction activities shall be protected from ongoing construction via an approved protection system.

D. All new and existing vegetated areas shall be protected until project Final Completion.

E. Plant materials inside the protected areas shall be watered and maintained per the Plant Salvage Plan.

1.3 Submittals

A. Submittals shall include but are not limited to: Plant Salvage Plan, Tree Protection Plan, Sample Warranties.

1.4 Warranty

A. Provide comprehensive replacement warranty for all protected materials for a period of (12) months after project acceptance or Final Completion.

B. All remedial or restoration work provided under the terms of the project warranty shall utilize species identical in size and characteristics of the damaged material unless otherwise approved by the Grounds Section. Warranty work shall include costs of all materials and labor.

PART 2 – PRODUCTS

2.1 Protection Materials

A. Burlap: utilize only untreated burlap fabric.
B. Mesh Fence Fabric: 4' high, orange mesh barrier or approved equal.
C. Fence Posts: 6' length TEE stud w/metal flange or approved equal.
D. Other: as required by Grounds Section to accommodate specific conditions.

PART 3 – EXECUTION

3.1 Identify areas requiring tree and plant protection and include in the Design Development Documents for approval. Include documentation of species, sizes, approximate age, condition, and other characteristics necessary to define protection requirements. Include a plan for protection of existing tree root systems. See graphic at the conclusion of this section.

3.2 Develop, submit, and maintain a protection plan utilizing approved barrier and fabric systems. The protection plan shall be approved during the construction documents submittal and should be reviewed on site with the Grounds Section during the Pre-construction meeting.

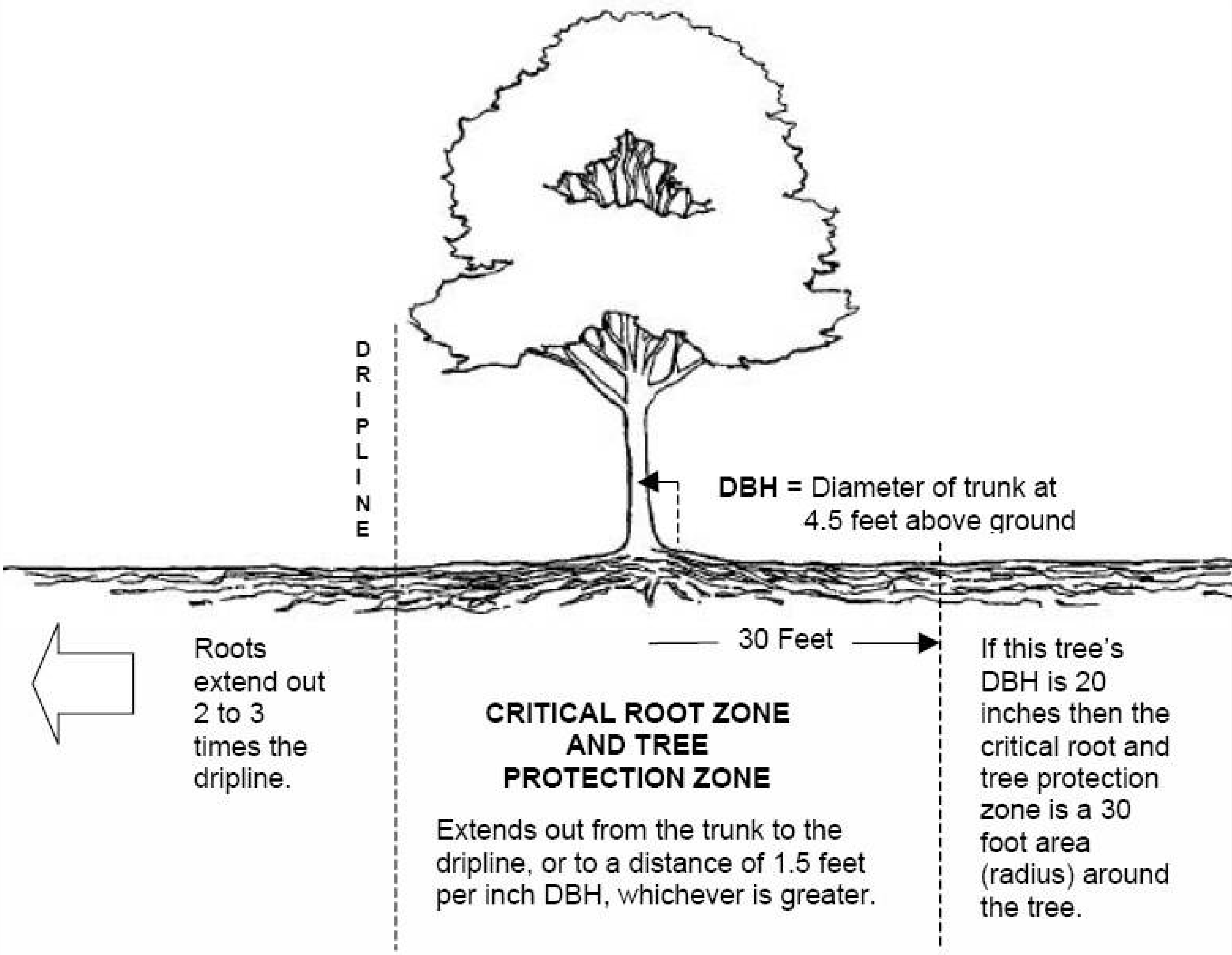
3.3 Protection systems shall be installed prior to construction mobilization or commencement of any construction activity.

3.4 Do not utilize the protected area for ANY construction activities to include: parking, traffic of any kind, storage of materials, trash or debris. Do not store excavated soil inside the protected area. Where the use of construction equipment can not be avoided inside the protected area, notify the Grounds Section via the Project Manager for assistance in determining proper protocol.

3.5 Excavation/trenching methods in areas adjacent to protected zones shall be discussed relative to the need for hand excavating or boring.

3.6 At the end of construction, all protected areas shall be returned to their original condition or an improved condition as specified by the construction documents. Repair or replacement of existing materials is subject to the acceptance of Grounds and the Project Manager and shall be at no cost to the project.

Figure 1. CRITICAL ROOT ZONE



END OF SECTION

THE FLORIDA STATE UNIVERSITY
Facilities

TREE PRUNING/REMOVAL PERMIT REQUEST

Request Submitted By: ____ Submittal Date:______________________
Address: ____
____ Response Req'd by Date: _____________
Email: __________________________ Phone: ___________________________

Tree Location/GPS Coordinates: ____

Construction Project Name: ____

FSU Project Manager: ____

Description of Work Proposed: (i.e. removal, prune, relocate, mitigate, etc.) ____
____
____

Tree Type(s):

________ 1 = Patriarch or exceptional specimen over 36" DBH
________ 2 = Contributes to canopy walk
________ 3 = Wetland tree(s) any size
________ 4 = Tree(s) over 18" diameter or 4" in lot perimeter zone
________ 5 = Memorial or honorary tree

Species of Tree(s) to Be Removed:

Number____________ Species/Type____ DBH (inches) _______
Number____________ Species/Type____ DBH (inches) _______
Number____________ Species/Type____ DBH (inches) _______
(DBH = dia. at 4 1/2 ft. above ground)

Reason(s) for Removal/Pruning:

- ☐ Dead
- ☐ Severe decay/rot
- ☐ Pathogen
- ☐ Insect infestation
- ☐ Disease (fungal)
- ☐ Structural damage
- ☐ Utilities conflict
- ☐ Infrastructure damage
- ☐ Other (specify) ______________________________________

Description of work other than removal:

____
____
____

Assessed Value: ___________________________

Arborists Report: ☐ Attached _______________(date) **Photos:** ☐ **Included**

Permit Is: ☐ Approved ☐ Denied

____
for FSU Grounds Department date

SECTION 329210

PLANT SALVAGE

PART 1 - GENERAL

1.1 Overview

A. **Coordination of landscape salvage activities:** All landscape and plant salvage shall be coordinated with and approved by the Grounds Section through the Project Manager.

B. **Salvage may include:** relocating, replacement, storage, and maintenance of all salvaged plant materials. Salvage may, also, include maintenance and protection of existing plant materials to remain.

C. **Work includes, but is not limited to:** all labor, material procurement, equipment, tools, transportation, and services required for complete plant salvage as indicated or reasonably implied on the plans and/or specified herein, unless specifically excluded by the Grounds Section.

D. **Related specifications** are included in Division 1-General Requirements and Division 2-Sitework.

1.2 Performance Requirements

A. **Identification of materials to be salvaged** and salvage company qualifications shall be included in the construction documents and reviewed for approval by the Grounds Section during Design Development.

B. Site Inventory: Perform a site inventory and submit results for review by the project team prior to beginning design.

C. **Plant Salvage Plan:** The Plant Salvage Plan shall be submitted to the Project Manager for submission to Grounds and written approval prior to completion of the Design Development phase. At a minimum, the plan shall include:

1) Listing of all materials to be salvaged, with itemization of species, quantity, size, condition, and photo documentation.
2) Information regarding storage facility including address.
3) Proposed preparations for salvage, i.e. pruning, root preparation, burlap wrapping, labeling, etc.
4) Proposed transportation methods.
5) Proposed maintenance activities and schedule: including watering methods, fertilization, and other as required.
6) Anticipated mortality rate and proposed warranty/remedy.

D. **Preconstruction meeting:** Prior to beginning construction, a preconstruction meeting will be held to develop a Plant Salvage Plan, which will be used to document materials, salvage methods, storage requirements/location, and maintenance during storage term.

E. **Storage Facility:** Unless approved in writing by Grounds, the storage facility shall be located within (50) miles of the University and available for periodic inspections of materials as desired by Grounds Section.

1.3 Submittals

A. Submittals shall include but are not limited to: Plant Salvage Plan, meeting minutes, proposed maintenance products, sample warranties.

1.4 Transportation

A. Salvaged materials requiring storage shall be transported in compliance with all State and local requirements. The salvage contractor is responsible for obtaining and payment of all necessary permits and tags for transportation of salvage materials or necessary equipment.

1.5 Salvaged Materials Warranty

A. All salvaged plant materials to be stored by the Contractor will be reviewed for condition at intervals as deemed appropriate by the Grounds Section. Any material found to be unacceptable shall be subject to replacement per the terms of the Plant Salvage Plan.

B. Warranty period shall begin immediately after the salvage operation and shall end commensurate with the warranty period for new plant materials OR shall extend a minimum of (12) months after re-installation and acceptance.

PART 2 – PRODUCTS

2.1 Supplements, fertilizers, and organics utilized during the storage period shall be proposed and submitted in the Plant Salvage Plan. Frequency and amount of application shall be indicated.

PART 3 – EXECUTION

3.1 Verify salvagability of all plant material indicated for salvage in the construction documents. Any material conditions anticipated to prevent successful salvage and future relocation shall be reviewed with the Grounds Section and documented in the Plant Salvage Plan.

3.2 Inventory and tag plants to be salvaged. Color code tags to indicate plants to remain and plants to be relocated.

3.3 Mark all salvaged plants to indicate their north side and the soil line prior to salvage.

3.4 The Contractor shall at all times during the salvage and storage operation utilize current standards for arboriculture, including but not limited to appropriate handling and watering methods, pruning, digging, pesticide control, weeding, and fertilization.

3.5 All plant salvage and re-installation shall be confined to the project limits as specified in the construction documents. No clearing or grubbing shall extend beyond these limits. All tree and plant materials to be salvaged in place shall be protected during the construction period with approved protection barriers. Refer to Section 015639 and the construction documents.

END OF SECTION

SOILS

PART 1 - GENERAL

1.01 Summary

A. This Section includes requirements for soils utilized in landscape work.

B. Quality Assurance: Samples of proposed soils and manufacturer's guaranteed analysis shall be submitted prior to acceptance of delivery of new topsoil. Test reports indicating compliance with specifications shall be required for existing materials scheduled to remain. Existing soils shall be replaced where test reports indicate unsatisfactory conditions.

1.02 Submittals - Samples

A. Submit samples and manufacturer's guaranteed analysis of the following items:

1. Topsoil: provide min. (5) lbs. sample of actual soil proposed for use.
2. Soil Analysis: provide testing agency report indicating:
    a. acceptable pH factor
    b. plasticity index
    c. % organic matter
    d. gradation
    e. PPM of soluble salts
3. Samples from each proposed source shall be provided for FSU Grounds review minimum (10) days prior to anticipated delivery to site. Written acceptance/rejection for incorporation into the project shall be provided by the University within (7) days.

B. Installed soils shall match approved samples.

PART 2 - MATERIALS

2.01 Topsoil

A. Topsoil shall be fertile, friable soil, obtained from well-drained arable land, and shall be free from nut grass, refuse, roots,

heavy clay, clods, noxious weeds or any other material toxic to plant growth.

B. pH factor: shall be min. 5.5 and no greater than 7.0.

C. Soluble salts: shall not exceed 1500 PPM.

D. Plasticity index: shall be min. 3 and no greater than 15.

E. Organic matter: approx. 1-1/2% by dry weight.

F. Gradation:

Sieve size	**Percent Passing**
1"	100
½"	95-100
#4	90-100
#10	70-100
#200	15-70

2.02 Planting operations backfill mixture

A. Clay Loam:

1. **1/3 max. organic matter from "Canadian Sphagnum Moss", "Florida Peat", "Mushroom Compost" or "Nitrolized Mulch".**
2. **2/3 native soil.**

B. Sandy Loam:

1. **1/3 max. organic matter from "Canadian Sphagnum Moss", "Florida Peat", or "Mushroom Compost".**
2. **2/3 native soil.**

PART 3 - EXECUTION

3.01 Soil replacement or amendment shall not begin without written approval by FSU Grounds, coordinated through the Project Manager.

3.02 Soils shall be mixed thoroughly, leaving no layers of soil amendments or clods of soil. For mass planting, till entire bed with amendment 8"-12" deep.

3.03 For sod installation, cultivate the area by roto-tilling to a depth of 8 inches and incorporate any amendments required by the soil tests.

3.04 Remove all debris, such as roots, wood, large clods, concrete, rocks, etc.

3.05 Complete final grading and smoothing by raking. Be sure to slope soil away from buildings to prevent drainage problems. Roll and water graded area to settle and firm the surface. Add additional soil to any low areas.

END OF SECTION

SECTION 02900

LANDSCAPE

PART 1 GENERAL

1.1 **<u>Summary</u>**

A. This section contains requirements relating to lawns, trees, shrubs, flowering plants and ground covers including site preparation, material installation and removal policies.

B. Contractor to establish boundaries for the site as determined and reviewed with University Project Manager in order to ensure seamless transitions between adjacent sites, coordinate project overlaps and to maximize the potential of open space.

1.2 **<u>Work Included in This Section</u>**

A. The Contractor shall furnish all labor, tools, equipment, products, materials and transportation. The work shall include, but is not necessarily limited to, the following:
1. Backfill Soil Mixture
2. Selection and Transporting Plant Material
3. Planting Operations
4. Maintenance and Guarantee of Plantings and Landscape Areas
5. Weed Control
6. Warranty
7. Topsoil

1.3 **<u>Related Work Included Elsewhere</u>** – Automatic Irrigation, Salvage, Tree and Plant Protection, Inert Groundcovers.

1.4 **<u>Quality Assurance</u>**

A. Prior to Design Development, the Landscape Architect of Record, if applicable, shall coordinate through the FSU Project Manager, and in conjunction with the Grounds Department develop an acceptable level of quality for each project. This shall be a written plan to include:
1. Development of a landscape design.
2. Determination of submittal and sample requirements for the specific project.
3. Determination of specific/unusual installation criteria.
4. Criteria for material acceptance.
5. Terms of replacement under warranty.
6. Other terms as deemed necessary by FSU Grounds specific to the project.

B. Prior to beginning installation, the Contractor shall request a pre-construction meeting with the FSU Project Manager, Grounds Department, and Landscape Architect of Record.

C. All planting work shall be done in strict accordance with sound nursery practice and shall include maintenance and watering of all plant materials installed until Substantial Completion acceptance by the University.

D. **Sidewalks** adjacent to work areas shall be kept broom clean daily during planting operation. Plant containers, empty fertilizer bags and containers are to be picked up and disposed of daily. Contractors trash shall be removed from the site at the completion of work each day. Any damage to the sidewalk shall be repaired or if necessary replaced.

E. Plant Materials:

1. Trees, Shrubs

a. Plant materials shall have been grown in nurseries which have been approved by State of Florida Department of Agriculture and shall be tagged with correct names. All plant materials shall be inspected by the FSU Grounds Department Representative and/or the Landscape Architect of Record post or prior to delivery, and all plant material not meeting Specification requirements shall be rejected. Contractor shall, at his own expense, replace rejected plant material with material of species and variety that meet Specification requirements.

b. Plants shall be quality material having the habit and growth which is normal for the species; sound, vigorous, healthy, free from insects, plant diseases and injury.

c. Container stock should not show evidence of being root bound.

d. All Plants shall be in accordance with Florida #1Grade as specified in "Grades and Standards for Nursery Plants", Second Edition; published by Florida Department of Agricultural & Consumer Services.
Refer: http://www.doacs.state.fl.us/pi/plantinsp/publications/g&s_updates.pdf

1.5 <u>Submittals - Samples</u>

A. **Submit** duplicate samples and manufacturer's guaranteed analysis of the following items and such other materials as may be required by the Landscape Architect and/or FSU Grounds Department Representative per above Quality Assurance requirements. All materials requiring approval prior to delivery must obtain written approval before beginning fabrication or delivery of material to the project site. Finished work shall match approved samples. Submittals will typically consist of the following, but may required for other items at the discretion of the Landscape Architect or FSU:

1. Tree ties and stakes
2. Fertilizers: 1/2 pound of each fertilizer with noted analysis
3. Topsoil
4. Seed Mix
5. Plant Material
6. Site Soil Analysis

B. Plant Guarantee and Replacement:

1. As a requirement of Substantial Completion, the Contractor shall submit to the Landscape Architect of Record or FSU Project Manager (2) copies of a written guarantee for all plant material for a period of one year post Substantial. The guarantee shall stipulate the following:

a. All trees, shrubs, ground cover, and grass lawns shall be guaranteed to take root, grow, and thrive through the one year guarantee period. <u>**Exception:** The guarantee period for deciduous trees and grass lawns shall be in effect for a period of one year OR until all are showing new growth, the spring following the end of the warranty period.</u>

b. Any plant materials that die back and lose the form and size originally specified shall be considered unacceptable and shall be replaced, even though they have taken root and are growing after the die-back.

c. Any plant required under this specification which is dead or otherwise not acceptable and not in a satisfactory growing condition in the opinion of the FSU Grounds Department Representative, shall be removed from the site and replaced with a suitable plant as specified within fifteen (15) days. Refer to Quality Assurance above.

d. Replacements shall be made to the same specifications required for original materials and shall carry the same guarantee from the time they are replaced.

C. Inspection and Analysis Certificates:

1. Submit the following to the FSU Project Manager for review by FSU Grounds Department, prior to or upon delivery, of the materials to the site:

a. **Plant material inspection certificates** required by State and Federal laws with respect to inspection for plant disease and insect infestation shall accompany each shipment of plant materials.

b. **Other analysis certificates** as required by the construction documents.

1.6 **Product Deliver, Storage, and Handling**

A. Manufactured materials shall be delivered in original containers with brand and manufacturer's name marked there on. Materials in broken containers or showing evidence of damage will be rejected and must immediately be removed from the site. Odorous materials shall not be brought to the site until they are to be used.

B. Store fertilizers and all other moisture sensitive materials in a dry place and protect from intrusion of moisture.

C. <u>Plant material:</u>

1. **Protect** plant material at all times during handling, shipping, storage and planting from extreme weather conditions, wind, drying roots and root balls and injury.
2. **Support root systems** of container plant material when lifting and moving to minimize injury to root ball.
3. Plant material showing damage from shipping, while in storage or during planting may be rejected by the FSU Grounds Department Representative. Rejected plant material shall be removed and replaced by the Contractor at his own expense.

1.7 **Site Conditions**

A. No planting procedures or other site work shall be performed during wet or muddy conditions.

B. All existing plant material not indicated for removal shall be protected as necessary to ensure survival. In support of University’s sustainability initiatives, all trees and landscape materials designated for removal shall be delivered to the FSU Nursery for mulching and later use in University landscape beds.

1.8 **Inspections**

A. A written notice or phone call requesting an inspection shall be given to the FSU Project Manager who will coordinate with the Grounds Department Representative **a minimum of 48 hours** prior to each anticipated inspection date.

B. **Progress Inspections:** The following inspections will be required.

1. Tillage and soil preparation of all planting areas.
2. Finish grading.
3. Inspection and approval of all plant materials upon delivery to the site. The plant material shall be assembled for this inspection.
4. Inspection and approval of trees and shrubs at site after being spotted by Contractor.
5. Inspection of irrigation system before backfilling trenches.
6. Inspection for both applications of pre-emergent herbicide before and after placement of inert ground cover.

C. Final Planting Inspection for Acceptance:

1. Final inspection of trees and shrubs shall be made at the conclusion of the project, provided that on such date all other project improvements and corrective work has been completed.
2. Prior to the time of final inspection, the following work shall have been completed:
   a. All weeds shall be sprayed with systemic herbicide and removed from all planted areas.
   b. All errant trash and debris shall be removed from all planted areas.

c. All components of irrigation system shall be operable and in proper working order.
d. All work put in a neat, orderly condition.

PART 2 PRODUCTS

2.1 General - Quality

A. These Specifications define <u>minimum acceptable</u> quality. Materials installed shall be as listed in this section on the drawings by manufacturer's name and model number or by description of attributes, performance of other standards.

B. Substitutions:

1. No material substitutions will be accepted unless request is submitted in writing to the FSU Grounds Department Representative for approval prior to commencing work on this Section. Any substitute material installed without prior approval may be rejected by the FSU Grounds Department Representative, and if rejected shall be removed and replaced to the satisfaction of the FSU Grounds Department Representative at no additional cost.
2. The Contractor shall submit to the FSU Grounds Department Representative proof that a specified plant is not reasonably available in the local region before a request for plant substitution will be considered.

2.2 **Materials – Plant Material**

A. The Contractor shall furnish and plant all plants shown on the drawing and as specified.

B. All plants shall be healthy, shapely, and well-rooted.

C. Genus, species, and variety; quantity, size and condition as indicated on the drawings and plant material listing. No substitutions without prior written approval of FSU Grounds Department Representative.

D. Plant material shall be healthy nursery stock, full foliage when in leaf; free from disease, injury, insects, all weeds, and weed roots.

E. Plants shall be in accordance with the Grades and Standards for Nursery Plants by Florida Department of Agriculture, current edition.

F. Cold storage plants are not acceptable.

G. Potted and container stock well rooted, vigorous enough to ensure survival and healthy growth.

H. Container plants, one gallon size and larger shall have grown therein a minimum of six months and a maximum of two years, with roots filling the container but not showing evidence of being or having been restricted, deformed or root bound.

I. Trees: Untapped, straight, single leader trees except for multiple stem (clump) trees. Deciduous trees with heavier than normal top and balanced branching.

J. Plant material shall be free from disfiguring knots, sunscald injuries, bark abrasion, evidence of improper pruning, and other objectionable disfigurements.

K. Trees shall have well-developed branch systems.

L. Thin, weak and leggy plants will be rejected by the FSU Grounds Department Representative.

M. All plant material shall be legibly tagged by species and variety with minimum of one tag per 10 trees.

N. Plant material not meeting these requirements shall be removed from the site and replaced to the satisfaction of the FSU Grounds Department Representative.

O. All plants shall conform to the measurements specified in the plant list. Exceptions are as follows: Plants larger than specified in the plant list may be used if approved by the FSU Grounds Department Representative, but use of such plants shall not increase the contract price. If the use of the larger plants is approved, the spread of root or ball of earth shall be increased in proportion to the size of the plant.

P. **Weed Fabric:** Do not use weed fabric in landscape beds without the approval of the FSU Grounds Department Representative.

Q. **Lawns and Grasses:** Unless specifically approved otherwise, newly grassed areas will be constructed using sod of a species appropriate to the site location. Seeding will be allowed in large areas with low public visibility only if approved in advance by FSU Grounds Department Representative.

1. Grass type shall be approved by FSU Grounds Department.
2. Any area of vegetation damaged during construction shall be restored to its original state within 96 hours of the completion of the associated construction work. Grassed areas will be re-sodded. Under no circumstances is sod to be placed against tree trunks. Special care will be taken before and after the restoration to ensure the area is not subject to erosion. Contractor shall be responsible for watering all replacement vegetation until project area is turned over to FSU Grounds.

R. **Fertilizers:** in conformance with the State Agricultural Code.

1. Dry chemical fertilizer: 16-20-0 (N-P-K).
2. Controlled slow release: Osmocote with 18-6-12 analysis (N-P-K), surface application.

S. Pre-Emergence Control Herbicide:

1. Surflan
2. Dacthal - DCPA W-75

T. Topsoil:

1. Topsoil shall be a fertile, friable soil, obtained from well-drained arable land, and shall be free from nut grass, refuse, roots, heavy clay, clods, noxious weeds or any other material toxic to plant growth. At least 10 days prior to delivery of topsoil to the site, the Contractor shall furnish the FSU Grounds Department Representative at no additional cost, with a soil sample from each source along with the analysis and test report for each sample. Written acceptance/rejection of the soil for incorporation into the project will be provided by the University with in 7 working days.
2. To be acceptable the pH factor shall not exceed 7.0 or be lower than 5.5, soluble salts shall not exceed 1500 PPM, the plasticity index shall be in the range of 3 and 15 inclusive, and it shall contain approximately 1 1/2%, by dry weight, or organic matter either natural or added. Gradation shall be in accordance with the table shown below:

Seive Size	Percent Passing
1”	100
1/2”	95-100
#4	90-100
#10	70-100
#200	15-70

PART 3 - EXECUTION

3.1 **Inspection of Site Conditions**

A. Examine site for conditions that will adversely effect execution, permanence, quality of work and survival of plant material. Advise FSU Project Manager and Grounds Department Representative of any concerns.

B. Work contained in this section shall not begin until after a **pre-construction** meeting and the site preparation is found to be satisfactory.
1. Attendees shall include: Construction Manager, Landscape Subcontractor, Landscape Architect, FSU Project Manager, and FSU Grounds Representative.
2. Required inspections/approvals will be determined in the pre-construction meeting.
3. Acceptable conditions for planting activities will be defined specific to project conditions. This shall include clarification of acceptable grades, soils, and weather conditions.
4. Length of plant establishment period shall be reviewed prior to start of construction and documented if determined to exceed 1 year past Substantial Completion.

C. All existing plant material to remain shall be identified protected and watered manually as necessary to ensure survival until such a time that automatic irrigation can be restored or installed.

3.2 **Site Preparation – Cleaning, Grubbing, and Soil Loosening**

A. All planting areas shall be cleared of all existing plant material, brush, weeds, debris and rocks over 1 inch in size prior to any soil preparation. Noxious brush weeds and grasses shall be removed by the roots wherever they are found at any stage of the work.

3.3 **Planting Operations – Backfill Mixture**

A. **Ingredients by soil type:**
1. Clay Loam:
   a. 1/3 max. organic matter from “Canadian Sphagnum Moss”, “Florida Peat”, “Mushroom Compost” or “Nitrolized Mulch”.
   b. 2/3 Native soil.
2. Sandy Loam:
   a. 1/3 max. organic matter from “Canadian Sphagnum Moss”, “Florida Peat” or “Mushroom Compost”.
   b. 2/3 Native soil.

B. Mixed thoroughly, leaving no layers of soil amendments or clods of soil. For mass planting, till entire bed with amendment 8”-12” deep.

C. FSU Grounds Department Representative’s approval shall be required prior to backfilling.

D. **Finish Grading:**
1. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or catch basins. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface.
2. All grades shall provide for natural runoff of water without low spots or pockets. Flow line grades shall be accurately set and shall not be less than 2 percent gradient where possible.

3. Tops and toes of all slopes shall be rounded to produce a gradual and natural appearing transition between relatively level areas and slopes.
4. Top 6 inches shall be free of rocks or other inert materials over 1/2 inch at greatest dimension.
5. All planting areas shall be free of road base, road materials and gravel. All road materials and gravel shall be removed and replaced with approved topsoil.

E. **Planting Holes:**
1. Locate planting holes per planting plans bringing any conflict with underground utility to the attention of the FSU Project Manager. All plants are to be spotted on the site and locations approved by the FSU Grounds Department Representative before planting.
2. Planting holes shall be excavated with vertical sides and flat bottoms to the size of twice the size of the root ball.

F. **Planting:**
1. Do not install plant material until all construction work that can interfere with planting operations has been completed and irrigation system has been installed and tested. Planting areas shall have been graded and prepared as specified and shall have been approved by the FSU Grounds Department Representative.
2. Do not plant during unfavorable weather. Soil shall be at optimum moisture content for planting. Do not plant in dry soil or muddy soil.
3. **Weed control:** Licensed pest control operator shall apply pre-emergent herbicide to all planting areas except for the native grass seeding areas before and after placement of inert ground cover, in accordance with the manufacturer's recommended rates. Any plant materials showing loss of vigor or health due to improper application of herbicide shall be replaced by the Contractor. **The FSU Grounds Department Representative shall witness both applications of pre-emergent herbicide.**

G. **Container Plant:**
1. Do not lift or handle container plants by tops, stems or trunks at any time.
2. Fill bottom of planting hole with backfill mix and compact.
3. Plants shall be set in center of hole plumb and straight and at such an elevation that after settlement the root crown of the plant will be 1-1/2 inch higher than surrounding finish grade.

H. **Backfilling:**
1. Backfill the planting hole with the backfill mix herein specified.
2. Water settle backfill thoroughly, or compact by other method approved prior to planting, so plants do not settle.

I. **Fertilizing Tablets:** Osmocote slow release
1. Surface application prior to watering in. Apply at recommended rates.

J. Immediately after planting hole is backfilled, a shallow reservoir slightly larger than the planting hole and 4 inches deep shall be formed.

K. **Watering:** Immediately after planting water each tree and shrub by filling reservoir twice.

L. **Planting Areas:** At project acceptance, planting areas shall be free of gravel or road material. All material found shall be removed by contractor and replaced with approved topsoil as incidental to the cost of plant material installation.

M. **Ground Cover:**
1. All ground cover areas shall be treated with a pre-emergent herbicide.
2. All ground cover planting shall be immediately watered to avoid drying out until the entire planted area is completed.

3. All ground cover areas which includes one gallon ground cover areas shall receive the Soil Rototilling and soil backfill mixture.

N. **Inert Ground Cover/Weed Control:** See also Section 329220.

1. Prior to placing Inert Ground Cover, the area shall be totally free of weeds, using chemical control as necessary. Apply a pre-emergent herbicide according to manufacturer's recommendations. The Inert Ground Cover shall be evenly distributed in the designated areas. A second application of pre-emergent herbicide shall be applied at this time.
2. Areas of existing inert ground cover disturbed by new construction are to be replenished with matching color and size, evenly distributed and sprayed with an application of pre-emergent herbicide. Color and size to be approved by FSU Grounds Department Representative.

3.4 **Clean-up**

A. Keep project site free from accumulation of debris resulting from work specified herein. Broom clean pavement daily. Remove weed fiber, fertilizers, etc., from walls, pavement and curbs. Project site shall be kept neat at all times.

B. Upon completion of planting operation, all remaining soil, stones and other debris shall be removed from site and disposed of in a manner satisfactory to the FSU Grounds Department Representative.

C. Upon completion of work, all trees and shrubs shall have been pruned and injuries repaired. Limit amount of pruning to the minimum necessary to remove dead or injured twigs of branches and to compensate for loss of roots as a result of planting and construction operations.

PART 4 – PROJECT ACCEPTANCE

4.1 Contractor shall maintain all landscaped areas on a continuous basis as they are completed during the course of work until accepted as Substantially Complete.

4.2 Maintenance during construction shall include, but is not limited to, the following:

1. All watering, fertilizing, cultivation and spraying necessary to keep the plant material in a healthy growing condition and to keep the landscaped area weed free.
2. All errant trash and debris shall be removed from the site on a continuous basis or as necessary.
3. Mowing of turf shall be done on a schedule as per industry standards based on the time of year and state of turf.

4.3. **Plant Establishment and Warranty Period**: Contractor shall provide full warranty for all plant material for a period of one year from the time of Substantial Completion; **OR,** if the plant material can not be expected to demonstrate establishment within that time period, the replacement warranty shall extend until a reasonable time shall have passed to ensure that the material is viable. The establishment period shall be determined at the time of the pre-construction meeting.

4.4 **Warranty Inspection:** The FSU Project Manager and the Grounds Representative, in conjunction with the Landscape Architect, shall perform an end of warranty inspection approximately 30 days prior to the end of the warranty period. At that time, all material found to be non-thriving or dead shall be replaced with specification compliant materials at no additional cost. Replacement material shall be installed within 30 calendar days.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

PART 1 GENERAL

1.1 Summary

A. **General:** Furnish and install a complete underground sprinkler, emitter and bubbler system for all turf and landscaped areas. Work shall include furnishing and installing all plastic and copper pipe and fittings, automatic control valves, valve access boxes, electric computerized central controllers, electric wire, telephone access line (if required), etc., as required for a complete system as indicated in the Construction Documents. The Contractor is responsible for all costs of water used during construction. Work shall, also, include all required tests to ensure adequate pressurization and area coverage.

B. **Irrigation line/component location:** Irrigation lines shown on the drawings are essentially diagrammatic. Actual locations of all heads, valves, piping, wiring, etc., shall be established by the Contractor at the time of construction with the approval of Florida State University Grounds Representative. Exact locations and type of component shall be field verified at project completion and documented in as-built drawings.

C. **Water conservation:** In the interest of conserving water, University Grounds Department is requiring the use of drip irrigation systems for all shrubs as well as separation of zones, i.e. turf, ground covers, trees, shrubs, palms, etc. All spray head areas are to be designed and installed to minimize overspray onto other zones as well as any hardscape surfaces. All lateral lines shall be self draining, with flush plugs installed on all drip lines, and be designed to minimize runoff of irrigation water onto roadways, driveways and walks.

D. The **final grade** shall be completed and shall have been approved by the Facilities Project Manager and a Grounds Department, Irrigation Division Representative before the Irrigation Contractor starts the irrigation layout.

1.2 –This section not used--

1.3 System Description

A. System Design Requirements:

1. **Design pressures:** Pressure shall not exceed 85 psi unless specified otherwise. Provide an approved pressure reducing valve. Contact Landscape Architect of Record for adjustments in system if existing pressure is less than design pressure.
2. **Location of heads:** Make minor adjustments as necessary to avoid plantings and other obstructions.
3. **Metering:** Meter location shall be coordinated with the University Utilities Department.
4. **Controller:** Provide Hunter ACC-1200/ACC-COM-HWR/RAD3/ANT#(RASREM).Location shall be coordinated with University Grounds Department and shall be proximate to the main building telecommunications room . Provide power to controller via independent circuit and install a ground rod per manufacturer's requirements 8' from the the controller.

B. **Minimum Water Coverage** (100% expected):

1. **Turf areas:** 100% head to head coverage.
2. **Other planting areas:** 90%.

3. **Layout** may be modified, if necessary to obtain coverage, to suit manufacturer's standard heads. Do not decrease number of heads indicated unless otherwise acceptable to FSU representative. If modified, provide shop drawing showing changes that were necessary and present to FSU Representative.

C. At Substantial Completion, provide the Owner with the following:

1. Manufacturer's operating and maintenance instructions.
2. Project record Drawings of the system, hard copies and CAD.
3. Schedule showing the length of time each valve is to be open to produce a given amount of precipitation per season.
4. Six extra sprinkler heads of each size and type, six emitters of each type and six sprays and nozzles of each type.
5. Two valve keys for manual valves.
6. Wrench for each type head core.
7. Wrench for removing and installing each type head.
8. Two Quick coupler keys as required.
9. A permanent identification of valve stations and areas irrigated on the 8-1/2" x 11" chart to be placed on the inside door to the appropriate controller. The chart shall be plasticized and sealed for permanency. Xerox reduction of print, sealed in plastic will be acceptable.
10. Two valve keys for mainline gate valves when mainline gate valves are required per plans.

1.4 Sequencing and Scheduling

A. **Maintain uninterrupted water service** to building during normal working hours. Arrange for temporary water shut-off with FSU during installation of irrigation system, if necessary.

B. Review installation procedures under other sections and coordinate the installation of items that must be installed with the irrigation system.

C. Do not begin work covered by this section until the landscape grading is complete and Utility location information has been verified by FSU. Utility locates should be scheduled through the Facilities Project Manager.

PART 2 PRODUCTS

2.1 Manufacturers

A. **Provide:** Hunter ACC irrigation controller capable of communicating with the University's central control system.

1. Model - ACC-1200/ACC-COM-HWR/RAD3/ANT3(RASREM)
2. Model – PRO-C

2.2 General

A. Unless otherwise specified or shown on the Drawings, the construction of sprinkler lines and installation of control wiring shall include excavation and backfill, the furnishing, installing and testing of sprinkler pipe and fittings, and the removal and/or restoration of existing improvements and all other work in accordance with the Plans and Specifications.

B. In support of sustainable practices, the University supports reduction of potable water use for landscape irrigation. The source of irrigation water should be determined in consultation with the University Utilities Department Representative, Grounds Department Representative and the Facilities Department Project Manager.

1. Use of City of Tallahassee supplied potable water for Irrigation should be minimized when possible.
2. All projects should consider other options for irrigation water to include: existing University irrigation well, captured rainwater, and recycled wastewater.
3. If non potable water is used, contractor to use self scrubbing valves, purple pvc pipe and boxes and any other equipment required to identify the water source. All valve boxes must be lockable.

2.3 **Pipe**

A. **Plastic pipe below ground**: Shall be rigid unplasticized PVC - Type I, 1120-1120 extruded from virgin parent material, Schedule 40 for all mains smaller than 4" and all lateral lines. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious materials, wrinkles, and dents.

B. **Pipe 4" and larger:** Shall be Class 200 rubber - ring type with Ductile Iron fittings and thrust blocked per details on the plans.

C. **Storage:** Make provisions for storing all irrigation PVC pipe out of sunlight throughout the installation period of the irrigation system.

D. **All pipe shall be continuously and permanently marked with the following information:** Manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation approval (N.S.F.).

E. **Deliver:** Plastic pipe shall be delivered to the site in unbroken bundles or rolls, packaged in such a manner as to provide adequate protection for the pipe ends, either threaded or plain.

F. **PVC below ground from backflow preventer to sprinkler system:** Provide type "K" hard copper above ground and from tap to meter to BFP. ANSI B16.22 wrought copper or cast brass, recessed solder joint type fittings. For assembly of backflow preventer.

2.4 **Fittings**

A. Manufacturer's standard, of type and size necessary to construct automatic irrigation system as shown on Plans. **General fittings specs shall be as follows:**
1. PVC plastic socket type, Schedule 40, ASTM D2466, typical.
2. PVC plastic threaded and socket type where detailed, Schedule 40, ASTM D2467.
3. Ring type applications, IPS Ductile Iron, grade 65-45-12, ASTM A536 & ASTM F477.
4. Copper, wrought copper or cast brass, recessed solder joint, ANSI B16.22.

2.5 **Reduced Pressure Backflow Preventer**

A. The backflow preventer shall be of the reduced pressure type provided with full flow resilient seated ball valve, (2) shut-off valves and test cocks for testing unit to insure proper operation. Provide Watkins or approved equal.

B. The backflow preventer body shall be of bronze construction and corrosion resistant internal components. Manufacturer's standard, of type and size to suit sprinkler system, as shown on drawings.

C. Include bronze filter, union downstream and brass test port plugs.

2.6 **Backflow Preventer Enclosure**

A. Install BFP to minimize visual impact to the campus and provide green covers labeled "Irrigation". Screen BFP with plant material.

2.7 **Isolation Valves**

A. Gate valves must be provided at all new branches of the main line. Manufacturer's standard, of type and size indicated on plans. Furnish 2 valve keys, 3 feet long with tee handles and key end to fit gate valves.

B. Unless otherwise specified, the installation of all valves shall include the excavation and backfill, the furnishing, installing and testing of risers, nipples, fittings, valves, and valve boxes, and the removal and/or restoration of existing improvements and all other Work in accordance with the Plans and Specifications and as required for the completed installation.

2.8 **Automatic Controller**

A. **Type:** Automatic controllers shall be installed where indicated on the Drawings and shall be as manufactured by HUNTER, model number PRO-C or ACC-1200. Additionally, the ACC-1200 controller shall include the following modules:
1. ACC-COM-HWR
2. RAD3
3. ANT3 (RASREM)

B. **Exterior Control Enclosure:** Manufacturer's standard weatherproof enclosure with locking cover.

C. **Mounting:** Controller shall be wall mounted at 5' from bottom of the enclosure to finished grade below. Power connection for controller shall be on its own circuit and provided via steel electrical conduit. Provide ground rod to be installed 8" from controller unless specified otherwise by manufacturer.

D. **Stations:** The basic controller shall have a minimum of 12 stations capable of being expanded to a maximum capacity of 42 stations.

2.9 **Automatic Remote Control Valves, Electric Solenoid Type**

A. **Automatic remote control valves** to be installed where shown on the Drawings and shall be slow acting diaphragm type electric solenoid operated valves of sizes as indicated on the drawings, or approved equal. All valves shall be professional grade with min. 150 psi rating that provide flow control, dial setting pressure regulation and have internal and/or external bleed.

B. **Installation:** Valves shall be installed one assembly per valve box unless approved by FSU Grounds Department, Irrigation Division Representative. Assemblies may include valve, "y" filter, and pressure regulator support appurtenances at detailed on the project plans.

C. **Valve:** Hunter ICV Filter Sentry – 1" and up. Threaded type. All valve assemblies shall be equipped with line size shutoff ball valves.

2.10 **Filter & Pressure Regulator**

A. Provide filter, pressure regulator, valve boxes, WYE strainer and other appurtenances required for the installation of a complete assembly/system.
1. **Y-Filter:** Hunter HY-100 on drip and micro-spray zones.
2. **Pressure Regulator:** Senninger 30 psi on drip and micro-spray zones.

2.11 **Sprinkler Heads**

A. **General:** Sprinkler heads shall be manufacturer's standard unit, to suit sprinkler system, as shown on the Plans. If necessary, layout shall be adjusted in the field to provide uniform coverage over entire area of spray shown on the Drawings at the available water pressure.

B. **Heads:** Shall be professional grade, heavy duty ABS construction including extra thick body and cap. Spray shall be adjustable from 1 to 360 degrees by a top adjustment screw on any spray watering an area less the 90 degrees.

C. Sprays and Rotors:

1. Hunter with 6" popup for turf. Pressure compensating bodies with check valve.
2. Sprays: PRO PRS30, PRS40
3. Rotors: PGJ, PGP and I Series
4. Swing joints.

2.12 **Emitters**

A. **Provide:** multi outlet drip emitters: Bowsmith 2 GPH threaded—ML220.

B. **Locate:** emitter in access sleeve for ease of maintenance. Sleeve: SALCO – DAS8

2.13 **Flush Plugs**

A. Provide flush plug at the end of each run for drip and micro-spray zones.

2.14 **Bubbler Heads**

A. All bubbler heads shall be set perpendicular to finished grades unless otherwise designated on the Drawings, or otherwise specified. Bubblers shall be ½" pressure compensated adjustable flow up to 2.0 gpm, capable of fine tuning by top mounted stainless steel screw.

B. **Hunter bubblers:** preset to desired GPM in access sleeve below grade.

C. **Provide:** 4" diameter root zone watering system, (2 per tree) wrap in filter sock and fill with gravel. Size dependent on size of tree. Or construct watering system from 4" perforated PVC with cap, wrap in filter sock and fill with gravel.

2.14 Risers

A. **Adjustable riser assembly:** All sprinkler heads and quick-coupling valves shall have an adjustable riser assembly (double swing joint riser) assembled by the use of at least three (3) Marlex street ells or PVC tees as recommended by the sprinkler manufacturer and/or as shown on the drawings. These double swing joint risers shall be of schedule 80 PVC plastic pipe and unless otherwise indicated, as shown on the Plans. The horizontal nipple connected directly into the side outlet of the main line shall be a minimum of 6" long.

2.15 Quick-Coupler Valves

A. Cast bronze two piece bodies with swing joint riser, actuator key, swivel ell and plastic cover imprinted "Do Not Drink".

B. Hunter with anti rotation wings, threaded key and hose swivel.

C. If using reclaimed water, cap of quick-coupler devices shall be purple to denote non-potable water supply.

D. Quick-coupling valve locations shown on the Drawings are essentially diagrammatic. It shall be the Contractor's responsibility to establish the location of all quick-coupling valves as directed by FSU Grounds Department, Irrigation Division Representative. In no case shall spacing of quick-coupling valves exceed distances shown on the Drawings and/or those specified.

2.16 Control Cable

A. All **electrical control and common wire** shall be irrigation control cable. Wiring used for connecting the automatic remote control valve to the automatic controller shall be Type "UF" 600 volt, solid copper, single conductor wire with PVC insulation and bear UL approval for direct underground burial feeder cable.

B. **Insulation** shall be a minimum 4/64" thick covering of ICC-100 compound for positive waterproofing protection. Each controller shall have its own common wire to respective valves.

C. Contractor verification of wire types and installation procedures shall be checked to make sure they conform to local codes. Where more than one wire is placed in a trench, the wiring shall be taped together at 10 foot intervals. All wiring is to be sleeved under paving and structures with a separate sleeve from any other utility or piping.

D. **Color designations:** All control wire shall follow the below color designations and be a minimum 14 Gauge solid copper.

Controller	Control Wire	Common Wire	Spare Wire
A	Red	White	Yellow
B	Purple	White	Yellow
C	Orange	White	Yellow
D	Green	White	Yellow
E	Blue	White	Yellow
F	Pink	White	Yellow

All common wire shall be white.
Under no circumstances may black wire be used.

E. **Coil a minimum of 24" of wire in each valve box.** Pull 2 additional spare wires to each valve location. Tag each spare wire in the controller and in each valve box. Tag station wire in the controller and in each valve box with station number. The color of this extra wire shall be yellow in all cases unless approved otherwise by the FSU Grounds Department, Irrigation Division Representative. Sleeve wires below paved surfaces in separate sleeves from mains and laterals.

F. Flow Sensor/Master Valve

a. All irrigation systems shall come equipped with a flow sensor and master valve. These devices shall be installed 5' from the BFP. Components shall be as indicated on the plans and approved by FSU Grounds Department, Irrigation Division.
b. Flow sensor: HFS with appropriate FCT Tee.

G. Rain Sensor

a. All irrigation systems shall come equipped with a rain sensor shut off. This device shall be as manufactured by HUNTER model Rain-Clik or Wireless Rain-Clik. Locations shall be approved by FSU Grounds Department, Irrigation Division.

PART 3 INSTALLATION

3.1 **General**

A. The Contractor shall lay out the system using stakes or paint to indicate the location of the various components as well as the location of each run of pipe and phone line. Preliminary adjustments to conform to actual site conditions shall be accomplished at this time.

B. Work shall be in accordance with the manufacturer's recommendations and shall be to the best standards of the industry. Spray back on buildings shall not be permitted. General arrangement and locations of piping, valves and equipment should be shown on Drawings. Make minor changes required by unforeseen conflict and Work of other trades. Connect to water source described in Drawings adapting as required.

C. Automatic irrigation controller location shall be approved by the FSU Grounds Department prior to installation.

1. Install irrigation controller per manufacturer's instruction manual, including proper grounding procedures.
2. Clock shall be securely mounted at a height of 5' from the bottom of the controller to finish grade.
3. Clock can be either pedestal or wall mounted as appropriate. Use mounting holes provided. DO NOT DRILL INTO ANY CONTROLLER PARTS.
4. Power source shall be hardwired and enclosed in electrical box/conduit in a manner to allow attachment through the controller box knock-outs. Connection to an open electrical outlet is not allowed.
5. Grounding shall be in accordance with ASIC specifications. Ground rod shall be located 8' from controller and connected by ground clamp to #6 AWG copper wire. Ground wire shall be enclosed in EMT separate from station and valve wires and installed 12" below grade.

D. Where rain sensors are NOT exposed to elements install Hunter Wireless Rain-Clik sensors at locations approved by FSU Grounds Department, Irrigation Division.

E. Separate zones shall be established for irrigation of trees, shrubs, turf, ground covers, annuals and palms. Wire electric valves to promote sequential testing of the individual zones. Connection to controller modules shall be one wire per station.

3.2 **Trenching**

A. **General:** Excavate straight and true. In areas subject to freezing bottom must slope uniformly to low points. Protect existing lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged lawn areas and plants with new to match existing. Notify FSU Grounds Department prior to cutting roots 1-1/2" or larger.

B. **Trench Depth:** Excavate to provide minimum cover and required pipe bedding.

C. Minimum Cover:

1.	Backflow Preventer Assembly	24"
2.	Mainline Beyond Backflow	18"
3.	Laterals	12"
4.	Under Vehicle Ways	30"
5.	Control Wire	18"

D. **Bedding:** Bed pipe in 1" minimum of loose friable soil, free of rocks and deleterious material.

E. **Backfill:** Backfill with clean material from excavation. Remove organic material as well as rock and debris larger than 1" diameter. Place and compact material in 6" lifts, to 85% density planted areas or 90% elsewhere.

F. Main line piping installation shall include **warning tape** and **tracer wire** for future use.

G. **Reseed and restore** to original condition any areas not in healthy condition which may have been damaged from installation of irrigation system.

H. **Pavements:** Where existing pavements must be cut to install landscape irrigation system, cut smoothly to straight lines 6" wider than trench. Excavate to required depth. Repair or replace pavement cuts with equivalent materials and finishes.

I. **Jacking:** At existing obstacles and walkways, jack pipe sleeves under paving material if possible, backfill and compact all voids.

J. **Bore:** Fire lanes shall not be cut in any manner. Dry bore and jack sleeve to provide 24" minimum cover. Sleeve with Schedule 40 or stronger black steel pipe, as per Plans for irrigation pipe and wire.

K. **Sleeves:** The General Contractor shall sleeve as per schedule at walkways, walls and obstructions. Provide 2" minimum wire sleeves as needed and 1 spare 2" sleeve. Field verify any existing sleeves shown on Plans.

L. **Drain Pockets:** Excavate to sizes indicated. Backfill with acceptable drain material to 12" below grade. Cover drain material with a sheet of 30 lb. asphalt saturated felt and backfill remainder with excavated material. Restore plantings disturbed by this Work.

M. **Alignment of pipe** shall be for a simple layout with pipe running parallel or perpendicular to features such as curbs and sidewalks as may be possible with on-site conditions and to avoid future conflict with the plant root balls.

3.3 <u>Installation of Plastic Pipe and Fittings</u>

A. **Expansion:** Plastic pipe shall be installed in a manner so as to provide for expansion and construction as recommended by the manufacturer. Maximum of two laterals per trench. Allow a minimum of 16" between all trenches.

B. **Cuts:** Plastic pipe shall be cut with a hand saw or hack saw with the assistance of squared-in sawing vise, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that smooth unobstructed flow will be obtained.

C. **Joints:** All plastic to plastic joints shall be made using Weld-On P-70 primer and Weld-On 711 solvent as recommended by the pipe manufacturer. Plastic to metal joints shall be made with plastic male adapter to PVC schedule nipples. The solvent-weld joints shall be made in the following manner:

1. Thoroughly clean the mating pipe and fitting with a clean dry cloth.
2. Apply a uniform coat of primer to both the pipe and fitting. While primer is still wet, apply a uniform coat of solvent to the outside of the pipe with a non-synthetic bristle brush.
3. Apply solvent to the inside of the fitting in a similar manner.
4. Re-apply a light coat of solvent to the pipe and quickly insert it into the fitting.
5. Give the pipe or fitting a quarter turn to ensure even distribution of the solvent and make sure the pipe is inserted into the full depth of the fitting socket.
6. Hold in position for 15 seconds.
7. Wipe off excess solvent that appears at the outer shoulder of the fittings.
8. Care should be taken so as not to use an excess amount of solvent, thereby causing a burr or obstruction to form on the inside of the pipe.

D. **Sub-base:** Lay pipe on solid subbase, uniformly sloped without humps or depressions.

1. For circuit piping, slope to drain valve at least 1/2” per 10 foot run.
2. All wall penetrations, pack the opening around pipe with non-shrink grout. At exterior face, leave a perimeter slope approximately 1/2” wide by 3/4” deep. Fill this slot with backer road and an acceptable elastomeric sealant. Repair below grade waterproofing disturbed by this work and make penetration watertight.
3. Contractor to ensure the installation of all sleeves necessary to route irrigation piping and electrical control wire.
4. Install PVC pipe in dry weather when temperature is above 40 degrees F before testing, unless otherwise recommended by manufacturer.

E. Threaded male adapters shall be compounded as per manufacturers recommendation. Adapter shall then be hand tightened, plus one turn with a strap wrench. 4" main line pipe shall be "Ring tite" with bolt-type fittings. Concrete thrust block all mainline fittings, behind fittings. No concrete on any inserted PVC joints.

F. Piping under paved or concrete areas shall be sleeved in schedule 40 PVC pipe as shown on the Drawings. Where any cutting of A.C. pavement, sidewalks and/or concrete work is necessary, it shall be removed and replaced by the Contractor. Permission to cut roadway, sidewalks and/or concrete shall be obtained from the Facilities Project Manager.

G. All pipe shall be thoroughly embedded 6" all around in construction grade sand or screened material. All lateral pipe in rocky soils shall be thoroughly embedded in sand or approved topsoil.

H. **Marking Tape:** All main line pipe shall be identified with 3" wide metallic marking tape for future locating of lines.

I. **Clearances:** All pipe lines shall have a minimum clearance of 6” from each other and 12” from lines of other trades. Parallel lines <u>shall not</u> be installed directly over one another.

J. **Pipe sizes** on Drawings are minimum allowable. Increase in size if required by Code and wherever necessary to meet unusual conditions.

K. Run lines parallel or perpendicular to buildings, walks, etc. and in straight lines as much as possible.

L. **Dielectric Protection:** Use dielectric fittings at connection where pipes of dissimilar metal are joined.

3.4 **<u>Installation of Equipment</u>**

A. **Backflow Preventer:** Provide union on downstream side. Install minimum 12” above grade. Maximum, height 16”. Enclose in an enclosure as required by these specs and details found on the plans.

B. Install **anti-drain valves** as needed to prevent drainage of lateral lines into parking areas and causing standing water.

C. **Flush** circuit lines with full head of water and install sprinkler heads after hydrostatic test is completed.
1. Install lawn heads at manufacturer's recommended heights.
2. Install shrubbery heads at heights indicated on Drawings.
3. Locate part-circle heads to maintain a minimum distance of 4” from walls and 2” from other boundaries, unless otherwise indicated.

3.5 **<u>Installation of Irrigation Heads & Risers</u>**

A. Heights of irrigation heads in relation to ground level shall be shown on the Plans and in the details.

B. Irrigation heads shall not be assembled to risers until flushing is completed. Care shall be taken prior to emitter installation and pipe kept free of foreign matter after flushing and prior to emitter installation.

C. **Coordination of heads with planting is a requirement.** In cases where irrigation and planting is contracted to separate parties, final coordination of heads shall be the responsibility of Irrigation Contractor. In the case where more than one emitter outlet is required to a single plant, Irrigation Contractor shall install emitters equal distance around base of plant.

D. **Contractor shall be responsible to ensure that all turf areas receive 100% spray coverage.** Contractor to add or delete irrigation heads as required to achieve desired result. If necessary, layout shall be adjusted in the field to provide uniform coverage over entire area of spray shown on the Drawings at the available water pressure.

3.6 **<u>Backfilling and Compacting</u>**

A. The trench shall be backfilled and compacted in 8" lifts and leveled to the grade of adjacent soil. Compaction shall be 95% of the maximum density of adjacent soil. Any settling of trenches shall be brought up to grade as necessary.

3.7 **<u>Installation of Control Cable</u>**

A. All electric control cable shall be of size as shown as specified herein and shall be installed in the piping trenches wherever possible. Pipe trench shall be partially backfilled to provide three to four inches of cover over the pipe before wire is installed. Wire shall be "snaked" into the trench as loose as possible and with as much slack as possible to allow for expansion and contraction of the wire. If it is so desired, rather than leaving slack in the wire, expansion joints in the wire may be provided at 200-foot intervals by making five to fifteen turns of the wire around a piece of 1/2" pipe. Where it is necessary to run wire in a separate trench, the wire shall have a minimum cover of 24”.

B. All wire connections at remote control valves, whether direct buried or in control boxes, and at all wire splices shall be left with sufficient "slack" so that in case of repair the valve bonnet or splice may be brought to the surface without disconnecting the wires (24” min.).

C. Wire connections to remote control electric valve and splices of wire in the field shall be made in the following manner using Pen-Tite wire connectors and sealing cement, or approved equal:
1. Strip ends of wires and push wires through the holes of the base socket.
2. Twist wires together and mechanically bond together using crimp sleeve and crimp pliers.
3. Pull wire connection back into base socket as far as possible.
4. Apply solvent cement to outside of sealing plug then fill cavity of sealing plug completely with solvent cement.
5. Push sealing plug into base socket, using slight twisting motion, until it bottoms.
6. Push wires unseating sealing plug. This assures cement completely sealing around wire insulation and waterproofing the connection.

D. It is important the joint be **absolutely waterproof** so that there is no chance for leakage of water and corrosion build-up on the joint.

E. **No splices shall occur between the controller and the remote control valve.** If outstanding circumstances occur that require wire splices the contractor shall first send written notification to FSU Grounds Department, Irrigation Division for approval. Contractor shall make all splices inside a valve box with adequate slack at the ends of the wire run (24” min.).

PART 4 AUXILIARY EQUIPMENT

4.1 Valve Boxes

A. **Type:** All remote control valves, unless otherwise indicated shall be installed in suitable plastic or other type valve access box of proper size and commercial grade as required for easy access to the valve. Access boxes shall be complete with plastic or other approved type locking cover. Keys shall be provided for the non-rusting locking covers. Valve boxes shall be CARSON or approved equal. All valve boxes in mulch areas shall be dark tan in color. Contractor shall make every effort to avoid placing valve boxes in turf areas. If, for proper operation of irrigation system, it is found to be impossible not to place valve boxes in turf, those valve boxes shall be forest green in color.

B. **Controller designation** shall be clearly and neatly etched into top of valve box lid. All valve access boxes shall be provided with proper length and size extensions, wherever required, to bring the valve boxes level with the finish grade.

C. **Weed Control fabric** shall be placed on bottom of box and wrap around piping to keep the interior of the valve box free from loose soil and weeds. A layer of pea gravel as detailed in the drawings shall also be placed within each component box.

4.2 Enclosures

A. The protective enclosure for the backflow preventers shall be detailed on the drawings. Padlocks shall be furnished by the Owner after final acceptance.

4.3 Field Quality Control

A. **Tests:** Notify FSU Grounds Department, Irrigation Division in writing when tests will be conducted. Notification of Tests shall be a minimum of 48 hours in advance. Conduct tests in presence of FSU Grounds Department Representative.

4.4 Flushing and Testing

A. After completion and prior to the installation of any terminal fittings, the entire pipeline system shall be thoroughly flushed to remove all foreign material. After flushing, the following tests shall be conducted in the sequence listed below. All equipment, materials and labor necessary to perform the tests shall be furnished by the Contractor and all tests shall be conducted in the presence of FSU Grounds Department Representative.

1. **Pipeline Pressure Test:** A water pressure test shall be performed on all pressure mains and laterals before any couplings, fittings, valves and the like are concealed. All open ends shall be capped after the water is turned into the lines in such a manner that all air will be expelled. Pressure mains shall be tested with all control valves to lateral lines closed. The constant test pressure and the duration of the test are as follows:

    a. **Mains:** 6 hours at 50 psi above operating pressure or 135 psi whichever is greater.

2. **Sprinkler Coverage Test:** The coverage test shall be performed after sprinkler heads have been installed and shall demonstrate that each section or unit in the irrigation system is balanced to provide uniform and adequate coverage of the areas serviced. The contractor shall correct any deficiencies in the system.

3. **Operation Test:** The performance of all components of the automatic control system shall be elevated for manual and automatic operation.

4. All necessary repairs, replacement and adjustments shall be made until all equipment, electrical work, controls and instrumentation are functioning to the satisfaction of FSU Grounds Department Representative.

4.5 Adjusting

A. After completion of grading, seeding or sodding, and rolling of grass areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than 1/2 inch above finish grade, and plumb. Do not over spray onto walks, walls, buildings, signs or parking areas. Adjust to conform.

B. Coordinate the controller watering schedules to minimize station overlap. Submit watering schedule to FSU Grounds Department, Irrigation Division for review prior to acceptance of project.

PART 5 - CLEAN UP

5.1 Clean-up

A. Clean up shall be made daily as each portion of the Work progresses. Refuse and excess dirt shall be removed from the site, and walks and paving shall be broomed or washed down daily.

5.2 Protection

A. Protect Work from damage until acceptance. Any damage shall be repaired to original conditions at Contractor's expense.

5.3 Protection of Existing Irrigation

A. The Irrigation Contractor is to protect the existing irrigation system and to provide 100% uninterrupted coverage to all existing plant material.

B. The Contractor is to supply temporary irrigation if there is work on-going within an existing irrigation system, i.e. temporary mainline, temporary lateral line, etc., to maintain uninterrupted service to all other areas.

C. Contractor shall demonstrate proper operation of all previously existing systems prior to final acceptance. Contact FSU Grounds Department, Irrigation Division for inspection of all new and affected systems.

PART 6 - RECORD DRAWINGS AND GUARANTEES

6.1 Record Drawings

A. During progress of the Work, keep an up-to-date set of Drawings showing field and shop drawing modifications. Record dimensioned locations and depths for each of the following:
   1. Sprinkler pressure line routing (Provide dimensions for each 100 lineal feet {maximum} along each routing, and for each change in directions).
   2. Gate valves and butterfly valves.
   3. Irrigation control valves
   4. Control wire routing and color designation.
   5. Sleeves under paving
   6. Turf sprinkler heads
   7. Other related items as may be directed by the Engineer/Owner's Representative
   8. Maintain as-builts on a daily basis to ensure accuracy.

B. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs or pavements).

C. Record all changes which are made from the Contract Drawings, including changes in the pressure and non-pressure lines.

D. Record all required information on a set of blackline prints of the Drawings. Do not use these prints for any other purpose.

E. Maintain information daily. Keep Drawings at the site at all times and available for review by the FSU Grounds Department, Irrigation Division Representative.

F. Make dimensions accurately at the same scale used on original drawings, or larger. If photo reduction is required to facilitate controller chart housing, notes or dimensions must be a minimum 1/4" in size.

G. Provide electronic as built record documents for all irrigation work as required elsewhere in the FSU Design Guidelines.

6.2 Guarantees

A. Submit for approval a written guarantee in addition to manufacturer's guarantees or warranties. All Work shall be guaranteed for one (1) year from date of final acceptance against defects in material, equipment and workmanship by the Construction Manager. Guarantee shall also include repairs to any part of the premises resulting from leaks or other defects in materials. Guarantee shall be presented on Contractors official stationary and signed by the Contractor and Subcontractor.

6.3 Operation and Maintenance Data

A. Submit detailed operation and maintenance data for all equipment and accessories provided under this Section including assembly and part lists for each type of valve, emitter, etc. Refer to requirements for project close-out documents.

6.4 Controller Charts

A. Do not prepare charts until Record Drawings have been approved by the FSU Grounds Department, Irrigation Division Representative.

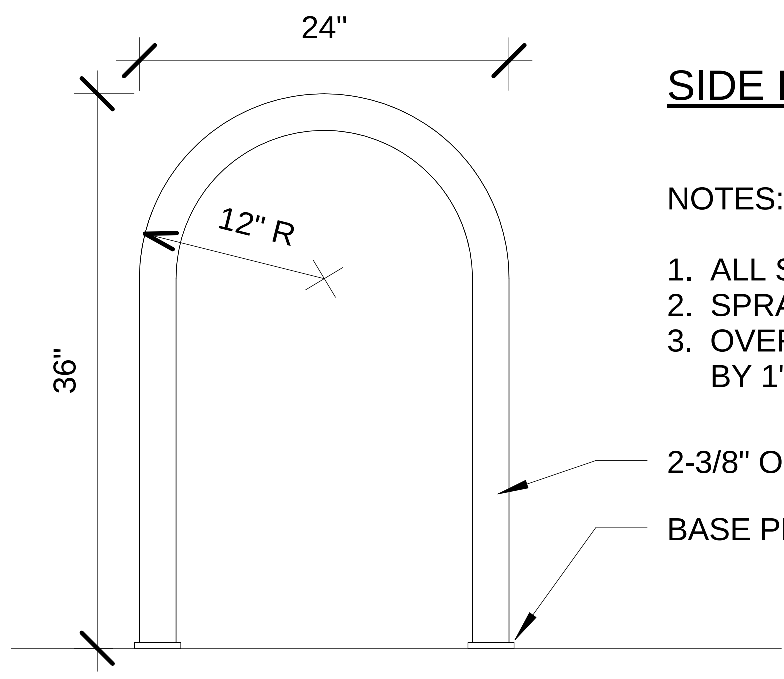
B. Provide one controller chart for each automatic controller installed.
   1. Chart may be a reproduction of the Record Drawing, if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
   2. Chart shall be blackline print of the actual system, showing the area covered by that controller.

C. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage.

D. Following approval of charts by the FSU Grounds Department, Irrigation Division Representative, they shall be hermetically sealed between two layers of 20 mil thick plastic sheet.

E. Charts must be completed and approved prior to final acceptance of the irrigation system.

END OF SECTION



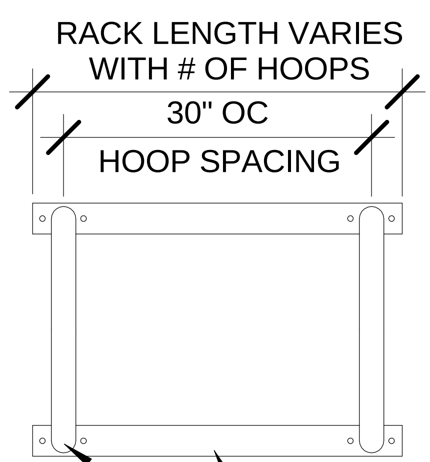
SIDE ELEVATION VIEW

NOTES:

1. ALL STEEL TO BE HOT-DIPPED GALVANIZED.
2. SPRAY ALL JOINTS WITH GALVANIZED SPRAY AFTER WELDING.
3. OVERALL WIDTH MAY VARY BY 2", OVERALL RADIUS MAY VARY BY 1".

2-3/8" OD, SCHED. 40 PIPE, .154" THICK, TYP.

BASE PLATE FLATBAR, TYP.



PLAN VIEW

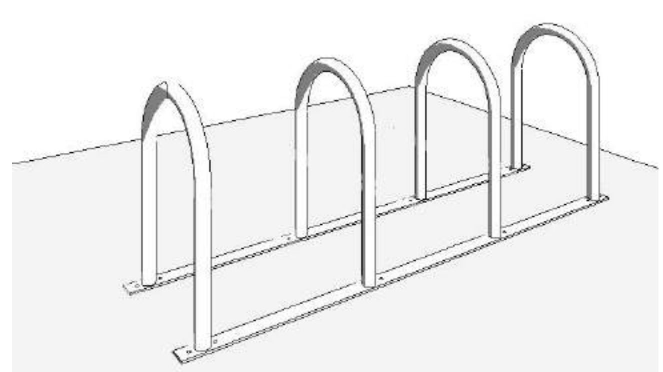
NOTES:

1. HOOP SPACING FOR ALL RACKS TO BE 30" OC.
2. PROVIDE MOUNTING HOLES AT BASE PLATE FLATBAR.

BASE PLATE FLATBAR, TYP.

2-3/8" OD, SCHED. 40 PIPE, TYP.

BICYCLE RACK LENGTHS		
# OF HOOPS	BIKE CAPACITY	LENGTH
2	4	36"
3	6	66"
4	8	96"



3D VIEW

Bicycle Rack Campus Guidelines
Manufacture

Sheet:

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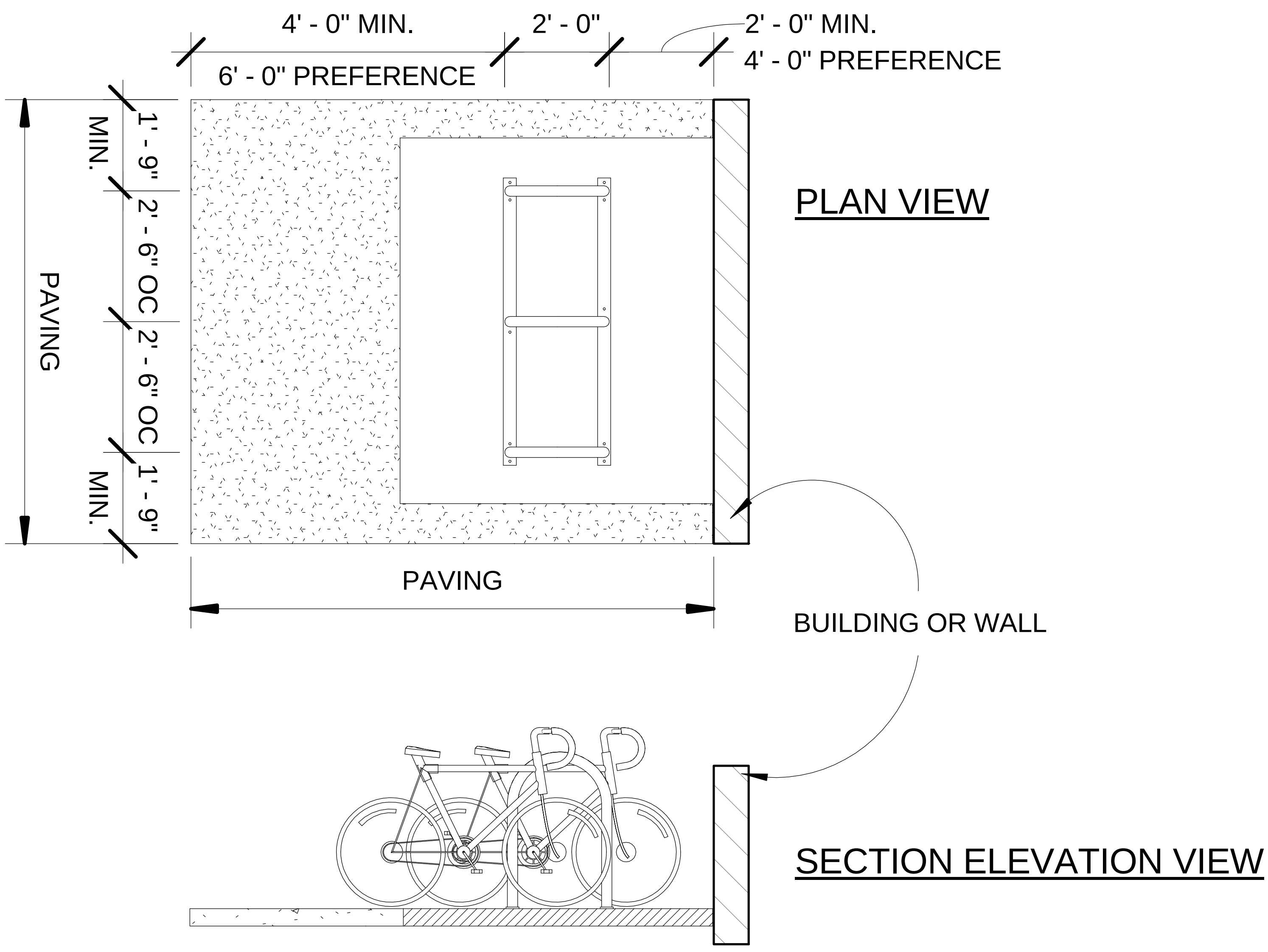

PAVING & RACK PLACEMENT NOTES:

1. SURFACE MOUNT ON CONCRETE SLAB OR RECESS RACK AND MOUNT ON ISOLATED FOOTING.
2. RECESSED RACKS MAY USE BRICK PAVERS, CONCRETE MOSAIC OR ROCK/ GRAVEL TO CONCEAL BASE PLATE; HOWEVER, VERTICAL DISTANCE BETWEEN FINISHED PAVED SURFACE AND TOP OF RACK SHALL NOT BE LESS THAN 32".
3. BICYCLES ARE APPROXIMATELY 6 FT IN LENGTH AND IDEALLY FOR MAXIMUM STABILITY CENTERED ON RACK TO RECEIVE SUPPORT AT TWO PLACES ACROSS FRAME WHEN PARKED. PREFERABLY, PAVEMENT PATTERNS MAY SUGGEST THIS PLACEMENT BY INDICATING A PATTERN APPROXIMATELY 2 FT ON EITHER SIDE AND APPROXIMATELY 1 FT ON ENDS. SEE DRAWING ABOVE.
4. ALTHOUGH RACKS ARE DESIGNED FOR CENTER RACK PLACEMENT, COMMON USAGE MAY INVOLVE SUPPORT AND ENGAGEMENT OF FRONT WHEEL ONLY. DESIGNERS SHOULD PLAN FOR ALTERNATIVE ALBEIT NOT IDEAL PLACEMENT ALLOWING ADDITIONAL SPACE SO PASSAGE OF TRAFFIC (FOOT, BIKE, OR VEHICLE) IS NOT IMPEDED. SEE SECTION DRAWING ABOVE.

Bicycle Rack Campus Guidelines
Single Rack Placement

Sheet:
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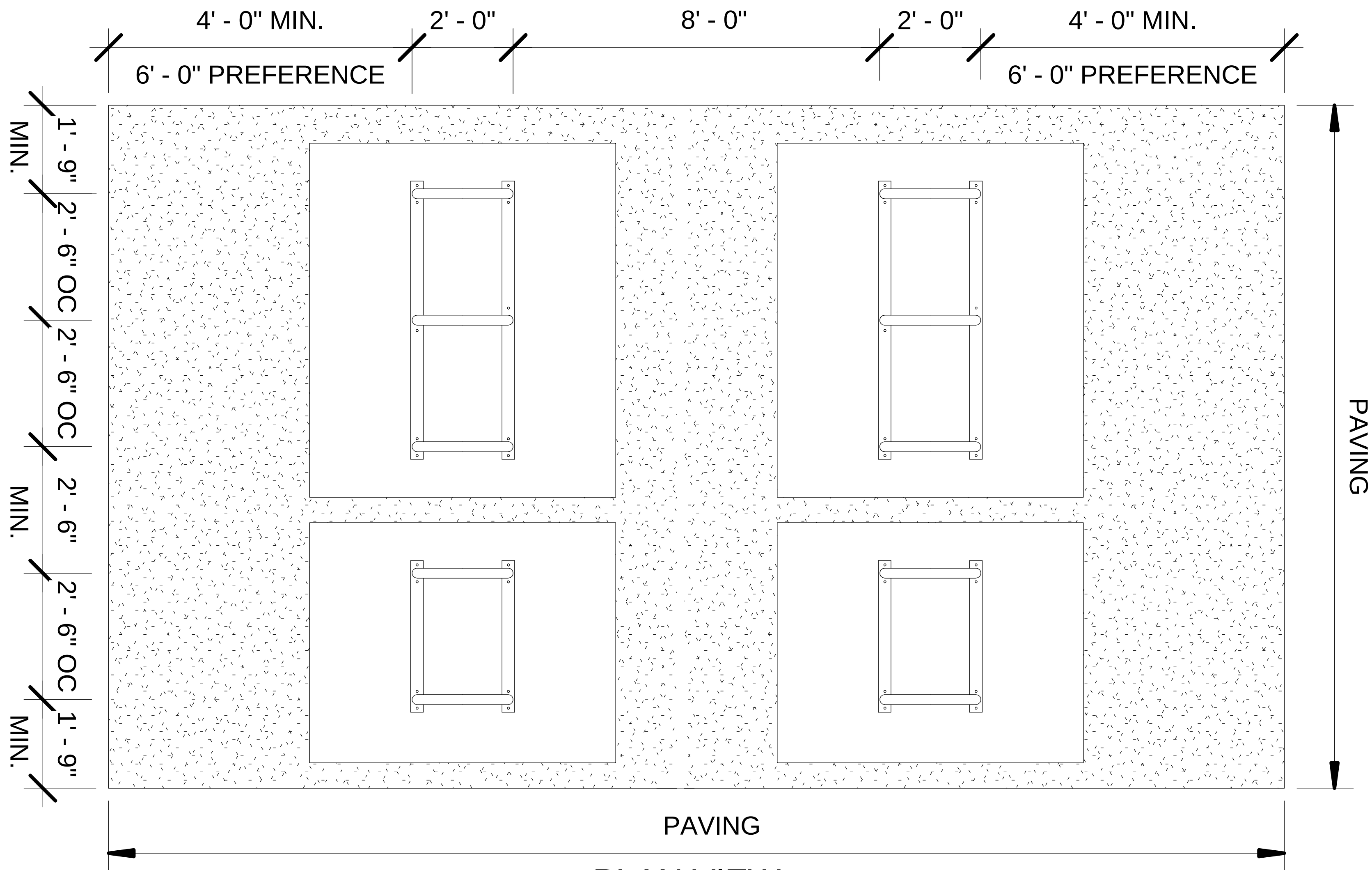
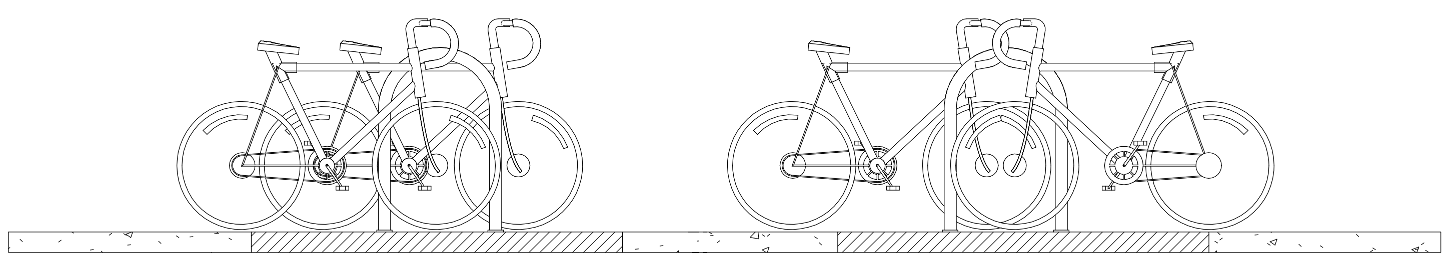


PLAN VIEW



SIDE ELEVATION VIEW

PAVING & RACK PLACEMENT NOTES:

1. SURFACE MOUNT ON CONCRETE SLAB OR RECESS RACK AND MOUNT ON ISOLATED FOOTING.
2. RECESSED RACKS MAY USE BRICK PAVERS, CONCRETE MOSAIC OR ROCK/ GRAVEL TO CONCEAL BASE PLATE; HOWEVER, VERTICAL DISTANCE BETWEEN FINISHED PAVED SURFACE AND TOP OF RACK SHALL NOT BE LESS THAN 32".
3. BICYCLES ARE APPROXIMATELY 6 FT IN LENGTH AND IDEALLY FOR MAXIMUM STABILITY CENTERED ON RACK TO RECEIVE SUPPORT AT TWO PLACES ACROSS FRAME. PREFERABLY, PAVEMENT PATTERNS MAY SUGGEST THIS PLACEMENT BY INDICATING A PATTERN APPROXIMATELY 2 FT ON EITHER SIDE AND APPROXIMATELY 1 FT ON ENDS. SEE DRAWING ABOVE.
4. ALTHOUGH RACKS ARE DESIGNED FOR CENTER RACK PLACEMENT, COMMON USAGE MAY INVOLVE SUPPORT AND ENGAGEMENT OF FRONT WHEEL ONLY. DESIGNERS SHOULD PLAN FOR ALTERNATIVE ALBEIT NOT IDEAL PLACEMENT ALLOWING ADDITIONAL SPACE SO PASSAGE OF TRAFFIC (FOOT, BIKE OR VEHICLE) IS NOT IMPEDED. SEE SECTION DRAWING ABOVE.

Bicycle Rack Campus Guidelines
Multiple Rack Placement Placement

Sheet:

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SECTION 329220

INERT GROUNDCOVERS

PART 1 - GENERAL

1.01 SUMMARY

The section includes requirements for providing complete inert groundcovers including, but not limited to: mulch, pine straw, granite rock, river rock, boulders in accordance with the Plans and Specifications. Requirements for all labor, material procurement, equipment, tools, transportation, and services required for complete installation of inert groundcover is also included.

1.02 SUBMITTALS/QUALITY ASSURANCE

A. Submit the following information except as modified herein.

1. **Samples.** Submit a sample of each material to the FSU Project Manager for review and approval of color, size, and appearance with the Grounds Department. Samples should be obtained from the proposed source and be of sufficient quantity and size to evaluate the proposed material.

2. **Gradation Test Results.** Where required, submit test lab results verifying material meets size requirements.

3. **Materials Source.** Provide proposed source for each inert groundcover and confirm in writing that the source is capable of providing a sufficient quantity of material to insure that the entire area covered will be of the same composition and appearance. All like materials must be provided from the same source unless specifically waived in writing by the University.

B. **Quality Assurance:**

1. Install materials which match the approved samples.

2. Keep a copy of the current plans and specifications at the work site until Final Acceptance.

C. **Materials Re-use:** Existing undamaged materials maybe re-used, subject to approval of FSU Grounds.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Granite, Boulders, River Rock, Mulch, Pine straw: size and color as per plans and specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not place inert groundcovers until the required water distribution systems and planting operations have been completed within the area.

B. Grades: In areas where inert ground cover will be installed, grade the applicable sub-grade before installation.

1. Verify that final grades are within plus or minus 0.10 foot of the designated elevation prior to commencing other landscaping operations.

C. Pre-Installation Weeding: Weed areas where installation will occur so they are totally free of weeds before the placement of the inert groundcover.

1. Apply a pre-emergent herbicide according to manufacturer's recommendations before installing inert groundcover.

3.02 INSTALLATION

A. Neatly join, course, connect, attach, or butt the Work to the existing construction as applicable; and match the color, texture, and appearance of the existing construction to the satisfaction of the FSU Project Manager and Grounds Representative.

B. Placing Inert Groundcovers Near Plant Materials:

1. Exercise care when placing inert groundcovers around plant materials so as not to choke, cover or damage plants.

2. Keep inert groundcovers out of the crowns of plants.

3.03 REPAIR/RESTORATION

A. Rejection of Work: Work judged to be in non-conformance of these guidelines will be rejected until found to be in conformance.

B. Repair damages to any plant material, irrigation systems, utilities, site structure or other damaged materials resulting from the application of inert groundcover at no additional cost to the Owner. Repairs shall match existing condition.

1. The limits of this work will be as determined by the limit of disturbance or as necessary to complete the satisfactory restoration of impacted systems as indicated on the plans.

END OF SECTION

SITE FURNISHINGS

PART 1 – GENERAL

1.01 Summary

A. This Section includes site furnishings to include: exterior benches, exterior tables, picnic tables, exterior trash receptacles, and exterior recycling containers.

B. Related work elsewhere includes: bike racks, exterior signage, and blue light phones.

PART 2 - PRODUCTS

2.01 Exterior Benches/Seating

A. General: Different bench and seat types may be allowed with respect to specific location, visibility and anticipated usage. For further clarification regarding specific seating choices, contact FSU Facilities @ 850/644-2843.

B. **Type A seating:** to be used in prominent, highly visible and most public locations, including but not limited to: Westcott Building Area, Woodward Avenue, Convocation Way, Legacy Walk, Mina Jo Powell Green, University Center, Howser Baseball Stadium, Landis Green, Strozier Library.

1. Bench seat: "Presidio" as manufactured by Landscape Forms, Inc., metal, straight or curved radius, with or without back and arms.
2. Finish/color: black powdercoat.
3. Support: embedded post set in concrete.

C. **Type B seating:** utilitarian bench intended for unpaved areas away from sidewalks and for less prominent locations.

1. Bench seat: "S-4A", "S-5A", or "S-6A" cast stone bench as manufactured by Dura Art Stone (or equal).
2. Finish/color: unpainted concrete
3. Support: freestanding

D. **Specialty benches and seating:** to be used at specific request of the University only. These benches include commemorative and Gothic benches produced by FSU Mastercraftsman Studios or others, as specifically approved by the FSU Aesthetics Committee for type, location, and installation method.

2.02 Exterior Tables and Picnic Tables

A. **Exterior table:** smooth surface table to be used in conjunction with Type A seating, single seat bench with or without back. Provide ADA compliant style where required.

1. **<u>Table:</u> metal café style table, "Steelsites" Series as manufactured by Victor Stanley, Inc.**
2. **<u>Shape:</u> round or rectangular.**
3. **<u>Size:</u> any size, as appropriate to application.**
4. **<u>Support:</u> embedded post in concrete or surface mounted.**
5. **<u>Finish/color:</u> black, powdercoat.**

B. **Tandem style picnic table: perforated metal metal table w/3,4,5 or 6 attached seats to be used on paved surface in locations adjacent to food service venues. Provide ADA compliant style where required.**

1. **<u>Picnic table:</u> metal table with attached perforated seats, "Carousel", as manufactured by Landscape Forms, Inc.**
2. **<u>Tabletop:</u> perforated metal.**
3. **<u>Seats:</u> perforated seat, with or without back.**
4. **<u>Installation:</u> surface mounted as per manufacturer's recommendation.**
5. **<u>Finish:</u> black, powdercoat.**
6. **<u>Optional umbrella mount:</u> umbrella only by approval of FSU Aesthetics Committee.**

C. **Concrete picnic table with bench: cast concrete table with coordinating concrete bench to be used in areas with lesser prominence. This table and bench combination is intended for utilitarian use in outlying areas of campus. It is NOT intended to be located in or visible form areas which are heavily used by the public. ADA compliance shall be required when located on an accessible route.**

1. **<u>Picnic table:</u> cast concrete table, as custom-fabricated by Brooks Concrete, Panacea, FL, OR as approved equal by the University Aesthetics Committee.**
2. **<u>Top dimensions:</u> 4'x4' or 3'x8'**
3. **<u>Finish:</u> standard concrete w/clear sealer.**
4. **Installation: with or without concrete pad; compliant w/ADA accessibility where required.**

2.03 Exterior Trash Receptacles and Recycling Receptacles

A. **<u>General:</u> Exterior trash and recycling receptacles with Owner provided labeling as required.**

1. **<u>Receptacle:</u> metal slat receptacle, "Ironsites", as manufactured by Victor Stanley, Inc. Model S-42.**
2. **<u>Capacity:</u> 36 gal.**
3. **<u>Liner:</u> provide interior, high-density plastic liner.**
4. **<u>Lid:</u> standard tapered, formed lid.**
5. **<u>Finish:</u> polyester powder coating.**
6. **<u>Color:</u> black.**

B. **<u>Installation:</u> Provide (2) receptacles at each location scheduled to receive trash/recycling containers, i.e. (1) trash receptacle and (1) recycling receptacle. Receptacles shall be permanently mounted to impermeable surface as recommended by manufacturer and located in prominent locations to promote use. Do not locate in exit pathways. Band type decal**

labeling for “Landfill” and “Bottles and Cans” will be provided by the University.

END OF SECTION

Accessible Curb and Detectable Warnings

1. All tactile warning devices should be fabricated integral to the construction materials and be of contrasting colors.

2. Cementitious materials are preferred at curb cuts. Provide warning materials constructed of 8000 psi concrete to prevent chipping at corners and edges.

3. No mechanically fastened mats will be allowed.

4. Color for tactile warning material at curb cuts shall be equal to U4008ADA as manufactured by Wausau Tile Inc. Contrasting border materials should be provided to aid visual discrimination. Contrasting color shall be equal to U-1008ADA also by Wausau Tile, Inc.

Ornamental Bollards

1. Ornamental bollards should be provided where required to prevent the entrance of motorized vehicles.

2. Bollards should match existing campus bollards and be equal to Sternberg "Richmond" series.

3. Material: cast aluminum.

4. Height: 42" above finish surface.

5. Finish: electrostatically applied, semi-gloss, powder coated; color shall be black.

6. Warranty: 5 years.

7. Installation: provide for quick release. Where bollards are mounted in series, provide for center-to-center clearance of 66" when golf cart access is anticipated.

CONCRETE

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for concrete and is intended to guide and supplement the specifications provided by the Architect and Engineer of Record. Cast-in-place and pre-cast stone are included in this section. Accessible curb is included in this section.

1.02 **Related Work:** Related work located elsewhere includes: masonry, concrete accessories and reinforcing, and pavers.

1.03 **Use of concrete materials:** No buildings or other structures shall be built using exposed concrete finishes. **Exceptions:** exposed concrete paving and pre-cast architectural concrete/cast stone. Exposed concrete paving shall not employ exposed aggregate.

1.04 Do **not** use colored or stained concrete in exterior applications, including walkways and plazas. Interior flooring may employ concrete stain if approved by the Facilities Department during design.

1.05 **Quality Control:**

A. All material products and execution shall conform to ACI 301 and applicable ANSI/ASTM Standards tests.

B. Testing shall also comply with the requirements of the FSU Professional Services Guide.

C. Mock-up: Provide a sample of finished concrete and pre-cast stone for approval by the University Project Manager prior to proceeding. At a minimum, provide mock-ups of the following construction areas:

1. windows and doors
2. flashing
3. trims
4. sealants

D. Drip edges and positive drainage should be employed to keep water from collecting on horizontal surfaces and discoloring surfaces.

PART 2 – MATERIALS

2.01 **Concrete:**

A. Cast-in-place concrete:

1. **Admixtures:** Do not specify or use admixtures without approval by the University Project Manager. For those cases where the use of admixtures can not be avoided, provide a written justification statement from the Architect/Engineer.

2. Include specifications for hot and cold weather concreting in accordance with ACI Standard Specifications.

3. Reinforcing specifications shall include requirements for proper coverage. Reinforcing bar supports which will be frequently exposed to weather should be plastic.

4. Provide location and detailing for expansion and other construction joints.

B. Pre-cast stone:

1. Provide all pre-cast stone elements from the same source.

C. Expansion joints:

1. Wall panels: specify filler and sealant as required to provide watertight construction and allow for expansion. Do not rely on expansion joints to repair damaged or mis-fitting panels. Joints should be straight and aesthetically pleasing where exposed to view.
2. Walks: ½” fiber or other highly resilient material capable of withstanding both hot and cold weather extremes.
3. Structural slabs: provide expansion joints between new slabs and any existing construction.

D. Contraction joints:

1. Locate contraction joints such that concrete restraint, hence cracking, is minimized.

PART 3 – EXECUTION

3.01 Pre-cast concrete and stone which is stored on site shall be protected to ensure that identification tags remain in place and damage does not occur causing chipping or cracks.

3.02 Stored pre-cast materials shall be protected from splatter caused by weather or other construction.

3.03 Do not cut cast concrete or stone products that contain steel reinforcement.

3.04 Employ appropriate measures to lift panels and pieces into place to avoid damage.

3.05 Employ proper detailing to prevent water and/or copper flashing stains. Should materials require cleaning prior to acceptance, review cleaning methods and products with the FSU Project Manager.

3.06 Patching or other repair of panels must be approved by the FSU Project Manager.

3.07 CIP concrete walks should employ designs and techniques which prevent cracking. Formed, “picture frame” joints are preferred for concrete walks and areas of concrete plazas. Do not use saw cut joints to prevent cracking.

3.08 For concrete walks/plazas, provide ½” expansion joint material to prevent cracking where required by ACI and where decorative or construction joints intersect or do not align, ex: T intersections. Expansion joint material should provide straight and aesthetically pleasing appearance.

3.09 Concrete walls and floor slabs should include provisions for proper sealing at pipe penetrations to prevent the passage of fire, vermin, and rodents.

END OF SECTION

MASONRY

PART 1 – GENERAL

1.01 **<u>Summary:</u>** This section describes University specific requirements for brick masonry and concrete masonry units. It is intended to guide and supplement the specifications provided by the Architect and Engineer of Record.

1.02 **<u>Related Work:</u>** Related work located elsewhere includes: waterproofing, pre-cast concrete, and masonry pavers.

1.03 **<u>Use of masonry materials:</u>** Masonry materials are preferred as the main components for the building envelope. Refer to traditional details and treatments described further in the Appendix of this document: "Architectural Design – Master Plan Element".

1.04 **<u>Quality Control:</u>**

A. All material products and execution shall conform to the current ACI specifications and applicable ASTM Standards tests. In addition, materials shall conform to the requirements of the Quality Control Standards of the National Concrete Masonry Association.

B. Testing shall also comply with the requirements of the FSU Professional Services Guide.

C. Mock-up: Provide a 4'x4' sample panel of finished masonry assembly for approval by the University Project Manager prior to proceeding. At a minimum, provide mock-ups demonstrating the following:

1. joints and reinforcement
2. flashing and waterproofing
3. mortar and grouting
4. bond pattern
5. color range and texture of masonry

The mock-up panel shall remain in place until masonry acceptance and shall act as the minimum standard for the work.

D. Drip edges and positive drainage should be employed to keep water from collecting on horizontal surfaces and discoloring surfaces.

PART 2 – MATERIALS

2.01 **<u>Concrete Masonry Units:</u>** Concrete masonry units are preferred for construction of building envelope walls, in lieu of, stud wall construction.

2.02 **<u>Brick:</u>** Face brick should be 7 5/8" x 3 5/8" x 2 ¼" standard units unless approved otherwise by the Facilities Project Manager. Colors shall consistent with existing Campus brick palette. Brick proposed for historic brickwork must be approved by the University for both type and color, and it must conform to the Secretary of Interiors Standards for color, texture, pattern, bond, and size.

2.03 **<u>Mortar:</u>** Provide mortar color consistent with existing gray mortars previously used on Campus.

2.04 Glass Unit Masonry: The use of glass unit masonry on the building exterior must be approved by the Facilities Project Manager prior to incorporation in construction documents. Use on the building envelope should be limited to small quantities and employ appropriate waterproofing. When utilized, include horizontal joint reinforcement, uniform joint treatment interface with adjacent wall systems, and compliance with strict structural and all other code requirements.

2.05 Waterproofing: Utilize through wall flashing, treated weeps, and waterproof coatings. Do not rely on exterior surface applied water repellants.

2.06 Wall Expansion/Control Joints: Specify filler and sealant as required to provide watertight construction and allow for expansion. Joints should be straight and aesthetically pleasing where exposed to view.

PART 3 – EXECUTION

3.01 Masonry which is stored on site shall be protected to ensure that damage does not occur causing staining, chipping, or cracks.

3.02 Lay concrete masonry as follows:

- A. Provide full mortar coverage on horizontal and vertical face shells.
- B. Embed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells and cavities to be filled with grout.
- C. Fill all below grade cells with grout.
- D. Maintain joint widths indicated, with only minor variations in order to maintain bond alignment, typically 3/8” (10 mm) joints.

3.03 Lay solid brick masonry units as follows:

- A. Completely fill bed and head joints, butter ends with sufficient mortar to fill bed and head joints and shove into place. Do not furrow bed joints or slush head joints.
- B. Slope beds toward cavity in cavity walls to minimize mortar protrusion into cavity. Use a drag stick to keep cavity clear of mortar and trowel mortar protrusion flat against cavity face of brick.

3.04 Lay hollow brick masonry as follows:

- A. Lay vertical cell units with full head joints, unless otherwise indicated.
- B. Provide bed joints with full mortar coverage on face shells and webs.
- C. Lay horizontal cell units with full bed joints, unless otherwise indicated.
- D. Keep drainage channels, if any, free of mortar.
- E. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
- F. Butter both sides of units to be placed.
- G. Maintain joint widths indicated, except for minor variations required to maintain bond alignment, 1/4”-3/8” (6-10 mm) unless otherwise noted.

3.05 Tool all exposed joints slightly concave when thumbprint hard, using a joint tool larger than the joint.

3.06 Cut joints flush for masonry walls that are to receive waterproofing or other direct applied finishes (other than paint), unless otherwise indicated.

3.07 Plasticizers, accelerators, retardants, water repellant agents, or other admixtures are not recommended for mortar unless specifically required and approved by the University Project Manager.

3.08 Tops of all masonry walls, exterior and interior, where applicable, shall be built tightly against the floor construction above for stability, fire, and sound protection. Where provision must be made for expansion, require alternative means for ensuring stability and other protections. Provide anchor sizes and spacing in project specifications.

3.09 Provide concrete block units wherever feasible for interior wall finish. All units shall comply with all structural codes and shall be properly protected at the job site to insure placing in the wall without excessive moisture content.

3.10 All walls exposed both sides shall be 6" thick minimum.

3.11 Provide bullnose on all exposed external concrete block corners that extend to the floor (or to top of base). Rub out all casting irregularities (so as to result in smooth transitions from flat face to rounded corner) before any finish treatment is applied.

3.12 Provide a weep cavity where concrete blocks are veneer faced with brick or precast units. Face units shall not be installed directly against outer face of interior wythe. The exterior facing shall be tied to the interior wythe with ties specifically designed for this purpose. A damproof coating shall be provided on the outer face of the interior wythe prior to installing the facing.

3.13 Check split coursing at the head of any type opening.

3.14 All brick shall be laid with modular coursing, three courses to 8", unless otherwise required to match existing coursing or to accentuate an architectural feature or pattern. ASTM standard shall be complied with for all face brick, Grade SW, Type FBS. In addition, manufacturer's certification will be required stating that the rating for effervescence is not more than "slightly effervesced" in accordance with ASTM.

3.15 Show location of control joints in construction drawings. Locate joints to minimize cracking.

3.16 Masonry Cleaning: Refer to the Southern Brick and Tile Manufacturing Association for bulletins concerning cleaning. Cleaning should be done sufficiently early for the walls to dry thoroughly, at least four weeks prior to application of silicone or other recommended waterproofing. Sandblasting is not recommended for bricks, terracotta, or ceramic finished material. Specify that brickwork, especially historic brick or stonework, must be inspected prior to application of waterproofing. Specify cleaning agents consisting of detergent or solvent. Specification of acid solutions is not recommended and MUST be approved by the FSU Project Manager prior to use.

END OF SECTION

METALS

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for ferrous metals. It includes structural metals for buildings, their components and accessories, handrails, railings, as well as, other exterior ferrous metal materials. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Related Work:** Related work located elsewhere includes: fire-proofing, bike racks, tree grates, metal roofs/flashings, and painting.

1.03 **Use of metal materials:** The use of heavy structural steel with appropriate fire-proofing is supported. However, the use of exterior metal stud backup wall assemblies will be considered only on a project by project basis. **Masonry backup wall systems are the University's preferred method of construction.**

1.04 **Quality Control:**

A. All structural steel shall comply with AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and applicable ASTM Standards.

B. Open web steel joists shall comply with Steel Joist Institute (SJI) standards.

C. Welding shall comply with American Welding Society (AWS) standards, including supplements and addenda. All welding shall be completed by a Certified Welder with current certification.

D. Steel roof and floor deck shall comply with AISC standards and standards established by the Steel Deck Institute (SDI).

PART 2 – MATERIALS

2.01 Refer to the USGBC LEED Reference Guide for additional requirements pertaining to LEED Certification.

2.02 All exterior ferrous metals shall be hot-dipped galvanized including all shelf angles and other metal used in cavity walls, whether or not it is exposed to view.

2.03 Use galvanized steel angles in all exterior masonry, stone, or precast concrete walls, and in all interior walls where used in conjunction with stone.

2.04 All metal components shall conform to ASTM requirements and shall include: gratings, castings, supports for ceiling hung equipment, framed partitions, construction inserts and fastening devices, expansion joint inserts and covers, stair nosings and access doors for both ceiling and wall applications, vertical ladders for elevator pits, elevator sump pit gratings, corner guard angles, steel angles, channels and clips, pipe sleeves for mechanical and electrical trades,

trench drain gratings and frames, galvanized steel corner guards, and miscellaneous structural shapes.

2.05 All steel ladders shall comply with OSHA requirements.

2.06 Steel grates (including storm inlets and trench drain covers) located in an exterior pedestrianway, such as a sidewalk or ramp, shall employ an ADA compliant design and incorporate openings constructed to prevent hazard and personal injury.

2.07 The use of tree grates shall be determined on a case specific basis in coordination with the FSU Grounds Department.

2.08 Handrails and railings: Utilize 1-1/2" standard steel or stainless steel pipe for horizontal rails and 2" x 2-1/2" standard steel or stainless steel pipe for posts. Comply with all applicable codes, including Florida Building Code, Accessibility Code. Do not extend handrails more than 3" into a circulation area. If a need for continuity requires the rail to end with a 90 degree angle, employ design methods which prevent hazard and preclude interference.

2.09 Steel expansion joints: Expansion joint assembly shall be complete and constructed of materials aesthetically compatible with surrounding construction. Provide complete waterproof assembly as required at between building areas, wall –to-wall intersections, wall-to-roof, deck-to-wall, etc. Cover finish shall be weather-resistant.

PART 3 – EXECUTION

3.01 Comply with all OSHA requirements for execution, including fall protection.

3.02 All iron and steel items must be shop primed and additional coats of primer/paint applied at the jobsite to prevent rusting.

3.03 Exterior ferrous metals exposed to view shall be primed and painted with a paint coating designed for compatibility with the galvanized surface on which it is applied.

3.04 All interior ferrous metal shall be painted with three mils of paint on all surfaces. Refer to USGBC requirements for low-VOC materials in order to promote indoor air quality.

END OF SECTION

WOOD AND PLASTICS

PART 1 – GENERAL

1.01 **<u>Summary:</u>** This section describes University specific requirements for the use of woods and plastics. It includes the use of pressure treated lumber and plastic surfaces.

1.02 **<u>Related Work:</u>** Related work located elsewhere includes: wood and plastic finishes specified in Division 9 and toilet partitions specified in Division 10.

1.03 **<u>Use of wood materials:</u>** Lightweight structural wood framing is discouraged and shall not be permitted without Facilities Project Manager approval. Exterior plywood sheathing should be utilized only with prior approval. Wood blocking and curbs should be limited to the extents possible.

1.04 **<u>Use of plastic materials:</u>** Solid plastic materials are preferred, in lieu of, plastic laminates.

1.05 **<u>Quality Assurance:</u>**

A. For <u>wood products</u>, comply with applicable standards as set forth by:

- APA – American Plywood Association
- SPA – Southern Pine Association
- SPIB – Southern Pine Inspection Bureau (grading rules)
- NLMA – National Lumber Manufacturer's Association
- AWPA – American Wood Preserver's Association
- WWPA – Western Wood Products Association
- UL – Underwriter's Laboratories, Inc.
- ASTM – American Society for Testing and Materials
- U.S. Forestry Products Council
- U.S. Forest Stewardship Council
- AWI – American Woodworking Institute
- NFPA 101, flame-spread requirements

B. For <u>plastics</u>, comply with:

- NEMA LD3 – National Electrical Manufacturer's Assoc. Standards for high pressure decorative laminates
- ASTM requirements
- NFPA 101, flame-spread requirements

- **ISSFA-2 – International Solid Surface Fabricators Assoc.**

C. For <u>adhesives</u>, provide low-VOC products compliant with:
- **USGBC LEED requirements for indoor air quality.**

PART 2 – MATERIALS

2.01 <u>Wood Blocking and Curbing:</u> Provide pressure treated lumber for all lumber in contact with concrete, masonry, or steel. Wolmanizing process is considered best of the treatments for lumber in buildings. Boliden salts may be used if pressure treatment of 100/150 psi is used.

2.02 <u>Solid Plastic Countertop:</u> Solid plastic countertops are preferred.

2.02 <u>Plastic Laminate:</u> Provide chemical resistance if required. Provide backing sheet as recommended by laminate manufacturer. Meet flame spread requirements of NFPA 101 for interior finish consistent with the occupancy classification.

PART 3 – EXECUTION

3.01 All wood shall be back painted.

3.02 Wood handrails are discouraged due to difficult maintenance. If utilized, wood handrails shall return to walls and/or newel-posts. Wood handrails will not be approved for exterior use.

3.02 Restroom countertops: Provide solid plastic countertops with seamless surface and backsplash minimum 4" high. Color shall be light to medium shade smooth material.

<u>END OF SECTION</u>

THERMAL AND MOISTURE PROTECTION

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for thermal and moisture protection. It includes waterproofing, air and vapor barriers, and sealants and caulks. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Related work** located elsewhere in these specifications includes roofing, flashing, and roofing accessories.

1.03 **Quality Control:**

A. Utilize qualified installers who are authorized, approved, or licensed by the manufacturer to install the specific product.

B. **Pre-installation conference:** Conduct pre-installation conference at the Project site to review site specific conditions and clarify project requirements.

C. **Single source:** Obtain materials from a single source with documented experience providing thermal/moisture protection.

D. **Water testing:** For waterproofing, obtain samples from the Project site at approximate locations of the work and perform tests for acids, alkalis, or other contaminants which might affect the performance of the waterproofing.

E. **Protect** stored waterproofing, roofing, and thermal insulating materials such that they are maintained in a dry condition prior to installation.

F. Comply with the following standards:

- ASTM requirements
- ABAA: Air Barrier Association of America
- NRCA Roofing and Waterproofing Manual
- SMACNA, Sheet Metal & Air Conditioning Contractor's National Association, latest edition.
- USGBC requirements for LEED certification

PART 2 – MATERIALS

2.01 Provide materials which sustain long-lived projects and encourage protection of the building envelope from damage caused by water and vapor intrusion.

2.02 Water-proofing products shall be designed to function as the principal moisture stop in arresting water predominantly in a horizontal application. **Subject to proven past-performance and available warranties, products may include:** sheet butyl, PVC, EPDM, CPE, CSPE, neoprene, hypalon, or composite laminated membrane. They may be adhesive bonded, self-adhered, loose laid, or mechanically secured.

2.03 Fire Stopping: Fire stop material shall be used to close all openings and seal all penetrations of fire resistive construction. Material should be rated such that construction rating is uninterrupted.

2.04 Sealants, Caulking and Seals: Provide the highest quality of sealants for each individual application. Provide long life-cycle products capable of sustaining water-tight construction while maintaining desired finished appearance. Carefully consider aesthetics of sealants applied at cracks or junctures of different materials or horizontal and vertical surfaces. Comply with ASTM requirements.

2.05 Exterior Closure Assemblies:

A. Do not use any exterior wall assembly which has not been tested (and found satisfactory) for a minimum of (20) years. EIFS (Exterior Insulated Finish Systems) are not acceptable to the University.

B. Do not use sealants to prevent water infiltration.

C. Do not use galvanized metal flashings.

PART 3 – EXECUTION

3.01 If required, give special consideration to design of Radon barriers to ensure that all barrier penetrations are thoroughly sealed.

3.02 Design vapor and air barriers so that a continuous seal is formed for the building enclosure. Seal gaps between adjacent materials forming wall and roof openings.

3.03 Slabs on grade shall be designed and installed so as to prevent damage to membranes during construction. AT special areas and where waterproofing is considered necessary for slab on grade, a double slab system is preferred in order to reduce chances of a punctured membrane. A product equal to “Bituthane” by W.R. Grace should be considered under the wear slab. For a basement waterproofing condition, a water bar is essential at walls and columns.

3.04 Basement walls shall be damp-proofed or waterproofed on the soil side. The type of material to be used depends upon the condition; a brushed-on coat of bituminous paint might be adequate for dampness but sheet membrane waterproofing of “Bentonite” or equal should be considered where hydrostatic pressure is suspected. Slope grade away from wall and provide drain system, if warranted.

3.05 Provide a through-wall damp-proofing membrane to prevent moisture in the soil from extending up the wall by capillary action. Material can be as light as 2 oz. copper-backed sisal paper if properly lapped and sealed at joints.

3.06 Design vapor and air barriers so that a continuous seal is formed for the building enclosure. Seal gaps between adjacent materials forming wall and roof openings.

3.07 In waterproofed floor areas, a 24-hour water test is required prior to placement of the finish flooring. If leaks occur, another test is required after repairs are made.

A. Special consideration shall be given to preventing leakage in shower and drying room areas.

B. A depressed floor shall be provided for toilet areas where ceramic tile is used to allow space for the waterproofing pan and slope to drain.

3.08 If water repellent materials are applied to the exterior wall system, provide clear elastomeric water repellent. In new construction, applied coatings will not be accepted as a substitute for good construction practices utilizing proper detailing, flashings, and air/vapor barriers.

3.09 Make provisions to prevent staining of the building envelope from flashing materials.

3.10 Caulking is not to be used as permanent construction and should be specified for use only as a supplement to properly designed and detailed joints.

END OF SECTION

ROOFING

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for roofing, flashings, and roofing accessories. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Related work** located elsewhere in these specifications includes: waterproofing, air and vapor barriers, sealants and caulks.

1.03 **Quality Control:**

A. Utilize qualified installers who are authorized, approved, or licensed by the manufacturer to install the specific product.

B. **Pre-installation conference:** Conduct pre-installation conference at the Project site to review site specific conditions and clarify project requirements.

C. **Single source:** Obtain materials from a single source with documented experience providing acceptable roofing work.

D. **Protect** all stored roofing materials such that they are maintained in a dry condition and remain free of cracks, penetrations, tears, perforations, UV or other damage prior to installation.

E. **Moisture scan:** For existing roofs to be re-roofed, obtain a copy of the latest moisture scan for information relating to roof performance and/or anticipated failure.

F. Comply with the following standards:
- ASTM requirements
- UL requirements
- Factory Mutual Approval Standard for wind uplift
- ABAA: Air Barrier Association of America
- RTI/WSRCA’s “Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions”
- NRCA Roofing and Waterproofing Manual
- SMACNA, Sheet Metal & Air Conditioning Contractor’s National Association, latest edition.
- Aluminum Association (AA) “Designation System for Aluminum Finishes”
- CDA’s “Copper in Architecture Handbook”
- USGBC requirements for LEED certification

G. The A/E shall provide full-time roofing inspection service and post-installation moisture testing. The proposed inspector shall be approved by the Facilities Project Manager prior to commencing work on the roof.

PART 2 – MATERIALS

2.01 <u>Clay Tile Roofing:</u> In keeping with the preference for sloped roofing and University aesthetic, preference is given to clay tile roofing assemblies. Tile profile and color should match that of surrounding facilities.

2.02 <u>Concrete Tile Roofing:</u> Concrete tile roofing may be an acceptable substitute for clay tile roofing under specific conditions. Due to the increased tendency for cracking and increased difficulty in maintaining the surface free of dirt, staining, mold, and mildew, this system should be discussed with the Facilities Project Manager prior to including in the project design.

2.03 <u>Low slope roofs:</u> will be accepted only where provision of greater slope is not feasible. Subject to proven past-performance and available warranties, products may include: built-up roofing and modified bitumen membranes.

2.04 <u>Roof Membranes:</u> Where utilized, provide a roof membrane capable of developing a solar reflectance value (SRI) compliant w/USGBC LEED requirements. SRI value should be indicated on the 100% CD Roof Plan.

2.05 <u>Flashings and Roof Accessories, Including Gutters and Downspouts:</u> Copper or other non-corrosive flashings and accessories are preferred. Galvanized flashings should not be utilized. Provide flashings and trim in accordance with the current Architectural Sheet Metal Manual, as published by SMACNA.

2.06 <u>Scuppers:</u> Provide emergency overflow scuppers in parapet walls to prevent water building up if the roof drains clog.

2.07 <u>Roof Drains:</u> Comply with Florida Building Code requirements for number and size of drains. Provide strainers at inlets to prevent debris from entering the drain system.

2.08 <u>Gravel Stops:</u> Provide high gravel stops to prevent staining by water on the building wall.

2.09 <u>Skylight Structures:</u> The University prefers clerestory structures, in lieu of, skylights. If skylights are used in the building design or a building repair, the A/E MUST include only the highest quality unit capable of meeting the daylighting requirements. The installation must be thoroughly detailed and reviewed with the FSU Project Manager prior to inclusion in the construction documents. The skylight shall become a portion of the roofing assembly and subject to the identical terms of the warranty for the entire roofing system.

2.10 Minimum roof system warranty shall be (20) years unlimited with no dollar limit. Warranties from roofing manufacturers shall include coverage for installation, as well as, materials. In the event of roofing material failure, the roofing manufacturer shall warrant all costs of roofing repairs, including labor, at no cost to the University. Labor warranty shall be in effect for as long as the material warranty is in effect.

PART 3 - EXECUTION

3.01 Roofs shall be maximized, but in no case less than ¼" per horizontal foot. The slope of the roof can be obtained either through the structural design or tapered insulation. The design and workmanship of the finished roof shall be such that no water shall pond on the roof surface more than 24 hours after a rainfall.

3.02 The A/E shall specify a minimum of three manufacturers of roofing systems and shall obtain notarized letters from each factory technical representative that the type of roofing system specified will perform in this locality and that all materials delivered to the job site and used by the contrctor complies with the specifications.

3.03 If pre-stressed concrete structural members are used to support flat roofs or roofs with minimum pitch (with or without a light-weight concrete topping poured on the structural members), an expansion joint shall be provided at the ends of each pre-stressed section where the structural members butt together to allow for proper expansion. The roof insulation shall be applied in two layers with no bonding applied between the two layers. Regardless of the thickness required to obtain required pitch or "R" rating, the thickness shall be enough to prevent expansion and contraction of the pre-stressed members. The bottom layer of insulation shall be bonded to the felt layer above. Care shall be taken to avoid coincident placement of joints.

3.04 Make provisions to prevent staining of the building envelope from flashing materials.

3.05 Roof drains shall be unobstructed, properly connected to storm drains and designed and installed as per the Florida Building Code.

3.06 Emergency overflow scuppers shall be constructed below the flashing and not more than one inch above the roof surface.

3.07 On all built-up or membrane roofs, roof walkways shall be provided from roof access point(s) to and around all roof installed mechanical or electrical equipment.

3.08 An interior means of gaining access to the roof shall be provided with locking capability. Access to the roof should not occur via student spaces.

3.09 Do not install rooftop A/C units or exposed ductwork.

3.10 Parapet walls and caps (or coping) shall have through the wall flashing. If limestone caps are used, they shall have a lead "T" shaped cap embedded in caulking between each piece of stone cap. Mortar shall not serve this purpose.

3.11 For existing roofs which are to be re-roofed, the A/E shall physically verify dimensions where critical to the project design, such as roof areas, parapet heights, etc.

3.12 The completed roof installation must meet current wind load design standards and be documented as such by the manufacturer.

3.13 Annual roof scans are executed by the University. Should the routine scan following roof completion reveal moisture, the contractor shall be responsible for

the roof repair and the cost of a repeat scan demonstrating that the roof has been established as "dry".

END OF SECTION

DOORS AND FRAMES

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for doors and frames. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Related work** specified elsewhere includes: door hardware and card access systems.

1.03 **Quality Control:** Comply with the following codes and standards:

- Florida Building Code and Florida Fire Prevention Code
- ASTM/ANSI/SDI Standards and Testing
- Obtain doors and frames from one source.
- Provide labeling as required.
- AWI Quality Standard for Architectural Flush Doors.
- National Woodwork Manufacturer's Association Standards.
- USGBC LEED requirements.

1.04 **Door Design Criteria**

A. **Design of entry doors:** At least one main entry door shall be accessible from adjacent sidewalks by wheelchair and shall display the proper handicapped signage. The current ANSI standards shall apply to raised letter signage for the blind. Provide an automatic opening device for accessible entry on the accessible path. If the building perimeter is secured by card access, at least one of the card accessed doors shall be located at an accessible entry. Automatic door opening devices and card reader access shall be coordinated.

B. **Design of interior wood doors:** Specifications shall include full specification, including species, finish, veneer patterns, core materials, and manufacturer's name. Door design shall not vary within the building, i.e. do not mix veneer treatments.

C. Minimum door dimensions are 3'-0"x7'-0". For renovations, do not mix heights in adjacent areas. Variances from a height of 7'-0" should be reviewed with the FSU Project Manager for applicability of a waiver.

D. All corridor doors and doors to closets shall be 1-3/4" solid core to meet requirements of NFPA 80 and 101, and they shall use mortise locksets meeting all code requirements. Where cutouts for closers are required, the head rail should be not less than 6 inches. If hardwood edges are desired, they should be completely specified with the thickness given.

D. **<u>Classroom doors</u> shall include a view panel.**

E. **If fume hoods or other large equipment occur in a room, provide doors of adequate width to provide clearance for moving the items in or out. If size is questionable, use larger size opening.**

F. **As part of the Design Development submittal, the A/E shall submit CAD drawings for room numbering. The FSU Project Manager shall coordinate with the FSU Planning and Space Management to ensure that proper room numbering is provided to the design team for use in the 50% Construction Documents.**

G. **All doorways shall be numbered, and a door sign shall be installed adjacent to the opening side of the door. Refer to the interior signage specification for lettering. Door numbering shall comply with accessibility code. Do not install door numbering directly on the door.**

H. **Refer to related work in the Hardware section of this guideline.**

PART 2 – MATERIALS

2.01 **<u>Exterior Metal Doors:</u> Provide extra heavy duty "monumental" quality, insulated metal doors. Door shall be seamless at face and edges. Minimum dimension per each leaf shall be 3' wide x 7' high.**

2.02 **<u>Interior Metal Doors:</u> Provide heavy duty, seamless metal door. Minimum dimension per each leaf shall be 3'x7'.**

2.03 **<u>Vision Panel:</u> Comply w/Florida Fire Prevention Code requirements. Glass shall be wired or wireless fire rated panels set in steel frame or stops according to codes.**

2.04 **<u>Exterior Door Louvers:</u> Inverted "Y" blade type louver set in accordance with codes for prevention of vandalism and to support heavy usage. Louver shall be installed compliant w/SDI-111C.**

2.05 **<u>Exterior Metal Door Frames:</u> Provide galvanized welded metal frame with factory primed finish. Minimum 14 ga. Frame should be prepped for card access security, if applicable.**

2.06 **<u>Interior Metal Frames:</u> Provide minimum 16 ga. factory primed finish.**

2.07 **<u>Interior Wood Doors:</u> Provide solid core wood door. Wood doors with natural finish shall be treated with insoluble coating is resistant to marring, abrasion and staining.**

2.08 **<u>Plastic Faced Wood Doors:</u> Plastic laminate face shall conform to NEMA LD-3. Adhesives for both exterior and interior doors shall conform to ANSI/NWMA-I.S.1.**

PART 3 – EXECUTION

3.01 Frames shall be installed plumb, level, rigid and in true alignment as recommended by ANSI/SDI A250.11.

3.02 Frames shall be properly anchored to prevent movement of frame during the opening and closing of the door. Frames in masonry shall be fully grouted. For all exterior doors other than building service doors (i.e. electrical room, mechanical room, etc.) provide conduit for card access prior to grouting.

3.03 In steel stud wall, a nest of studs shall be provided to prevent the flexing and breaking of the wall along the door frame. The number and gauge of studs in the nest must be specified. The finished wall shall extend into the doorframe throat opening a minimum of 1-1/2" for wrap-around frames.

3.04 All exterior doors shall be insulated doors and include adequate weatherstripping and threshold utilized to conserve energy. If glass vision panels are included, the glass shall be thermal/safety glass and non-reflective.

3.05 All exterior doors and operable items shall have an integral finish applied by the manufacturer.

3.06 Where two doors swing from the same mullion, provide minimum 18 ga. mullion and reinforcing.

END OF SECTION

WINDOWS AND GLAZING

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for windows. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Quality Control:** Comply with the following codes and standards:

A. Federal Consumer Product Safety Standard for glazing.

B. ASTM requirements

C. Comply with Florida Building Code for energy requirements, wind load resistance, missile impact resistance, safety, and other construction requirements.

D. AAMA – American Architectural Manufacturer's Assoc.

E. WDMA – Window & Door Manufacturers Assoc.

D. Applicable USGBC LEED requirements for daylighting, views, and energy efficiency.

PART 2 – MATERIALS

2.01 **Window Profile:** Provide aluminum profiles for windows in new construction and renovation, unless specifically authorized to match existing wood windows. Finish shall be high performance, Kynar 500 fluoropolymer 3-coat system, to match historical "FSU Beige" color utilized on campus landmark buildings. Refer to window finish at newly renovated William Johnston Building, Wescott Administration Building, or Student Success Building.

2.02 **Glazing:** Provide energy efficient thermopane units meeting requirements for windload, thermal transmission, and structural loading. Glazing unit should be resistant to failure due to water or air infiltration. Consider providing an outer shield of solar glass if window area exceeds 3% of wall area.

2.03 **Warranty:** (10) year manufacturer's warranty on window unit.

PART 3 – EXECUTION

3.01 Select window materials which will provide long range, life-cycle cost.

3.02 Provide manufacturer's labeling indicating glazing strength, grade, thickness, type and quality in each piece of glass. Clearly, indicate glass type for all windows in the drawings or technical specifications.

A. Specify safety and tempered glass in locations required by codes.

B. Utilize obscure glass in toilet and bathroom windows.

3.03 Windows shall be glazed in the closed position and left closed for several weeks, particular awning or projected types.

3.04 Do not specify pivot type windows.

3.05 All windows shall be capable of being opened manually for cleaning and in the event of a shutdown of the HVAC equipment, unless fixed windows are required for control/security reasons. Operable windows shall be provided with positive locking devices.

3.06 Glass should not be located in areas which can not be accessed for cleaning. Exterior windows shall be accessible for washing either by manually operable sash, the use of a swinging scaffold or the use of safety gear that snaps onto the window frame. Each window shall be properly equipped with anchors to support safety gear. The architect shall design and supervise the installation of the windows into the building frame, insuring that the windows are adequate and safe.

3.07 All window glass shall be replaceable from inside the building wherever feasible.

3.08 Provide guardrails at all full height glass panels in accordance with applicable codes.

3.09 Confirm that any hurricane shelter requirements have been considered in the design of windows and window material.

END OF SECTION

DOOR HARDWARE AND KEYING

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for door hardware and keying. Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

A. Permanent key cores shall be installed by the University Key Shop. All other work, including specification, coordination, purchasing, delivering, and scheduling remain requirements of the A/E team and the Construction Manager.

1.02 **Related Work** specified elsewhere includes: doors, frames, card access systems, and fire alarm systems. Refer to "Key Issuance Policy" for requirements and link to Contractor Key Request Form.

1.03 **Quality Assurance:**

- Utilize a certified DHI Architectural Hardware Consultant.
- Comply with NFPA requirements for fire-rated door assemblies and for electrified door hardware.
- Comply with Builder's Hardware Manufacturer's Association (BHMA) standards and certifications.

1.04 **Design Criteria:**

A. The Architect shall include a completely itemized hardware schedule in the technical specifications. A cash allowance shall not be utilized unless specifically authorized by the Facilities Project Manager.

B. The hardware schedule shall include a complete list of items proposed as standard, together with manufacturer's names and with the names of manufacturers whose products are proposed as equals. This schedule must be approved by the Facilities Project Manager by completion of 50% Construction Documents.

C. Specify one manufacturer as standard and, whenever possible, at least two other manufacturers whose products are proven equal EXCEPT comply with specific manufacturers as required herein.

D. Avoid thresholds raised above floor levels at doors to trash and receiving rooms and at all doors intended for use by handicapped persons.

E. **Hardware Design for Specific Spaces:**

1. **All Classroom doors shall have:**
    a. Electric strikes at each entry door for operation with a card access system.
    b. Cores with Best key override.
    c. Surface applied closer.

d. Door contacts and requests to exit.
e. Conduit and power for operation of electric hardware and data communication components.

2. <u>All Custodial Closet doors:</u>
a. Core shall be individually keyed and keyed to the grandmaster system.

3. <u>Restroom doors:</u>
a. Provide 10" wide stainless steel or lexan kickplate.
b. Provide stainless steel push/pull hardware. Doors are to be non-locking unless approved otherwise by the FSU Project Manager.

4. <u>Mechanical Room doors:</u>
a. Provide weather-stripping at heads and jams and surface applied door bottoms on machine room doors and other doors where excessive noise is anticipated.

PART 2 – MATERIALS

2.01 <u>General:</u> Hardware materials shall be designed and specified to withstand heavy use. All operable items on exterior doors shall have an integral manufacturer's applied finish. Stainless steel is the preferred finish for all hardware.

A. <u>Closers:</u> Non-handed closers are preferred. Russwin 2800 series, Sargent 1230 series, or LCN equivalent. EXCEPTION: Provide Corbin 110 series in residence halls.

B. <u>Hinges:</u> Provide only five-knuckle, stainless steel ball-bearing hinges. Provide heavy-duty ball bearing butts, with 4 ball bearing for exterior doors and interior doors over 3' wide and standard weight butts with 2 ball bearing for interior doors up to 3' wide.

2.02 <u>Existing Building:</u> Hardware added to existing buildings may utilize the same manufacturer as the existing hardware, at the discretion of the FSU Project Manager and the Key Shop. New hardware added to an existing building shall be compliant with accessibility codes.

2.03 <u>Exterior Doors:</u>

A. <u>Exit Devices:</u> Von Duprin 99 series shall be specified. No substitutions allowed.
a. <u>Single doors:</u> Provide Von Duprin 99 panic device. Do not use mortise lock.
b. <u>Double doors:</u> Use Von Duprin 99 series panic device with removable mullions. Rim type devices may be provided. Head and foot bolts shall be Russwin 298 with dustproof strike, or Sargent equivalent. Do not use mortise locks.
c. Exit bolts shall have cylinder dogging devices.
d. Exit bolts for narrow stile exterior doors shall be Von Duprin 55 series.
e. Vertical rod exit bolts are not desired unless their use is dictated by specific functional requirements. When required, they should be concealed. Surface mounted vertical rods for exit devices are not acceptable.

B. **<u>Hinges:</u>** **Exterior doors with security requirements shall have extra-heavy duty, non-removable pins to prevent the unauthorized removal of the door from the outside.**

C. **<u>Mullions:</u>** **Shall be aluminum or steel and key locked into the door frame; Contractor to provide Best cylinder.**

D. **<u>Narrow stile doors:</u>** **Hardware shall have the same functional requirements as specified for other exit bolts. All double doors shall have a removable rabbeted mullion and each door leaf shall not be less than 36 inches wide.**

2.04 <u>Interior Doors:</u>

A. **<u>Classroom or Laboratory Locks:</u>** **Provide mortise lockset Best 35H7J, Russwin ML2255, or Sargent 8237. Lockset must be capable of accepting Best keyway.**

B. **<u>Office and Corridor Locks:</u>** **Provide mortise lockset Best 35H7E, Russwin ML 2251, or Sargent 8205. Lockset must be capable of accepting Best keyway.**

C. **<u>Restrooms:</u>** **If approved for locks, provide Best mortise lock 34H7R, Russwin ML 2212, or Sargent 8203.**

D. **<u>Custodial Closets:</u>** **Provide Best mortise lock 35H7EW, Russwin ML 2257, or Sargent 8250.**

E. **<u>Hardware Trim:</u>** **<u>Finish</u> shall be Satin Chrome, US26D, or 626. <u>Trim design</u> shall be Best 15J, Russwin NSN, or Sargent WTL, cold forged escutcheon plate.**

F. **<u>Interior Double Doors:</u>** **Provide removal astragals for security.**

G. **<u>Interior Fire Doors:</u>** **Provide magnetic door holders actuated by the building fire alarm system, where appropriate and allowed by code.**

PART 3 – EXECUTION

3.01 All hardware, including keyways, shall be included in the construction project cost borne by the contractor. Obtain each type and variety of door hardware from a single manufacturer when possible.

3.02 The hardware supplier shall furnish to the door manufacturer templates or the actual door hardware.

3.03 Conduct a pre-installation conference prior to beginning installation. The FSU Project Manager will coordinate and ensure that representatives from the FSU Key Shop, FSU Police, and ITS Departments are in attendance.

3.04 The Contractor shall install the cylinders. The Key Shop shall install the keyways and distribute keys to building users.

3.05 The Contractor shall supply and install temporary construction cores and provide construction personnel and the Owner with keys during construction.

PART 4 – KEYING

4.01 All door locks shall be on the University's proprietary keying system, i.e. BEST Removable Core, as specified by Facilities Operations and Maintenance Key Shop. ALL keyed locks shall be subject to the Zone Master as assigned to the facility at Florida State University. <u>The University will accept no substitutes.</u>

4.02 The Contractor shall provide extra copies of the approved hardware submittal and current floor plans, showing door numbers, to the FSU Project Manager for submittal to the Key Shop, who will develop the Final Keying Schedule and submit it to BEST. The Key Shop will determine the exact number and type of keyways prior to ordering.

4.03 All keying schemes shall be planned in coordination with the FSU Project Manager and the Key Shop. The process shall begin early enough to insure that systems (key plans, keyways, cores) are compatible with FSU's total Master Keying System, that adequate time is allotted to phasing, and that the FSU Key Shop retains control of <u>ALL</u> keys and cores.

4.04 Keyways should be purchased from BEST by the Contractor with stipulations that they be delivered directly to the FSU Key Shop. The Key Shop will install keyways and distribute keys.

4.05 In order to allow proper time for "pinning", the approved hardware submittal must be provided to the Key Shop (120) days prior to Substantial Completion for projects containing more than (250) doors, and (90) days prior to Substantial Completion for projects containing less than (250) doors.

4.06 With a minimum of two weeks' notice, projects having less than (12) doors, may obtain keyways directly from the Key Shop stored stock. Coordinate with the FSU Project Manager to ensure availability and timely installation.

4.07 NOTE: All doors with card access shall have cores with BEST key override.

END OF SECTION

CARD ACCESS SECURITY FOR DOORS

PART 1 – GENERAL

1.01 **Summary:** This section describes University specific requirements for the inclusion of FSU Card Access systems (a/k/a cCure Card Access). Information in this section is intended to guide and supplement specifications provided by the Architect and Engineer of Record.

1.02 **Related Work** specified elsewhere includes: doors, frames, ITS/data services, fire alarm, and architectural hardware.

1.03 **Quality Assurance:**

- Include schematic representation of door controls for FSU approval in Design Development submittal.
- Utilize a certified DHI Architectural Hardware Consultant to assist in coordination of architectural hardware and security hardware.
- A preconstruction meeting shall be held prior to beginning conduit installations. This meeting shall be coordinated by the FSU Project Manager and will include representatives from FSU ITS, FSU PD, the AE team, the Contractor, and the Key Shop.

1.04 **Design Criteria:**

A. **Required Approvals:** The plans for placement of card access must be reviewed and approved by the FSU Police Department to promote Campus safety and consistency with security policy. Security devices are managed by FSU Information Technology Services (ITS), who will provide the hardware and data services for monitoring. ITS must review/approve the construction documents to assure that a fully operational system is being planned. The FSU Project Manager shall coordinate the drawing review process with both FSUPD and ITS.

B. **Perimeter Doors:** All perimeter doors which provide access to the interior of the building shall be fully secured through the use of cCure Card Access:

1) Provide a minimum of two card readers for building access afterhours.

2) Locate card readers at well lighted entries away from concealed hiding spaces or dead-end passageways.

3) Ready access to lighted parking is preferred.

4) Provide at least one card reader at an accessible entry.

5) All perimeter doors which allow building entry shall be equipped with a door contact and request to exit. EXCEPTION: service doors serving areas such as mechanical or electrical rooms which do not permit entry to internal areas of the building do not require a card reader door

contact, or request to exit. These doors shall be scheduled to be key locked at all times.

6) A BEST “Z key” cylinder should be provided at all card accessed doors.

7) Perimeter doors which are scheduled to be “Exit Only” doors shall NOT include a keyed cylinder.

C. **Interior Doors:** Interior doors of new buildings may include cCure Card Access, but unless specifically exempted by University policy (OP-H-4B-1), interior areas will not have monitoring devices installed, i.e. door contacts and requests to exit.

1) The FSU PD will work with future building occupants to ascertain the proposed use of the building areas and will make the determination as to whether an interior area qualifies as a “mandatory” alarm area pursuant to policy.

2) The use of “Locknetics” devices is no longer accepted.

D. **Door Conduit Standards** are included in Division 16 – *“Telecommunications Infrastructure Standard”*, Revision 2.3, June 20, 2012. These standards must be followed for all perimeter doors for wiring of door contacts and requests to exit. Interior doors which will be monitored require the same conduit as perimeter doors. Interior doors which will not be monitored but which will have card access also require the same infrastructure as perimeter doors except the conduit to the top of the door that would ordinarily be used for the door contact cable.

PART 2 – MATERIALS

2.01 **General:** Security hardware components, including the card reader, door contact, request to exit, and security panel shall be Owner furnished and Owner installed. Architectural hardware and conduit/pathways required to provide a fully operational system shall be Contractor furnished and Contractor installed.

2.02 The use of other types of security materials, other than those included in this specification, shall be considered on a case-by-case basis and approved by FSU PD. This policy includes the use of security cameras or special alarm systems.

PART 3 – EXECUTION

3.01 Conduit and boxes for card access shall be installed in grouted frames or interior to wall framing to avoid surface mounting.

3.02 Security access panels shall be located in the main telecommunications closet.

END OF SECTION

DIVISION 9 - MATERIALS AND FINISHES

GENERAL MATERIAL AND FINISH GUIDELINES

1. The selection of materials shall have the benefit of long range, life cycle cost analysis. All selections shall, however, be within budget limitations. It is expected that the A/E will advise the University of all savings opportunities regarding material selections. Solid and hazardous waste disposal costs for excess materials shall be included in the life cycle cost analysis.
2. The A/E shall coordinate all color and material color selections with the Project Manager. Color schedules will be required for University review with the check set of working drawings. Schedules and samples shall be provided for interior finishes, such as paint, vinyl, baseboards, carpet, tile, bathroom partitions, and the like as well as exterior finishes, such as paint, roof shingles, glazing, and so on. Colors shall be presented in the form of a non-returnable "color-board," which demonstrates all color selections in the form of an overall project color palette.
3. Samples of all finishes and finishing material shall be submitted to the University for approval no later than the 50% Construction Documents phase. In case of special concrete finishes or stucco work, a sample at least 2'-0" square shall be submitted.
4. As a minimum, use a latex-based semi-gloss paint on all wall surfaces to be painted to facilitate cleaning. Use water based epoxy paint behind and beneath water coolers, trash receptacles, adjacent to elevations, in vending rooms and in all restrooms. Do not use paint containing lead.
5. All horizontal, plastic laminate surfaces shall have a matte finish.
6. Blown-on acoustical ceilings and walls are not acceptable.
7. For promotion of indoor air quality, low emissive finish systems should be provided.

GENERAL FINISH REQUIREMENTS FOR SPECIFIC SPACES

Restroom Floors

1. Floors shall be of ceramic, porcelain or quarry tile with dark epoxy grout. They shall have a watertight membrane/sealed so as to prevent seepage.
2. Floor texture should prevent slips.

Custodial Closet Floors

1. The floor shall be finished with ceramic or quarry tile and dark grout, or sealed concrete. The walls shall be of ceramic tile or other special waterproof coating material, a minimum of 4 feet high.

CARPET

General Carpeting Design Guidelines

1. Refer also to Appendix K – Carpet Guidelines for specific product requirements.
2. The design professional shall comply with all carpet specification requirements. No variance from these guidelines shall be approved during the shop drawing process without written approval from the Project Manager. The University reserves the right to test all carpet materials delivered to the site for compliance with specification requirements. The Contractor will be liable for replacement should materials fail testing.

3. Carpet grain direction, seaming, and scribing shall be carefully addressed in drawings and specifications.
4. All carpet, unless otherwise specified, shall run in the same direction. Lay with a minimum number of seams and carpet sections. All carpet is to be smoothly laid with no bubbles, ridges, etc.
5. Where roll carpet is used, no seams shall occur at doorways and entries perpendicular to doors and entries. Seaming occurring at doorways parallel to doors shall be centered directly under doors. When seams occur at corridors, change of directions shall follow wall line parallel to carpet direction.
6. Cross-joints, which are necessary due to length of rolls, shall be placed in the cutting, to avoid occurrence at conspicuous locations, near doors, or at pivot points.
7. Where needed, raw carpet edges at doorways and the like shall be finished with a top quality metal strip or molding.
8. Do not specify carpet in stairways.
9. Incorporate patterns to alleviate soiled appearance.
10. Medium dark colors are preferred.

Carpeting And Related Products

The Contractor will be responsible for coordinating material delivery and installation with the sequencing of the work. Carpet shall be installed using an installer, installation materials, i.e., adhesives, edging, etc., and methods approved by the carpet manufacturer.

The Design professional shall be responsible for carpet type and color selection. Based on appropriateness of use, design selections shall be made from the following:

a) Broadloom Carpet – 12’ roll goods, woven polypropylene backing.

b) Hard-backed Carpet – 6’ roll goods, solid backing impervious to moisture.

c) Modular Carpet – same as hard backed carpet except supplied as individual solid backed carpet squares. Install with releasable adhesive. Recommended for general use and where additional cleanability, acoustical dampening and durability is desired. Modular carpet is recommended where frequent carpet replacement is anticipated, where access to the substrate is necessary and where replacement of roll goods is impractical due to obstructions in the space.

d) Solution Dyed Carpet – made with carpet yarn that has color throughout the yarn and therefore has superior color retention and resistance to fading. Solution Dyed Carpet may be supplied as Broadloom, Hard-Backed or Modular. Recommended for general use and use in areas with high sunlight exposure and/or potential exposure to bleaching agents, such as laboratory zones where chemicals in use may have a bleaching action, and areas near toilets or janitor’s closets where bleach is used in cleaning.

Use of Carpet

Carpet shall be applied to areas within projects according to the following recommendations:

1. Very High Traffic Zones – Immediately inside entrance doorways, elevator doors, and other places where traffic is very highly concentrated, use tile, walk-off mats, or similar materials in the immediate vicinity of the doorway, elevator entrance or other high traffic zone. As traffic concentration begins to be more spread out, transition to carpet, using the recommendations below for High Traffic zones.

2. High Traffic Zones – Modular Carpet is recommended for High Traffic Zones where frequent carpet replacement is likely. Transition to Hard Backed Carpet as traffic becomes less concentrated, and frequent carpet replacement becomes less likely. These zones must be designed carefully and with respect to the challenges of each particular project, but, in general, the designer should consider Hard Backed Carpet in corridors, lobbies, atriums, aisles, walkway areas within open office areas and similar spaces. Give careful consideration to the transition of this thicker carpet to adjoining areas using Broadloom Carpet.
3. Classrooms – Due to the severe use, likelihood of spills and acoustical considerations, Hard Backed Carpet is recommended for most classrooms. The backing provides this carpet with much better acoustical properties and is much more impervious to moisture penetration.
4. Areas With High Sunlight Exposure or Exposure to Bleaching Chemicals – Use Solution Dyed Carpet for superior color retention and resistance to fading. Provide this carpet as a Broadloom, Hard Backed or Modular design, depending on the traffic characteristics of the space, as outlined above. Examples of such areas are Atria, spaces located inside large areas of South-facing glass, spaces adjacent to certain laboratories using chemicals with bleaching properties, and carpeted areas adjacent to Janitor’s Closets and Toilets.
5. All Other Areas – Other areas, including offices and other spaces, can be carpeted with Broadloom carpet, at the discretion of the designer and University Project Manager. Careful consideration should be given to the use, traffic load, and sunlight exposure of each area in choosing the most effective carpet for that area.

Carpet Cleaning

1. As job progresses, surplus adhesive squeezed out between joints shall be removed.
2. Any stains remaining shall be removed by approved methods.
3. Upon completion of work, all base and edging shall be cleaned, all foreign materials removed by approved methods.

General Carpeting Installation Guidelines

1. Use low VOC adhesives unless specifically authorized by the Project Manager.
2. Installation of carpeting and related items shall be done by a competent contractor normally engaged in this trade with materials and methods complying with the specifications and drawings, and in such a manner as to insure a workmanlike job.
3. Any existing resilient vinyl cove base shall be cut to obtain a flush edge with the wall.
4. Sub-Floor Preparation: It is the responsibility of the carpet contractor to remove the existing carpet and pad, where necessary. All surfaces on which the carpeting is installed shall be clean and free of dust, dirt, and debris. Any holes, cracks, depressions, or other imperfections shall be filled and brought to a true plane with non-shrinking grout (similar or equal to "Surco" by W.R. Grace and Company). The A/E shall inspect the surface preparation prior to the installation of the carpet. Moisture tests of substrates are required prior to the installation of carpet and vinyl tile in new structures. A satisfactory reading, conforming to the manufacturer’s requirements, shall be obtained before installation is permitted.
5. Damage to the facility or surrounding property incurred by the contractor during any stage of carpet installation shall be repaired and the damaged area restored to its original condition by the contractor at no expense to the University.
6. Installation of carpet shall not disturb the normal usage of the facility. Therefore, the contractor shall arrange with the University Project Manager a time schedule not concurrent with student, faculty, or staff occupation or use.
7. Carpet shall not be installed prior to drywall installation.

Glue-Down Installation Guidelines

a) Floors shall be free of all wax, grease, paint, oil or any other substance that would create adherence problems. Cracks, expansion joints, etc. are to be filled with a top quality patching compound and finished smoothly. The carpet contractor shall notify the A/E and the University of any flooring conditions that would prevent the completion of satisfactory work.

b) Floors are to be thoroughly swept and vacuumed by the carpet contractor before applying adhesive.

c) The mill or factory edge on all roll carpet is to be trimmed far enough in from the carpet edge in order to provide a clean and even seam. Manufacturers' recommended cutting methods shall be used.

d) Cut edges on all roll carpet are to be treated with a seam sealer at the edge of the carpet at the base of the pile and primary backing. On all carpets, excess sealer is to be removed in accordance with the manufacturer's recommendations. To insure an almost 100% contact with the adhesive, the carpet is to be pressed with a roller or push broom per the manufacturer's standard procedures. Note: Carpet with an attached cushion is not to be treated with a floor-covering roller exceeding 30 pounds.

e) All carpet shall be installed in strict accordance with the approved seaming plan.

f) Glue down carpet and/or carpet tiles shall not be installed over existing flooring materials.

Carpet Warranty

Contractor Warranty: The Contractor shall give the University a written, notarized warranty guaranteeing carpet installation and related work for a period of one year after the date of substantial completion. The warranty shall commit the Contractor to making all repair and replacement including labor and materials at no cost to the University.

Manufacturer's Warranty: The Carpet Manufacturer shall provide the University an unrestricted, full replacement, non-prorated, minimum fifteen-year warranty against wear, edge ravel, tuft bind and delamination. The Carpet Manufacturer shall coordinate any and all installation and material approvals, inspections and certifications required to support the specified warranty with the Contractor and Owner's Representative.

RESILIENT FLOOR TILE

General Considerations for Resilient Tile

1. The contractor shall visit the site and familiarize himself with the work to be accomplished. If verification of sub-flooring is required, the contractor shall, upon approval of the Project Manager, remove a portion of the existing flooring material, as required.
2. The A/E shall submit to the University representative samples and manufacturers' literature of materials to be used for approval.
3. The A/E shall submit no later than the completion of the 50% Construction Documents scheduled information regarding floor tile location, color, material, size, gauge, as well as similar information for base and edging. Specify 12" X 12" X1/8" thick per Federal Spec. FS-312-IV.
4. Damage to the facility or surrounding property incurred by the contractor during any stage of resilient flooring installation shall be repaired and the damaged area restored to its original

condition by the contractor at no expense to the University.

5. Installation of resilient flooring shall not disturb the normal usage of an existing facility. Therefore, the contractor shall arrange, with the University Project Manager, a time not concurrent with student, faculty, or staff occupancy or use.
6. Immediately upon completion of the tile installation, apply a high quality floor sealer and the minimum number of coats of floor finish recommended by the manufacturer to prevent damage to the floor during construction. Re-coat prior to acceptance of the facility by the owner.
7. 5% surplus floor tile to be saved for the owner.
8. Resilient Tile shall not contain asbestos.

General Resilient Tile Installation Guidelines

Installation of resilient flooring and related items shall be done by a competent contractor normally engaged in this trade with materials and methods complying with the specifications and drawings and in such a manner as to insure a workmanlike job.

Sub-Floor Preparation: All surfaces on which resilient flooring and edging are to be installed shall be cleaned free of grease, dirt, paint, and hardeners. Holes, cracks, and other depressions in the existing floor slabs shall be filled or patched, and brought to a true plane with a non-shrinking grout similar or equal to "Loxon."

Floor tile shall be laid with the proper adhesive, meeting Federal specification standards and with close, even joints, to a smooth, even surface, and square with the corridor axis.

Floor tile shall be laid with the grain direction alternating in a checkerboard pattern.

Floor tile at borders on opposite sides of the space shall be equal, and shall be laid, cut, fitted, and scribed to walls, columns, door frames, and the like after laying of the field tile.

Base and molded corners shall be firmly cemented to walls and other vertical surfaces with tight joints. Base throughout its entire length shall have its top and bottom edges in firm contact with the floor and walls. Base shall be scribed accurately to molded corners and to doorframes.

Resilient Tile And Related Products

1. The University must approve all resilient floor tile and related products. Samples of all resilient floor tile and related products as well as manufacturer's product literature must be submitted to and approved by the University prior to the 100% Construction Document submittal.
2. Adhesives for flooring and accessories shall be of the types specifically recommended by the resilient material manufacturers, for the installation conditions involved and shall meet Federal specification standards. For the installation of floor tile and edge strips, waterproof adhesive only shall be used.
3. All resilient tile and resilient base shall be of the same millrun to maintain consistency.
4. All resilient edging strips shall be vinyl with factory formed feathered edge (similar or equal to Johnsonite Reducer Strips).

Resilient Tile Cleaning

1. As the job progresses, surplus adhesive squeezed out between the joints shall be removed. Any stains remaining shall be removed by approved methods.
2. On completion of this work, all tile, base, and edging shall be cleaned as recommended by the tile manufacturer. All foreign matter shall be removed and any chipped or broken tile, base,

or edging shall be replaced with sound material.

Resilient Tile Warranty

1. The contractor shall give the University a written warranty guaranteeing all work performed under this contract for a period of one year after the date of completion. In this written guarantee, the contractor shall agree to make all repairs or corrections required to maintain the completed work in first class condition for the one-year period at no cost to the University. If subcontractors are involved in this project, a similar written guarantee shall be furnished by each subcontractor covering his portion of the work. Subcontractors' warranties will not relieve the general contractor of any warranty responsibility.

STUCCO AND PLASTER

1. Use galvanized steel metal lath in conjunction with acoustic plaster to eliminate rust stains.
2. Where conditions require the highest corrosion resistance, specify that lathing accessories such as corner and casing beads be made of zinc alloy.
3. Provide ample control joints in stucco, particularly in overhangs. Two No. 60 expansion type casing beads butted together are preferred.

QUARRY TILE

1. Quarry tile is a desirable material for stairways, corridors, kitchens and for many other areas both interior and exterior because of its enduring quality, ease of maintenance and fire resistance.
2. Quarry tile treads are preferred for main stairs and should have an integral abrasive of approximately 65% aluminum oxide, ceramically bonded at high temperature.
3. Quarry tile treads shall be replaceable.
4. Quarry tile specified for exterior slab finishes must have an integral abrasive.

CERAMIC TILE

1. The current edition of "The Handbook for Ceramic Tile Installation," published by the Tile Council of America, shall be used as a reference guide for selecting design details and specification wording.
2. Ceramic tile is desirable for floors and walls or wainscots in toilets as well as in some laboratories and utility rooms. Toilet floors shall have dark sealed grout.
3. Ceramic tile on a masonry wall is insufficient to prevent water from permeating a shower room wall. Specify parging or painting the back of the wall and provide a through-wall flashing near the base as a means of conducting the water back to the shower room floor.

ACOUSTICAL CEILING TILE

1. Use extreme care in choosing the correct acoustic units. Do not specify exotic patterns, etc. Ensure that only standard patterns have been specified that will be available for many years in the future.

2. Specify that the Contractor cannot accept discontinued acoustic units, since matching replacements is impossible.

3. Specify that all acoustical ceiling materials shall meet flame-spread rating requirements of prevailing codes for interior finish according to occupancy classification.

4. Specify acoustical ceilings, not only by noise reduction coefficient, but also by tile thickness.

5. Specify mechanical suspension of acoustical ceilings. Adhesive attachment is not permitted.

6. Do not specify acoustical tile in dormitories unless specifically authorized and coordinated with the Project Manager and Housing Department. Acoustic tile is a poor material to use in dormitories because of vandalism.

Where exposed grid systems are specified, a reflected ceiling plan is required on the drawings. Specify construction tolerances regarding plumb, dimensions and locations, particularly where exposed masonry and concrete is used.

Specify that the buildings must be dried by heat or other means prior to installation of acoustical ceilings, to control humidity.

Specify that all suspension systems shall be intermediate duty rated. Heavy duty systems will be provided if the loading dictates. All grid systems shall be supported at a minimum of 4ft in each directon in accordance with the provisions of the latest edition of ASTM 635 and 636.

All lay-in light fixtures regardless of weight shall be independently supported from the structure above.

PAINTING

1. Require undercoats to have slightly different tints, and to be inspected and approved by the Architect/Engineer prior to application of the next coat.
2. Specify the total thickness of paint by "dry mil" or "wet mil" thickness (according to which is recommended by the paint manufacturer), and verify the thickness on the job by use of special low-cost gages.
3. The university will assist the Architect/Engineer in specifying the quality of paint required, acceptable vendor products and paint specifications for specific types of paint and their application. Paints with the highest proportion of titanium dioxide should be used for dirt shedding properties.
4. Clearly describe substrate preparation requirements.
5. Require metal doorframes in masonry walls to be back painted prior to installation.
6. Specify paint on steel and iron items on the basis of mil thickness rather than number of coats. Items exposed to the weather shall have a minimum of six mils total dry film measurement. Interior steel and iron shall have a minimum of four mils dry film measurement.
7. Use a clear silicone waterproofing or approved alternative the exterior of all brick buildings including the stone. 3% silicone is considered adequate; for limestone a 5% silicone is desirable. Products, which have been used and found acceptable, are: Florida Laboratories Chemclear 30 and Sonneborn-Hydrocide S-X.
8. Clear silicone waterproofing shall contain a minimum of 3-5% silicone resin solids in a hydrocarbon solvent conforming to formulation and performance standard of Federal Specifications SS-W-OO11O (G.S.A.). Container label shall certify that it meets above

requirements. Where an interior paint is used on masonry or concrete surfaces, no silicone waterproofing is desired.

9. Provide latex based paint for interior applications and an oil based paint for exterior applications and interior metal applications susceptible to contact and wear. Interior paint shall be no or low VOC to promote indoor air quality.
10. To promote indoor air quality, provide low VOC paints and coatings whenever possible.

END OF SECTION

SECTION 09680

CARPET

PART 1 - GENERAL

1.01 Summary

A. This Section includes carpet, carpet adhesive, and carpet accessories.

1.02 Submittals

A. Product Data: Provide complete product data for each type of carpet material, adhesive and installation accessory required. Submit written data, and test results as required below, on physical characteristics, durability, appearance retention characteristics, and fire performance characteristics.

B. Samples: Provide samples for verification purposes in manufacturer's standard size, showing full range of color, texture, and pattern variations expected. Provide six (6) additional larger 12" x 12" samples for testing purposes. Prepare samples from same material to be supplied to the Owner.

C. Warranties: The carpet manufacturer shall supply copies of all warranties required below with their bids.

1.03 Quality Assurance

A. General: Provide carpet identical to that tested as required below, by independent, approved testing agencies. All carpet supplied to each project under this contract shall be clearly identified with appropriate markings of the applicable testing and inspecting organization for each test required below.

B. Fire Performance Characteristics: Provide carpet meeting or exceeding the following fire performance characteristics or the current requirements of Code authorities, whichever is more restrictive.

1. Carpet Surface Burning Characteristics – small scale ignition test (Pill Test):
   - a) Test Method: DOC FF 1-70.
   - b) Rating: Pass.

2. Critical Radiant Flux:
   - a) Test Method: ASTM E-648; NFPA 253.
   - b) Rating: Class I.

3. Smoke Generation Characteristics:
   - a) Test Method: ASTM E-662.
   - b) Rating: 0 - 450.

C. Appearance Retention Characteristics – Provide carpet meeting or exceeding the following:

1. Appearance Retention Rating (ARR):
  - **a) Test Method: Carpet and Rug Institute (CRI) test TM101 graded in accordance with ASTM D-5252(hexapod).**
  - **b) Rating: Severe Use**

2. Colorfastness to Light:
  - **a) Test Method: AATCC-16, option E.**
  - **b) Rating: 4 minimum, 4.5 for heavy light exposure locations, after 40 AATCC fading units using AATCC gray scale for color change.**

3. Soiling Resistance:
  - **a) Test Method: AATCC 189**
  - **b) Rating: An average of 3 fluorine analyses of a single composite sample to be a minimum of 300 ppm fluorine by weight when new and 200 ppm fluorine by weight after 2 AATCC 171 (HWE) cleanings.**

D. Durability Characteristics – Provide carpet meeting or exceeding the following:

1. Tuft Bind / Edge Ravel:
  - **a) Test Method: ASTM D-1335.**
  - **b) Rating: 10 lbs. Of force or higher, wet.**

2. Delamination Strength of Secondary Backing:
  - **a) Test Method: ASTM D-3936.**
  - **b) Rating: 2.5 lbs. of force per inch width.**

3. Dimensional Stability of Modular Carpet:
  - **a) Test Method: Physical measurement.**
  - **b) Rating: within 1/32” of specifications.**

E. The Carpet Manufacturer and/or their authorized representative, will be required to coordinate all installation and material approvals, inspections, and certifications required to support the specified warranties with the Contractor and Owner’s Representative prior to the start of work.

1.04 Warranties

A. General: The manufacturer shall supply unrestricted, full replacement non-prorated warranties as listed below.

B. Wear: No more than 10% yarn loss by weight for a minimum of 15 years of carpet under normal use.

C. Edge Ravel: Guaranteed no edge ravel in normal use for a minimum of 15 years of normal carpet use.

D. Tuft Bind: Guaranteed not to zipper for a minimum of 15 years of normal carpet use.

E. Delamination: Primary and secondary backings guaranteed not to delaminate for a minimum of15 years of normal carpet use.

PART 2 - PRODUCTS

Note: All Invista products shall be "Antron Certified" prior to installation to certify fiber content and fiber weight.

2.01 Broadloom Carpet

A. Carpet:

1. Construction: tufted level or multi-level loop pile.

2. Yarn: Invista Antron Legacy, or Invista Antron Lumena type 6,6 nylon. No substitutions.

3. Dye Method: 100% yarn dyed or a combination of yarn dyed and solution dyed.

4. Pile Weight: 26 oz per square yard or higher measured according to ASTM D-5848.

5. Stitches: 8.3 per inch minimum measured according to ASTM D-5793.

6. Pile Height: 0.145" minimum measured according to ASTM D-6859.

7. Primary Backing: Woven polypropylene or equal.

8. Secondary Backing: Woven polypropylene or equal.

9. Stain Resistant Treatment: Duratech.

10. Moisture Penetration: Impermeable.

B. Carpet Adhesive: Provide highest quality adhesive recommended by the carpet manufacturer for intended use condition. No substitutions.

2.02 Hard Backed and Modular Carpet

A. Carpet Materials – recommend use: general use where additional cleanability, acoustical dampening and durability is desired. Available in modular and 6' roll goods. Modular carpet is recommended in areas where frequent carpet replacement is anticipated and where replacement of roll goods is impractical due to obstructions in the space.

1. Primary Backing: Reinforced synthetic.

2. Yarn: Invista Antron Legacy, or Invista Antron Lumena type 6,6 nylon. No substitutions

3. Secondary Backing: Fiberglass reinforced thermoplastic composite.

4. Pile Weight: 20 oz per square yard or higher measured according to ASTM D-5848.

5. Stitches: 10.0 per inch minimum measured according to ASTM D-5793.

B. Carpet Adhesive: Provide highest quality adhesive recommended by the carpet manufacturer for intended use condition. All adhesive used for modular carpet tile shall be a **releasable** adhesive. No substitutions.

C. All other requirements of 2.01 above.

2.03 Cushion Backed Modular Carpet

A. Carpet Materials – recommend use: general use where additional clean ability, acoustical dampening and durability are desired. Modular carpet is recommended in areas where frequent carpet replacement is anticipated and where replacement of roll goods is impractical due to obstructions in the space.

1. Primary Backing: Reinforced synthetic.

2. Secondary Backing: PVC Free polyurethane cushion.

3. Pile Weight: 20 oz per square yard or higher measured according to ASTM D-5848.

4. Stitches: 10.0 per inch minimum measured according to ASTM D-5793.

B. Carpet Adhesive: Adhered, Pre-adhered or Adhesiveless backing system. No substitutions.

2.04 Solution Dyed Carpet

A. Carpet Materials – recommended use: areas with high sunlight exposure and/or potential exposure to bleaching agents in use or in cleaning adjacent areas.

1. Yarn – Antron Lumena/Legacy, type 6,6 nylon. No substitutions.

2. Dye Method – 100% solution dyed.

B. All other requirements of 2.01 or 2.02 above.

2.05 Acceptable Carpet Manufacturers

A. Subject to the requirements of this specifications, provide carpet manufacturers as follows:

1. Mohawk

2. Mannington

3. Milliken---Cushion Backed Modular Products Only

4. Tandus

5. Interface

6. Other, if approved in advance

PART 3 – EXECUTION (NOT USED)

END OF SECTION 09680

WILDWOOD HALL

THE FLORIDA STATE UNIVERSITY

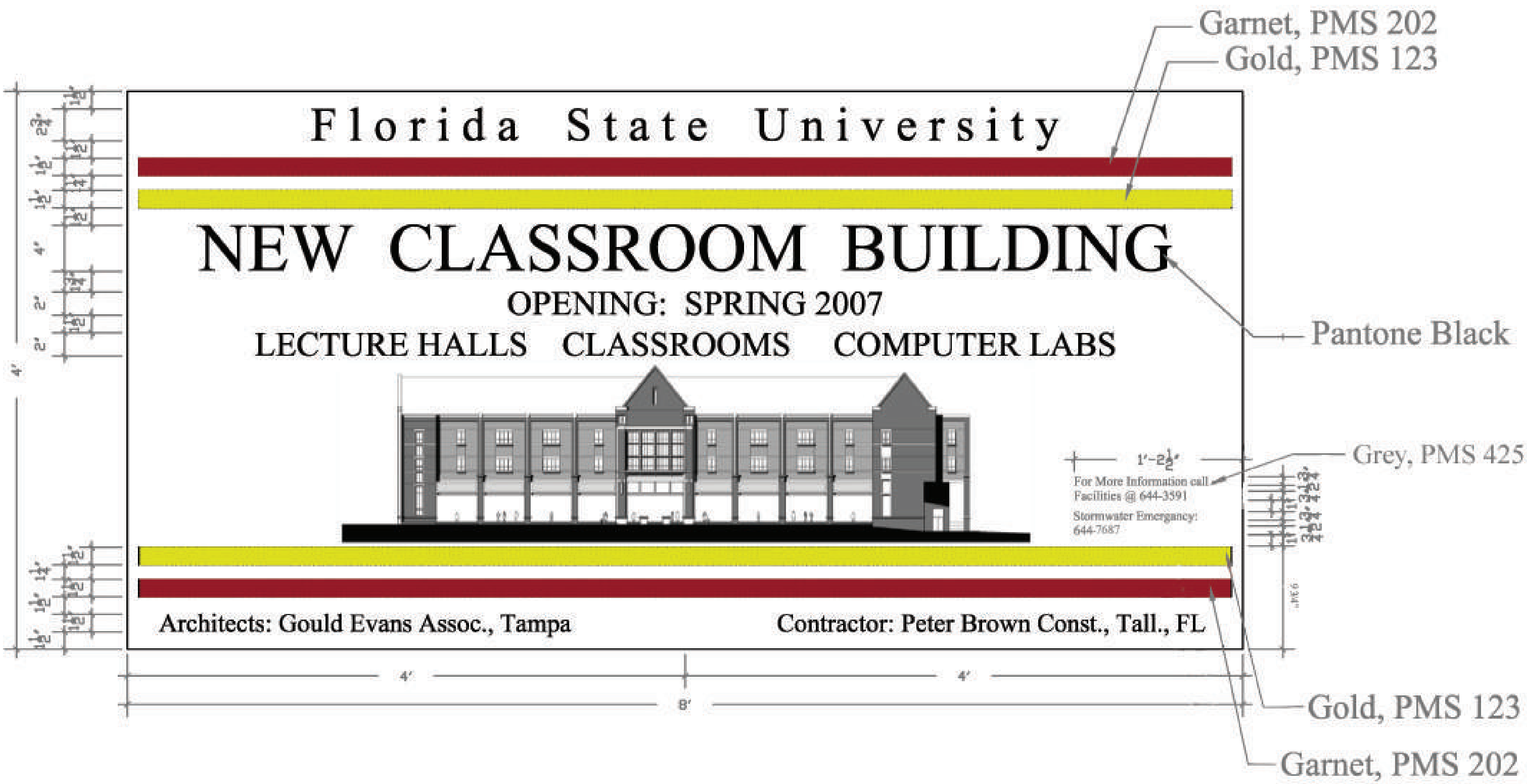
TALLAHASSEE, FLORIDA

T. K. WETHERELL
PRESIDENT

GILCHRIST ROSS CROWE
ARCHITECT

CULPEPPER CONSTRUCTION COMPANY
CONSTRUCTION MANAGER

Times New Roman



TOILET ROOM PARTITIONS AND ACCESSORIES

PART 1 – GENERAL

1.01 Summary

A. This Section includes toilet partitions, soap dispensers, paper towel dispensers, toilet tissue dispensers, waste receptacles, mirrors and other accessories required for toilet rooms.

1.02 Quality Assurance

A. For refillable accessories, provide accessories compatible with FSU Building Services refill requirements.

B. Accessories should be tamperproof and capable of secure mounting.

C. Utilize accessories fabricated from graffiti resistant materials.

PART 2 – PRODUCTS

2.01 Toilet/Urinal/Shower Stall Partitions

A. Stall materials: solid plastic, phenolic stall walls, Santana or approved equal. Material must be resistant to water, oil, bacteria, and damage by cleaning products. Consider low-emitting materials such as GREENGUARD Certified.

B. Mounting: stable mounting resistant to movement, using solid wood blocking as required. Limit attachment to floor in order to facilitate cleaning. Where possible, utilize partitions capable of attachment to building structure or overhead braced.

C. Pilaster shoe: 4” high min., Type 304 stainless steel.

D. Hardware: heavy-duty stainless steel, tamper-resistant fasteners.

1. Hinges: self-closing, full height stainless steel continuous piano hinge

2. Latch and Keeper: surface mounted slide latch w/provision for emergency access.

3. Coat hook: combination coat hook and rubber-tipped stop.

4. Door Pull: standard unit on outside of in-swinging doors. Provide pulls on both sides of out-swinging doors.

2.02 Toilet Tissue Dispenser

A. Item: Jumbo bath tissue dispenser as manufactured by Georgia Pacific or approved equal. Grainger #4DJU8.

B. <u>Type:</u> Wall mounted.

C. <u>Material:</u> ABS plastic

D. <u>Color:</u> Translucent smoke.

E. <u>Capacity:</u> (2) 9” jumbo rolls.

F. <u>Dimensions:</u> height=11-1/2”; width=20”; depth=5-1/2”.

G. <u>For use with:</u> Tissue 1PHJ2 or 1PHJ1.

2.03 Soap Dispenser

A. <u>Item:</u> GOJO dispenser, Fmx, 1250 ML. Grainger #3WU72.

B. <u>Capacity:</u> 1250 mL.

C. <u>Color:</u> Gray.

D. <u>Dimensions:</u> height=10 ½”; width=6”; depth=4”.

E. <u>For use with:</u> Luxury Gojo Foaming Hand Soap sealed dispenser type refills.

2.03 Paper Towel Dispenser

A. <u>Item:</u> High capacity, wall mounted, SofPull Roll Towel System as manufactured by Georgia Pacific. Grainger #6HKU8.

B. <u>Capacity:</u> 1000 foot primary roll plus stub roll.

C. <u>Material:</u> ABS Plastic.

D. <u>Color:</u> Translucent Smoke.

E. <u>Operation Method:</u> Manual.

F. <u>Dimensions:</u> height= 16-7/10”; width=12-3/5”; depth=9-3/10”.

G. <u>For use with:</u> Paper towel 6TKF2, 6TKF3, GP26470 or 26480.

2.04 Waste Receptacle

A. <u>Item:</u> Semi-recessed waste receptacle ***without*** paper towel dispenser.

B. <u>Capacity:</u> 10 L.

C. <u>Material:</u> Type 304 stainless steel, satin finish.

D. <u>Mounting:</u> Semi-recessed wall mounted.

2.05 Sanitary Napkin Disposal Unit

A. Item: Wall mounted feminine hygiene disposal unit.

B. Material: Type 304 stainless steel, silver color.

C. Dimensions: height=9-1/4”; width=4-1/4”; depth=4-1/4”.

D. Provide (1) ea. female toilet stall.

2.06 Other toilet room accessories:

A. Mirrors: Provide mirrors in all restrooms. Do not install mirror within view of entrance way. Install at HC accessible height as required by code.

B. Do **NOT** provide ashtrays.

C. Provide water cut-off under each sink with hose adapter.

END OF SECTION

INTERIOR SIGNAGE

PART 1 - GENERAL

1.01 Summary

A. This Section includes the following types of signs: ADA interior signage system and bronze building plaques.

B. Related work elsewhere includes: exterior signage, FSU Signage manual, construction project sign, sample bronze building plaque.

1.02 Submittals

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

B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

D. Provide message list for each sign required, including large-scale details of wording and layout of lettering.

E. Attachment: For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

F. Furnish full-size spacing templates for individually mounted dimensional letters and numbers.

G. Furnish full-size rubbings for metal plaques.

H. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Cast Acrylic Sheet: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
    a) Provide sample sign for final approval. Sample, upon approval, may be returned for use on the project.

1.03 **Quality Assurance**

A. **<u>Single-Source Responsibility:</u>** **For each separate type of sign required, obtain signs from one source from a single manufacturer.**

B. **<u>Substitutions:</u>** **Requests for substitution of manufacturer or materials must be approved in writing prior to bid opening.**

1.04 **<u>Project Conditions</u>**

A. **<u>Field Measurements:</u>** **Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings.**

B. **<u>Coordinate fabrication schedule</u>** **with construction progress to avoid delay and ensure completion of signage commensurate with plans for occupancy.**

PART 2 - PRODUCTS

2.01 **Manufacturers**

A. **<u>Manufacturers:</u>** **Subject to compliance with requirements, provide products from one of the following OR approved equal:**

1. **Manufacturers of ADA Interior Signs:**
   - ABC Architectural Signing System, Division of Nelson-Harkins Industries.
   - Allenite, A Division of Allen Marking Products, Inc.
   - Andco Industries Corp.
   - APCO Graphics, Inc.
   - Architectural Graphics, Inc.
   - ASI Sign Systems, Inc. - Basis of Design: “SPF” Series
   - Best Manufacturing Co.
   - Kroy
   - Modulex.
   - Mohawk Sign Systems.
   - Spanjer Brothers, Inc.
   - The Supersine Company.
   - Vomar Products, Inc.

2. **Manufacturers of Cast Plaques:**
   - Andco Industries corp.
   - A.R.K. Ramos Manufacturing Company, Inc.
   - Best Manufacturing Co.
   - Gemini, Inc.
   - Lake Shore Markers
   - Metal Arts, Division of L & H Manufacturing Co.
   - OMC Industries, Inc.
   - The Southwell Company.

3. **Materials:**

a) <u>Cast Acrylic Sheet:</u> Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:

b) <u>Opaque Sheet:</u> Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

c) <u>Bronze Castings:</u> Provide bronze castings, copper alloy UNS C83600, complying with the requirements of ASTM B 584.

d) <u>ABS Plastic:</u> Provide high-impact thermoplastic composed of copolymers of acrylonitrile, butadiene, and styrene.

e) <u>Anchors and Inserts:</u> Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled - in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

f) <u>Colored Coatings for Acrylic Plastic Sheet:</u> Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.02 ADA Interior Signs

A. **<u>ADA Interior Signs:</u>** Comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally. Provide raised 1/32" graphics and Braille consistent with ADA requirements.

2. **Unframed Panel Signs:** Fabricate signs with edges mechanically and smoothly finished to conform to the following requirements:

a) **Edge Condition:** Beveled

b) **Edge Color for Plastic Laminate:** Edge color same as background

c) **Corner Condition:** Corners rounded to radius indicated. Refer to illustration included at the end of this section.

d) **Graphic Content and Style:** Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letter, numbers, and other graphic devices. Provide 1/32" raised copy with Braille etched photopolymer faceplate and acrylic backplate.

e) **Basis of Design:** TS150, TS250 as manufactured by ABC, Nelson-Harkins.

B. **<u>Cast Metal Plaques</u>**

1. **Plaques:** Castings shall be free from pits, scale, and holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Refer to the "Finishes" Article for other finish requirements.

a) **Size of Plaque:** 1' - 6" x 2' - 4"

b) **Metal:** Bronze

c) **Border Style:** Raised flat band

d) **Background Texture:** Manufacturer's standard pebble texture

e) **Background Finish:** Provide dark statuary finish to comply with the requirement specified for bronze finishes, except provide background texture specified above in lieu of mechanical finish indicated.

f) **Letters:** Raised, polished, Helvetica style

2. **Mounting:** Concealed studs as manufactured by Spanter Bros., Inc., 1160 North Howe Street, Chicago, IL, or approved equal.

C. **<u>Finishes</u>**

1. **Colors and Surface Textures:** For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

2. **Metal Finishes:** Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

3. **Bronze Finishes:** Finish designations prefixed by "CDA" conform to the system established by the Copper Development Association for designating finishes.

4. **Natural Satin Finish:** CDA-M3106x (Mechanical Finish: Fine satin directional textured; Clear Organic Coating: Manufacturer's standard air-dry clear organic coating as specified below).

5. **Clear Organic Coating:** Air-dried acrylic coating Incralac as developed by International Copper Research Corporation, 1.0 mil minimum dry thickness.

6. **Color:** Uniform, matching color of the Architect's sample.

PART 3 - EXECUTION

3.01 **Installation**

A. **General:** Locate sign units and accessories where indicated, using mounting method of the type described and in compliance with the manufacturer's instructions.

B. **Install** signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

C. **Wall Mounted Signs:** Attach panel signs to wall surfaces using the methods indicated below:

D. **Vinyl-Tape Mounting:** Use double-sided foam tape, of thickness indicated, to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

E. **Cast Metal Plaques:** Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.

F. **Concealed Mounting:** Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.

3.02 **Cleaning and Protection**

A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.03 **Signage Schedule**

A. Provide room names and room numbers to rooms as indicated on Sign Type Schedules.

B. Signage **mounting** location and height as follows:

1. All Signs: Mount 60" above finish floor to the centerline of the sign. Mount on wall adjacent to the latch side of the door.

2. At Double Doors: Mount on wall on left-hand side of doorframe. Mount 60" above finish floor to the centerline.

C. **Sign Types:**

1. Stairs
2. Handicap Restrooms
3. Restrooms
4. Unisex Handicap Restrooms
5. Suites

END OF SECTION

The Florida State University

Signage Style Manual

April, 2012

FSU Facilities

Contains Sections:

A- Design Concepts

B- Sign Types

E- Specifications

EXTERIOR WAYFINDING SIGNAGE AT FLORIDA STATE UNIVERSITY

Consistency of building signage is an important means to identify the University facilities. All exterior sign types shall be designed in accordance with the specifications contained in this Exterior Signage Style Manual. The size, proportion, color etc of the sign must be one of the standard prototype signs and must be of an appropriate size for its function. The campus way-finding signage program is intended to be part of a way-finding system and not commemorative. Building signs identify campus buildings by official name. The name must be limited to key phrases, for example “Mendenhall Maintenance Complex” not “Lt. Colonel Herbert D. Mendenhall Maintenance Complex.”

Since color helps to identify the University, it is important that the identification colors specified below are reproduced faithfully and consistently. All painted surfaces must be finished low gloss to comply with the most current ADA Accessibility Guidelines.

Follow the color identification code below each color for matching.

Refer to Manual Section E for paint and finish specifications.

Primary Colors

Garnet

Garnet

University sign field color to match PPG color #435-7,Merlot

Solid plastic equivalent to match Burgundy by Laminations, Inc.

Gold

Gold

University sign field and rule line color to match 3M Company Scotchlite 467 MP

Gray

Gray

Sign cap and post color to match PPG color# 521-4, Silver Dollar

Solid plastic equivalent to match Canyon Granite by Laminations, Inc.

White

Messages and pictogram figures, white reflective sheeting 3M Company Scotchlite 280-10

The following specified sign colors are to be used consistently in the campus sign program to identify services, parking areas, and regulatory messages. All painted surfaces must be finished low gloss to comply
with the most current ADA Accessibility Guidelines.

Follow the color identification code below each color for matching.

Refer to Manual Section E for paint and finish specifications.

Sky Blue

Sky Blue

Accessibility symbol and sign field color to match PPG color #150-7, Cobalt glaze
Solid plastic equivalent to match PBlue by Laminations, Inc.

Dark Red

Dark Red

Regulatory sign field color to match PPG color #334-7, Apple A-Day

Solid plastic equivalent to match Red by Laminations, Inc.

Yellow

Yellow

Warning/cautionary sign field color to match PPG color#11707, Fall Gold
Solid plastic equivalent to match Yellow by Laminations, Inc.

Green

Green

Visitor/Metered parking sign field color to match PPG color# 107-7, Leap Frog
Solid plastic equivalent to match Custom Green by Laminations, Inc.

Violet

Violet

Student/Freshman parking sign field color to match PPG color# 144-7, Dutch Iris
Solid plastic equivalent to match Custom Purple by Laminations, Inc

Orange

Orange

Student parking sign field color to match PPG color# 125-7, Field Poppy
Solid plastic equivalent to match Custom Orange by Laminations, Inc

Brown

Brown

Faculty/Staff parking sign field color to match PPG color# 422-7, Covered Bridge
Solid plastic equivalent to match Chocolate Brown by Laminations, Inc.

Dark Gray

Dark Gray

Motorcycle parking sign field color to match PPG color# 530-5, Antique Silver
Solid plastic equivalent to match Custom Dark Grey by Laminations, Inc.

The primary signage alphabet is Garamond Bold. Alternate weights of the Garamond family of letterforms are specified for special signing conditions. Alternate alphabet is Times New Roman Bold where noted.

Refer to manual pages A 2.01, A 2.02 and A 2.03 for alternate letterform displays and to Manual Section B for special letterform uses.

ABCDEFGH
IJKLMNOPQRS
TUVWXYZ
&
abcdefghijklm
nopqrstuvwxyz
1234567890

An alternate weight letterform is Garamond. Refer to Manual Section B for special letterform uses.

ABCDEFGH
IJKLMNOPQRS
TUVWXYZ
&
abcdefghijklm
nopqrstuvwxyz
1234567890

An alternate weight letterform is Garamond Italic. Refer to Manual Section B for special letterform uses.

ABCDEFGH
IJKLMNOPQRS
TUVWXYZ

&

abcdefghijklm
nopqrstuvwxyz
1234567890

An alternate alphabet is Times New Roman Bold. Applied
only on the building exterior.

Refer to Manual Section B for special letterform uses.

ABCDEFGH
IJKLMNOPQRS
TUVWXYZ
&
abcdefghijklm
nopqrstuvwxyz
1234567890

Proper letter and word spacing is essential for legibility. If spacing is too tight, letters will blend together visually and words will be readable only at close range. If spacing is too open, letters will separate making the word forms difficult to read.

All letter and word spacing for non-illuminated signed messages are to be opened (kerned) 25 percent over normal computer generated spacing. When messages are interior illuminated, all kerning is to be increased to 50 percent to compensate for irradiation that causes illuminated letters to appear thicker than non-illuminated letters.

Unique letter combinations having overlapping or angular shaped letterforms will require special kerning to achieve an consistent appearance.

University Center

Non-illuminated spacing

University Center

Illuminated spacing

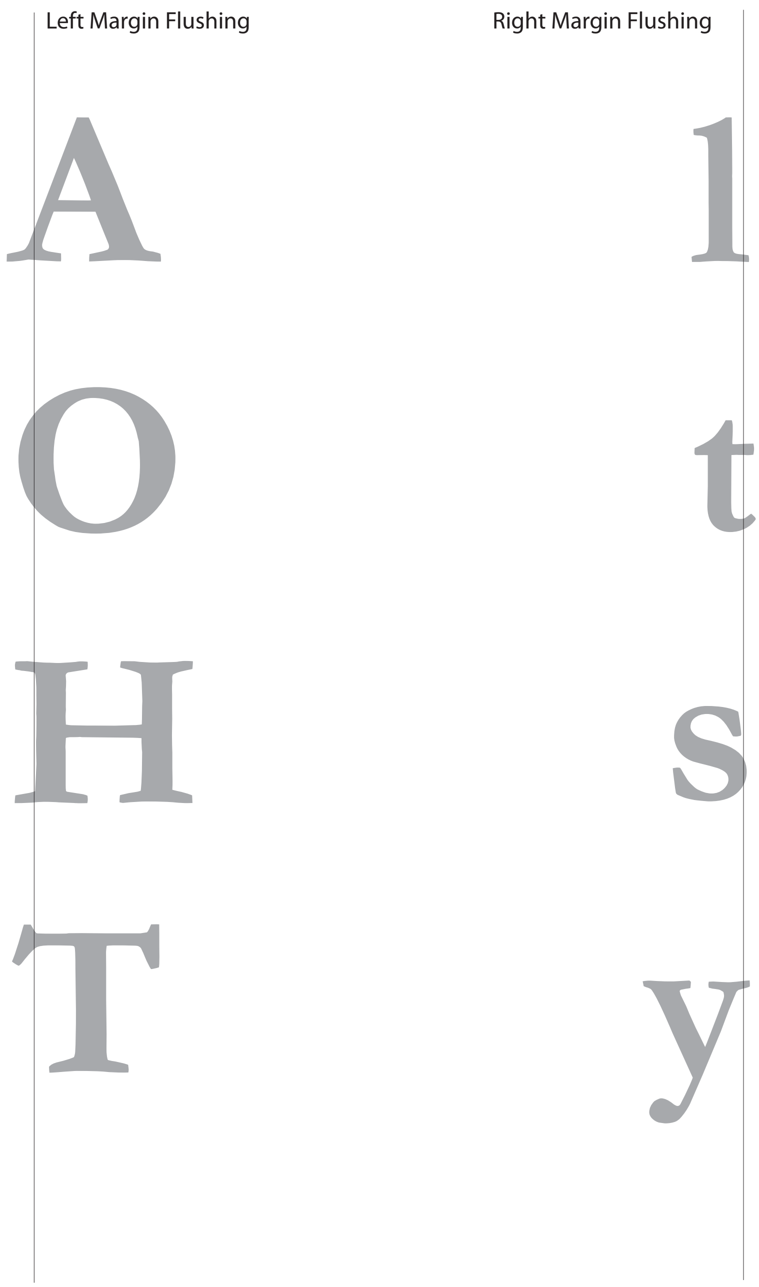
Aw Wo Tv La

Some unique letter combinations requiring special kerning

Proper vertical spacing between individual and multi- line messages is necessary for proper legibility. Measurements for determining proper message spacing are based on the height of the capital letter identified as "x".

x	**College of Social Sciences**
1.5x	
x	**Center for the Study of**
.75x	
x	**Critical Issues in Economic**
.75x	
x	**Policy and Government**
1.5x	
x	**School of Public**
.75x	
x	**Administration and Policy**

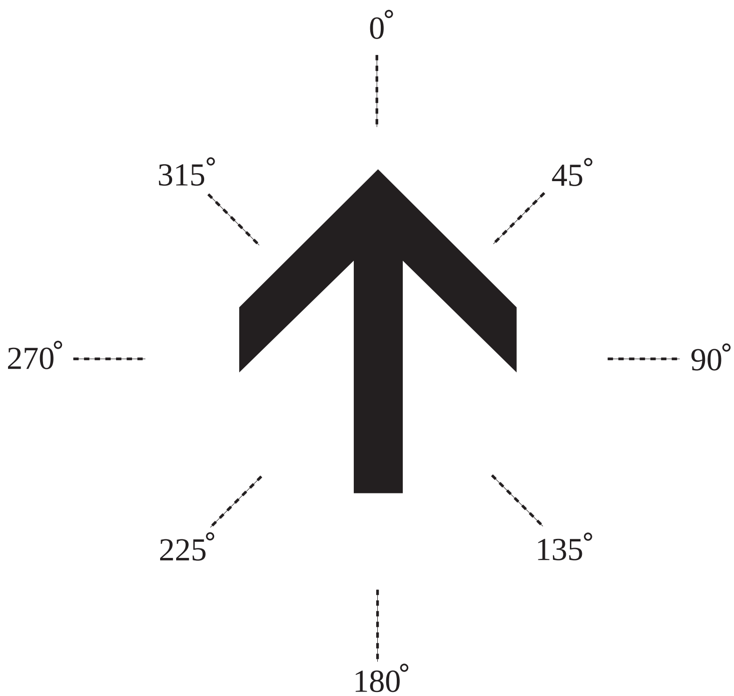
Due to the different characteristics of letterforms, letters must be visually aligned to appear flush and not mechanically aligned.



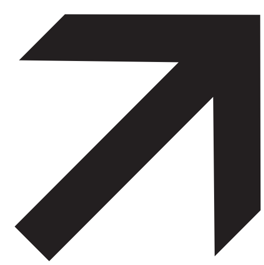
Shown below is the official Seal of the University. Obtain digital art from the University.

Refer to Manual Section B for University Seal applications with regard to placements, sizes, colors, and materials.

Refer to Manual Section B for arrow placements, sizes, color uses, and materials.



Directional Positions



Display

Refer to Manual Section B for pictogram placements and sizes.
Reproduce using white PSV and screened background colors.


Symbol 1


Symbol 2

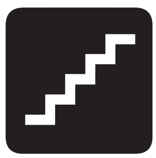

Symbol 3


Symbol 4


Symbol 5


Symbol 6


Symbol 7


Symbol 8


Symbol 9


Symbol 10


Symbol 11

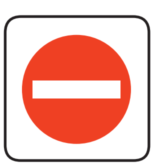

Symbol 12


Symbol 13


Symbol 14


Symbol 15


Symbol 16


Symbol 17

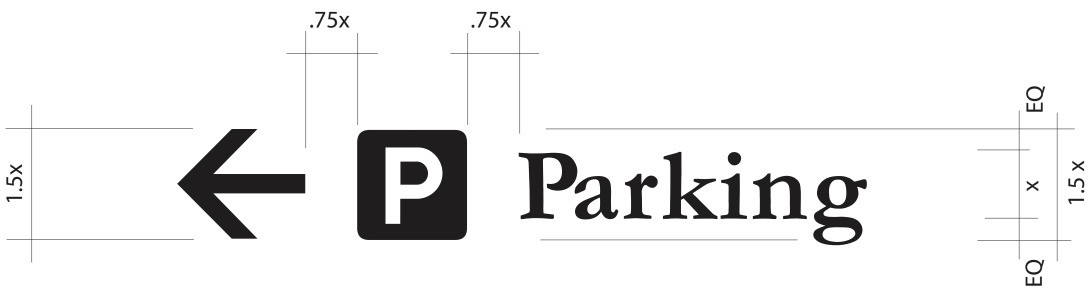

Symbol 18


Symbol 19


Symbol 20

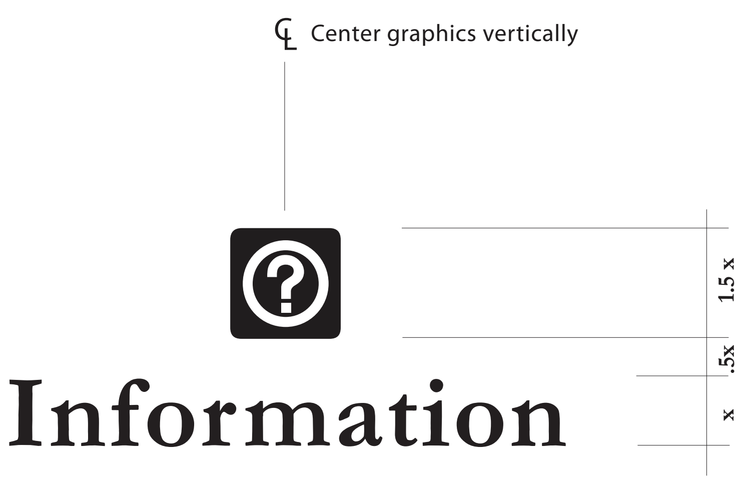

Symbol 21

The graphics relationships shown below are to be consistent on all signage applications. Exceptions to these guidelines are noted and dimensioned on individual sign type illustrations.



Arrow, Symbol, and Letterform Relationship

Multi-Symbol and Letterform Horizontal Relationship



Symbol and Letterform Vertical Relationship

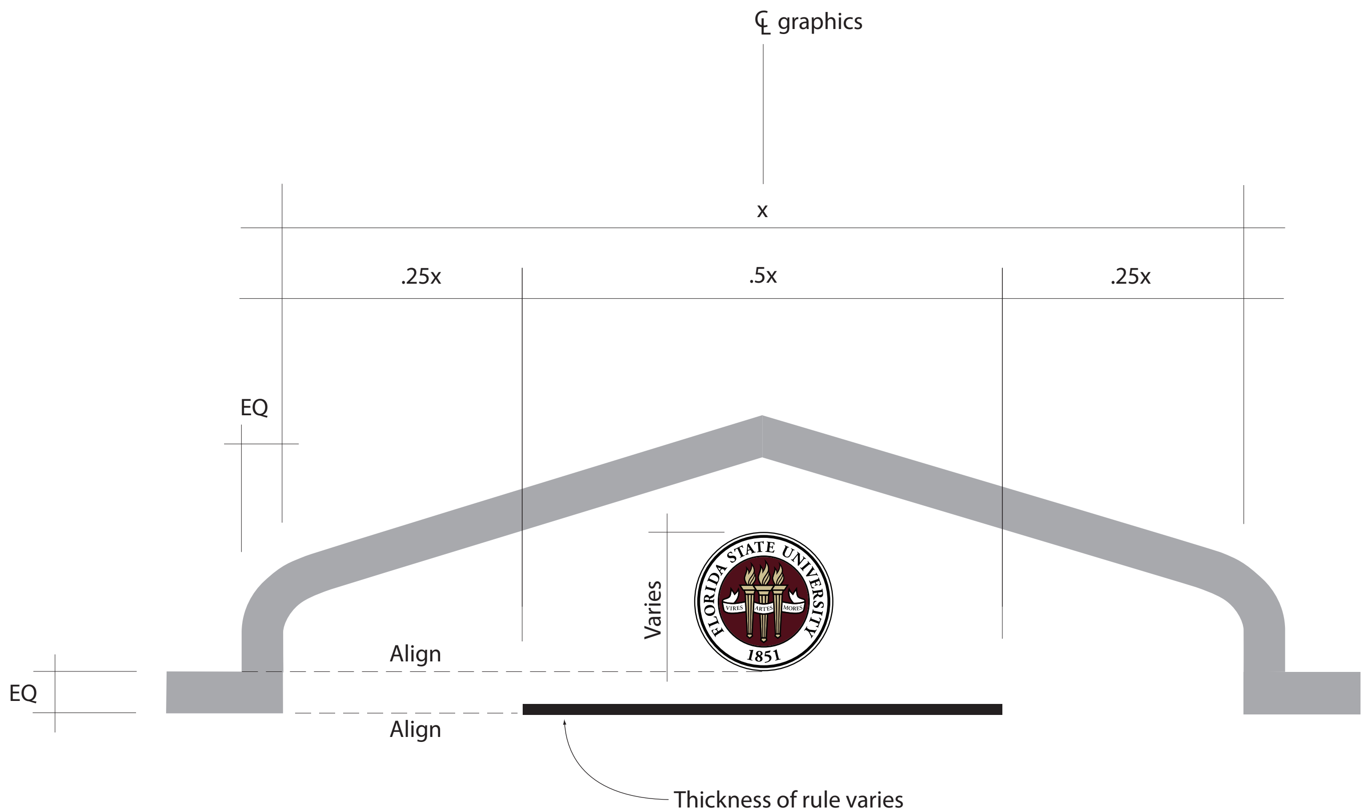
The graphics relationships shown below are to be consistent on all signage applications. Exceptions to these guidelines are noted and dimensioned on individual sign type illustrations.

Arrow, Symbol, and Letterform Relationship for straight ahead and left pointing arrows

Arrow, Symbol, and Letterform Relationship for right pointing arrows

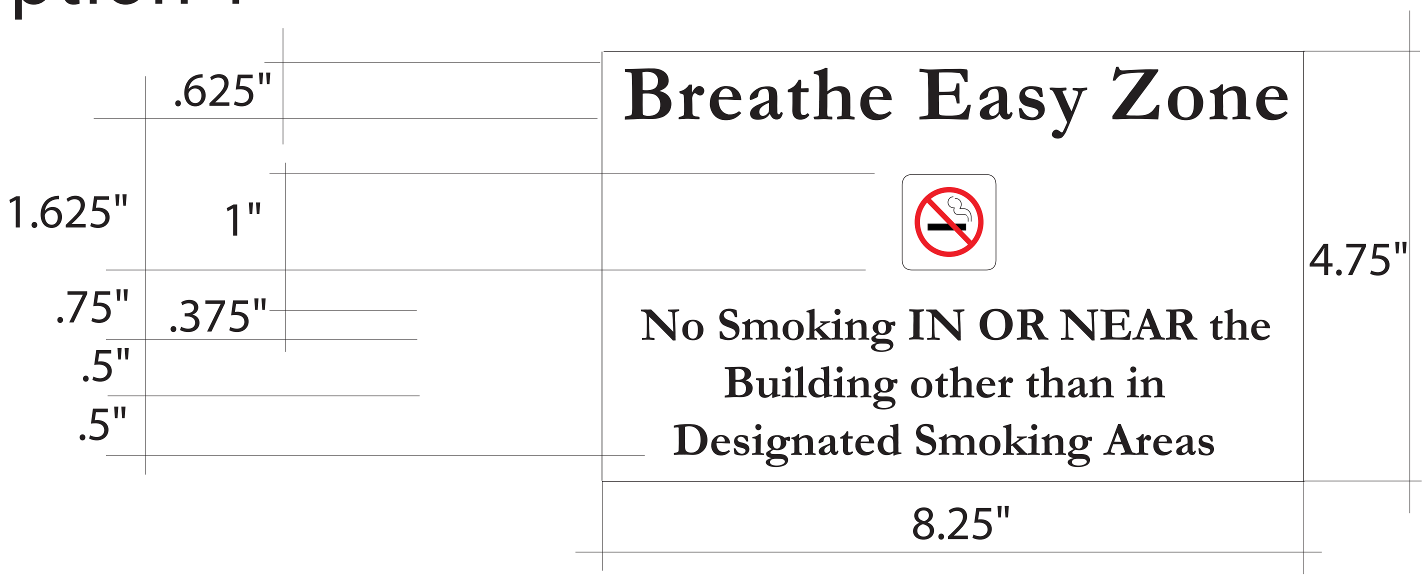
Arrow and Letterform Relationship for right pointing arrows

The graphics relationships shown below are to be consistent on all sign types. Exceptions to these are the height of the University Symbol and the thickness of the rule. Sizes are indicated on individual sign type illustrations. Refer to Manual Section B.

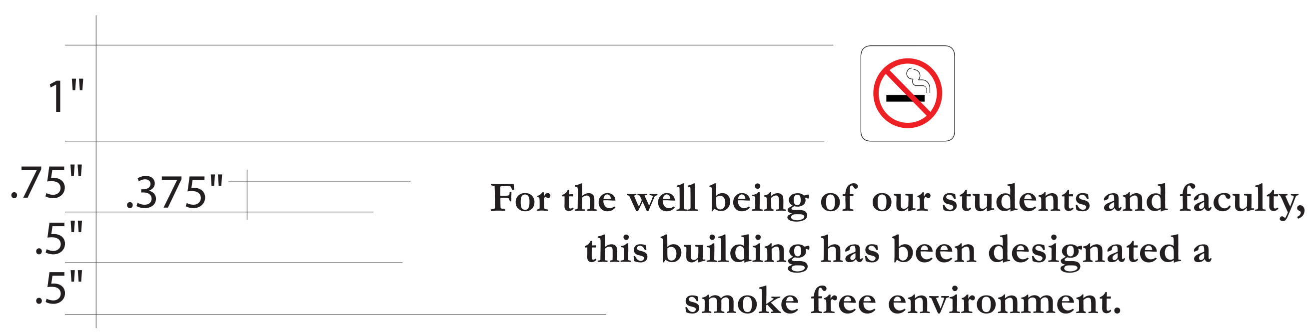


The following no smoking policies are to be selected at the option of each camplus department. Produced as decals.

Option 1



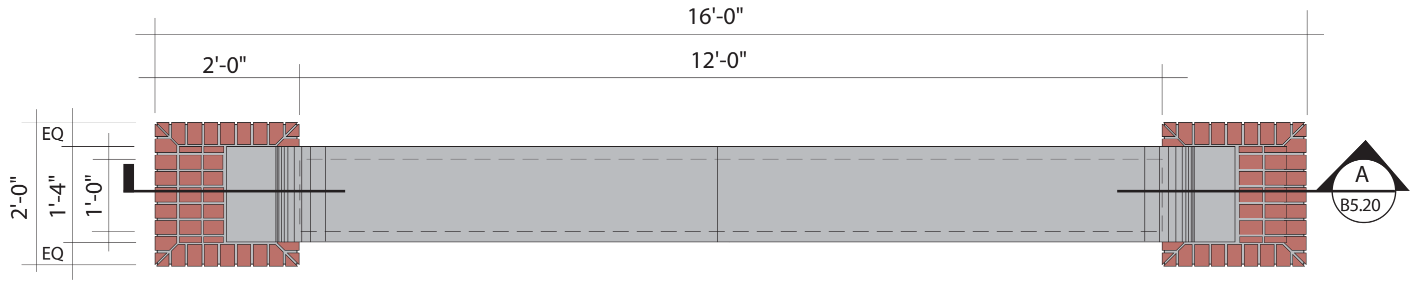
Option 2



Campus Identification Signs are intended to supplement Gateway features. Signs may display a directional arrow if the sign's location is removed from a Gateway or if a Gateway feature does not exist. These internally illuminated signs may be single or double sided.

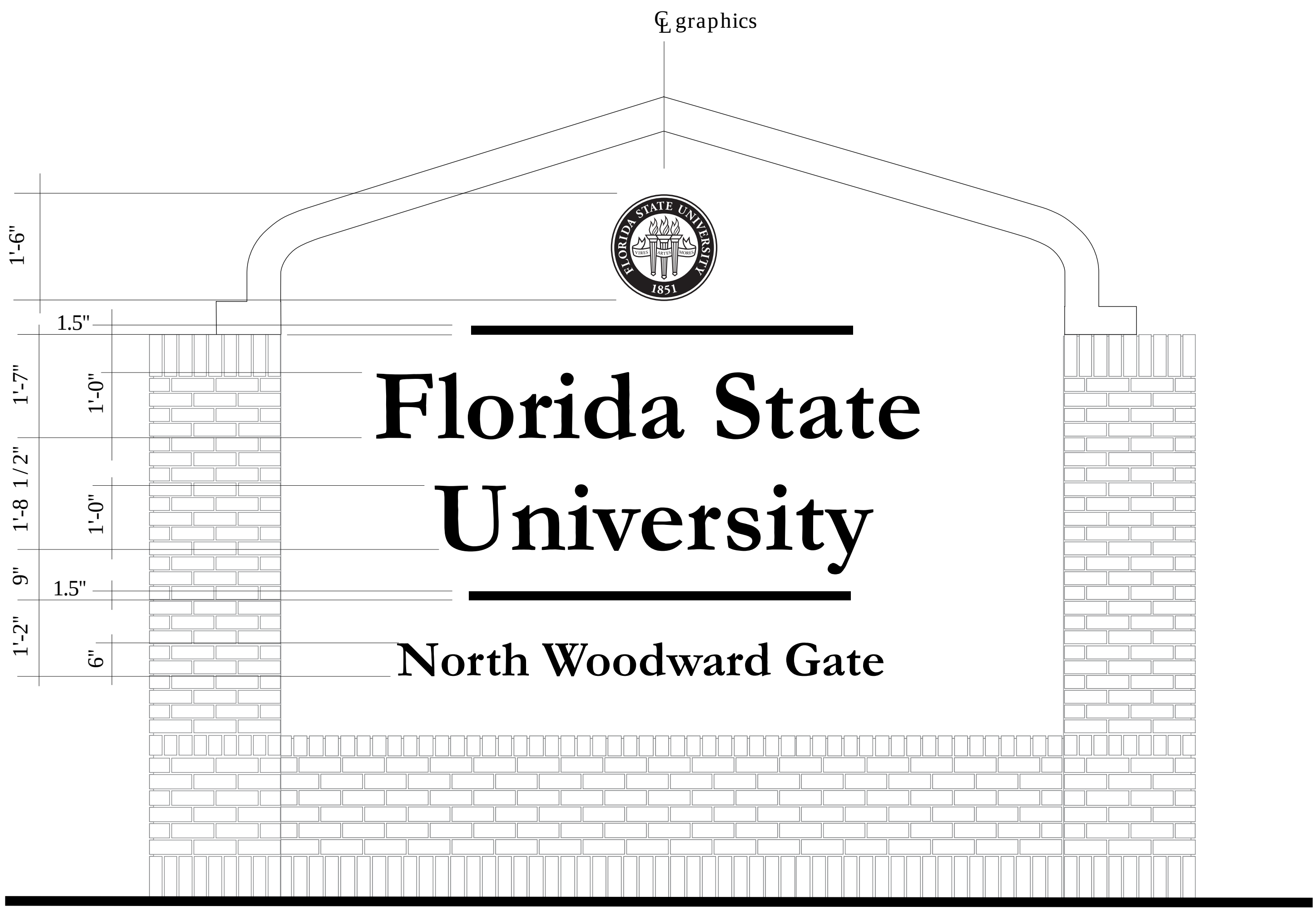
Fabrication Guidelines: Base, CMU substrate with face brick veneer; Foundation, formed concrete footing, Sign Cabinet, formed aluminum with garnet polyurethane finish and internal structure with internal light track behind routed graphics; Cornice, foremed aluminum with light gray textured coating; Interior Illumination, 277 v., white message, gold university symbol, and rules; Lamps, H.O. fluorecent daylight.

Refer to manual pages B 5.01 for graphics measurements, B 5.10 for placement guidelines, and B 5.20 for design intent drawings.



Plan View

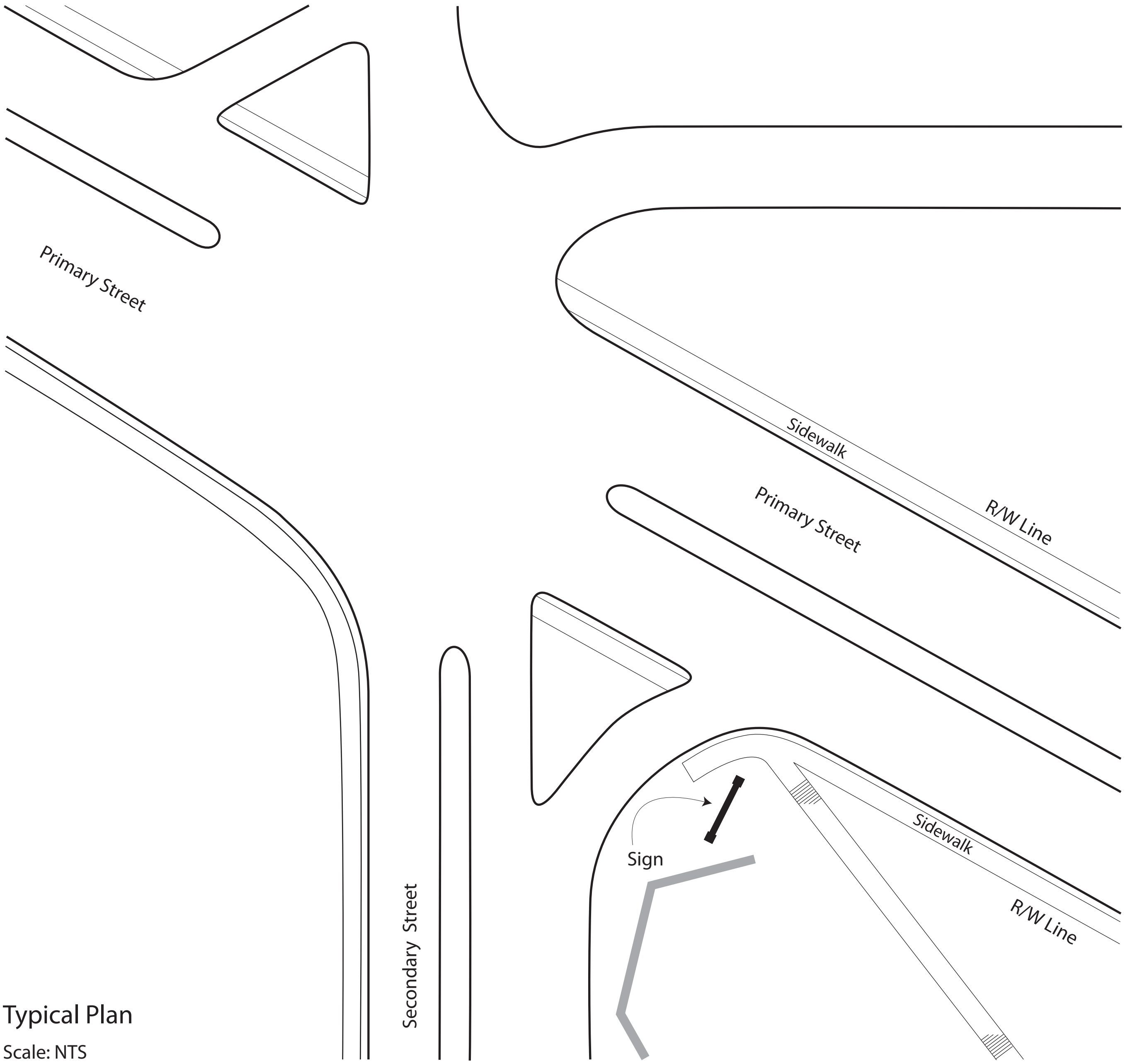
Elevation
Scale: 3/8"=1'-0"



Elevation
Scale: 3/8"=1'-0"

Signs are to be positioned perpendicular to street from which they are to be viewed and behind street right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

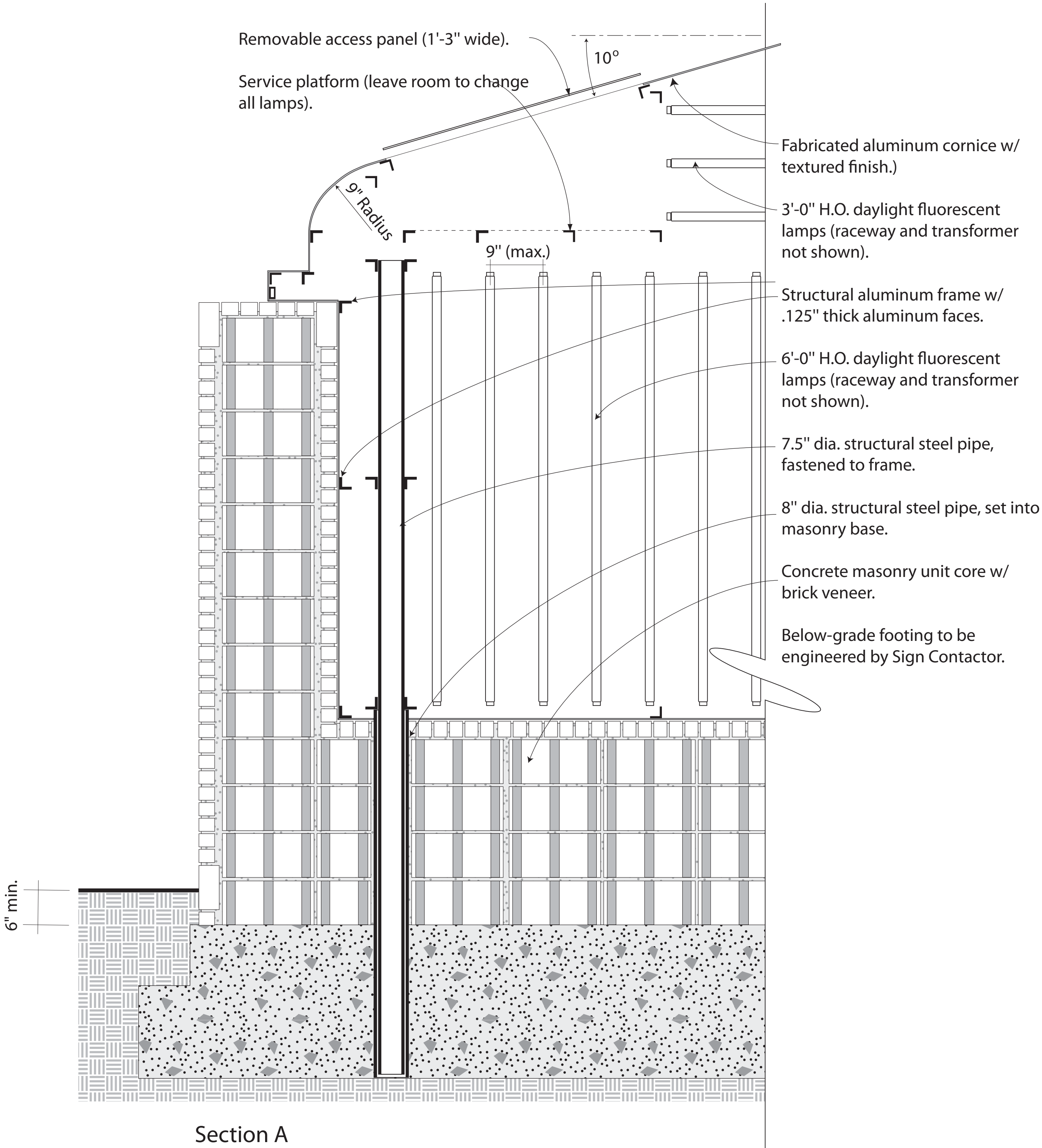
Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



Typical Plan

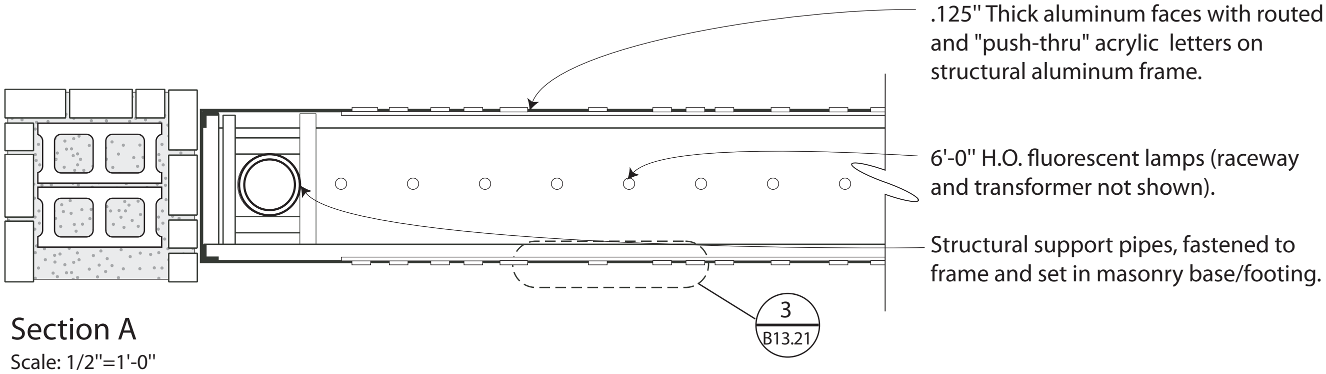
Scale: NTS

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

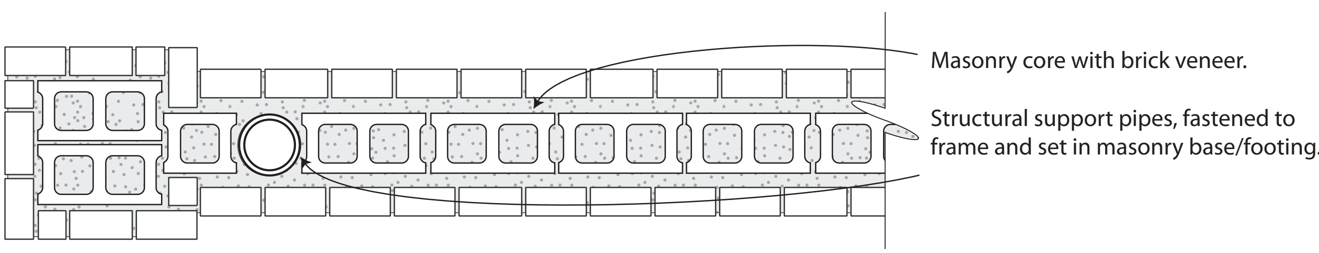


Section A
Scale: 1/2"=1'-0"

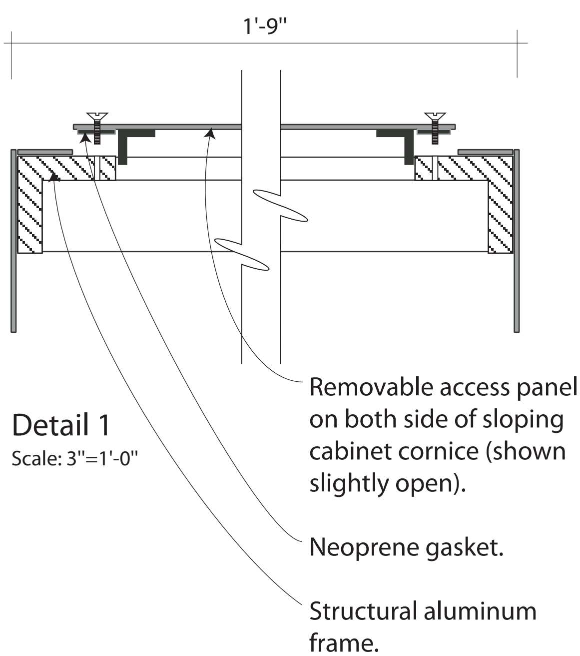
Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



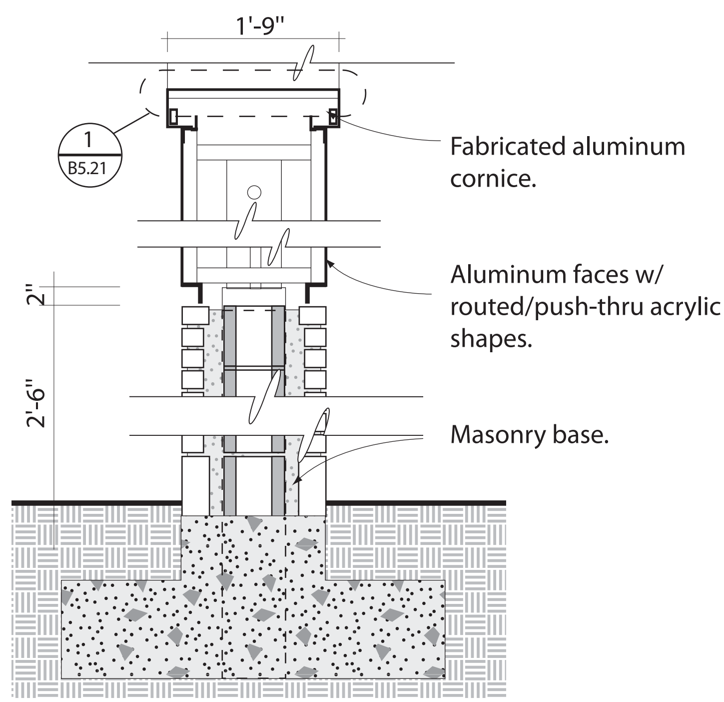
Section A
Scale: 1/2"=1'-0"



Section B
Scale: 1/2"=1'-0"



Detail 1
Scale: 3"=1'-0"



Section C
Scale: 1/2"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

.125" colorless acrylic.

.125" thick aluminum faces w/ routed-out letters.

Light gauge aluminum, laminated to acrylic and finished to match garnet sign face.

.5" white lighting acrylic- shaped "push-thru" letters, laminated to colorless acrylic backing with translucent gold faces and returns.

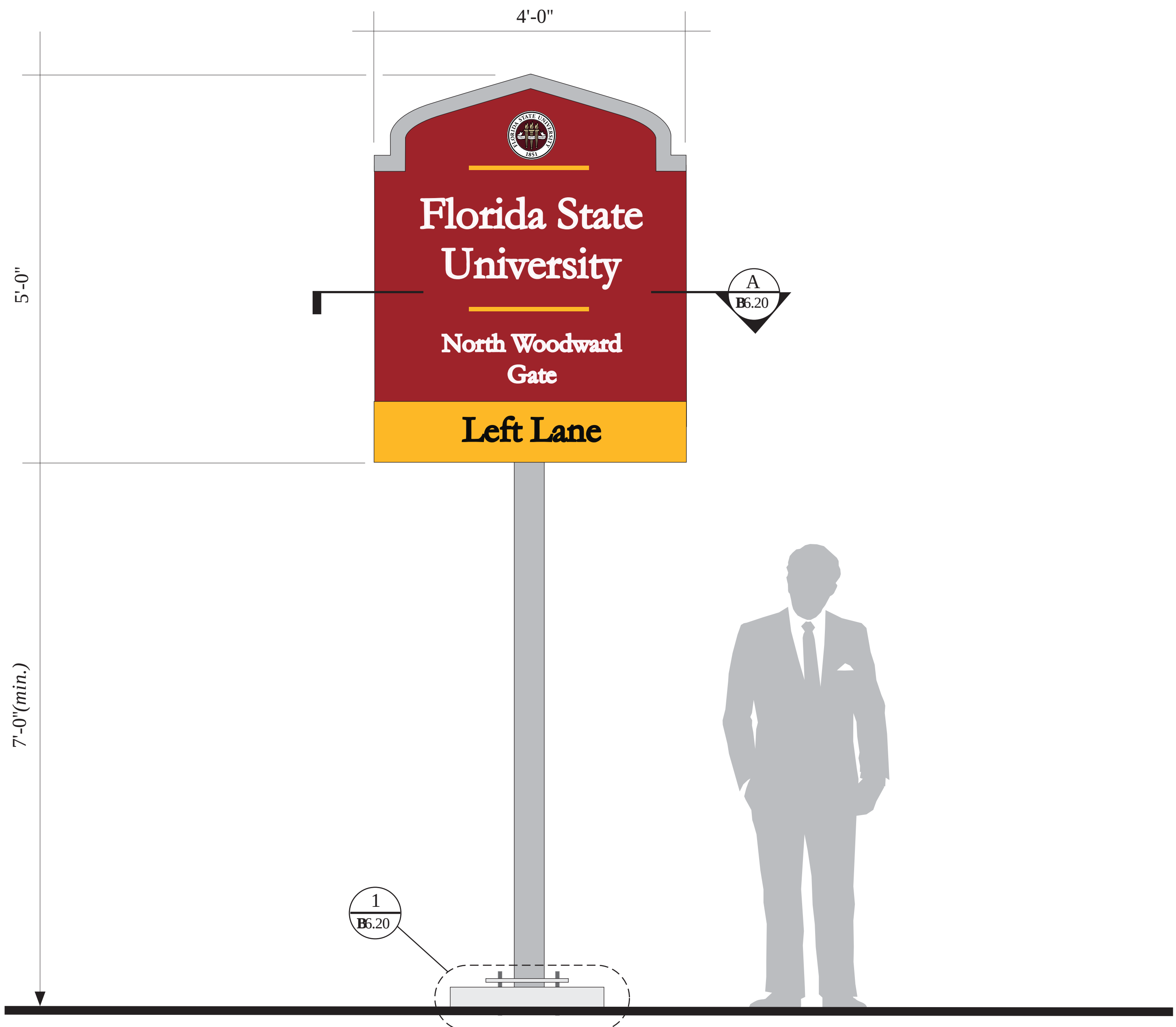
Section A thru University Symbol

Scale: 3"=1'-0"

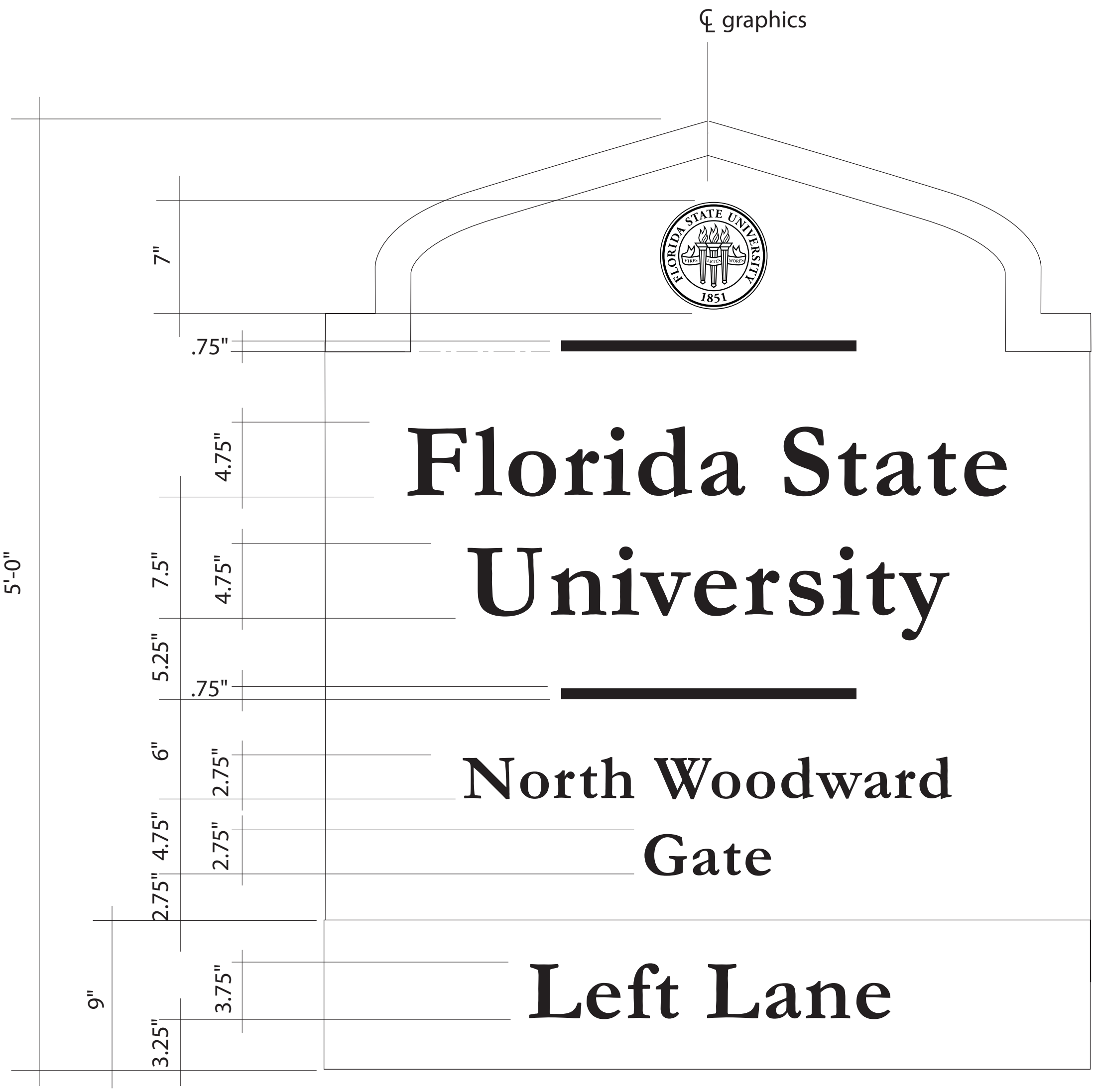
Primary Vehicular Directives are designed for congested areas where message height is important and available ground space is limited. These may be located prior to a decision point and display advanced information as illustrated below or may be located adjacent to a decision point and display arrows.

Fabrication Guidelines: *Post*, structural aluminum section with frangible mount, light gray polyurethane finish; *Foundation;* formed concrete footing, *Graphics Panel*, solid plastic panel-burgundy color, *Graphics*, reflective sheeting, light gray cornice, gold university symbol and rules, white and black copy.

Refer to manual pages **B** 601 for graphics measurements, **B** 610 for placement guidelines, and manual page **B** 620 for design intent drawings.



Elevation
Scale: 1/2"=1'-0"



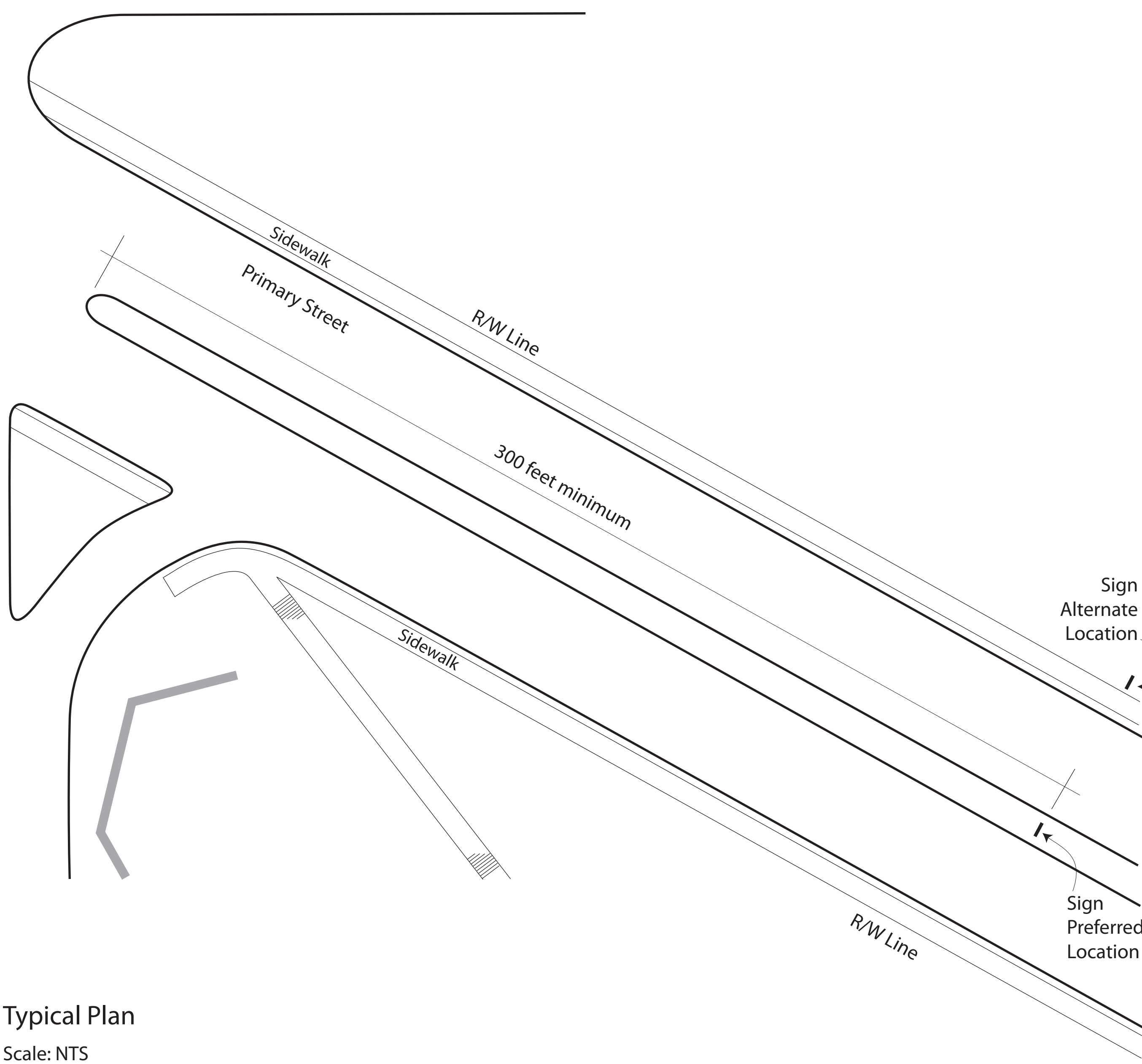
Elevation
Scale: 1"=1'-0"

Type 5 signs used as advance directional signs must be located the proper distance ahead of the intersection to permit vehicular traffic sufficient time to safely merge into the proper turning lane. Those used as directional signs may be located at closer distances.

Signs are to be positioned perpendicular to street from which they are to be viewed.

Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would obscure visibility.

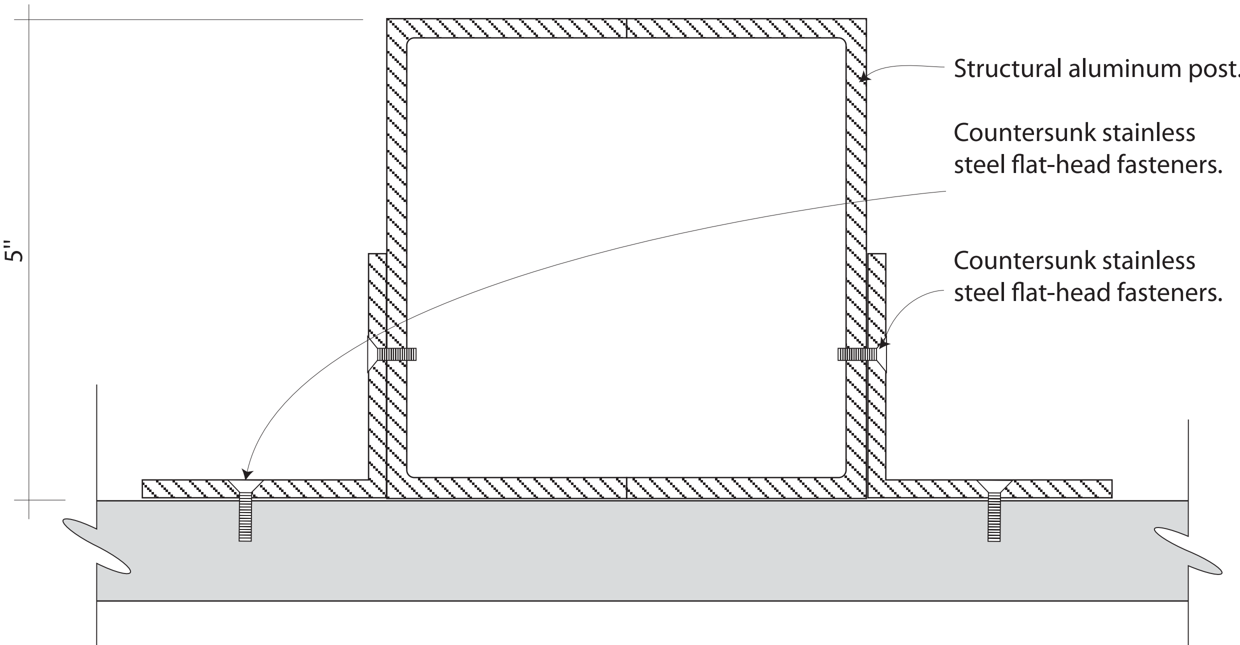
Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



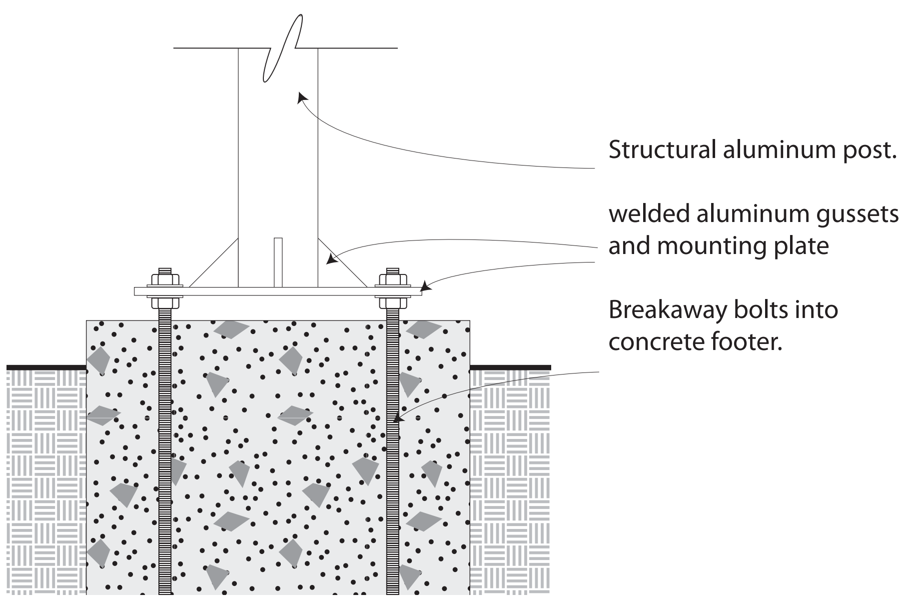
Typical Plan

Scale: NTS

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A
Scale: Half Size

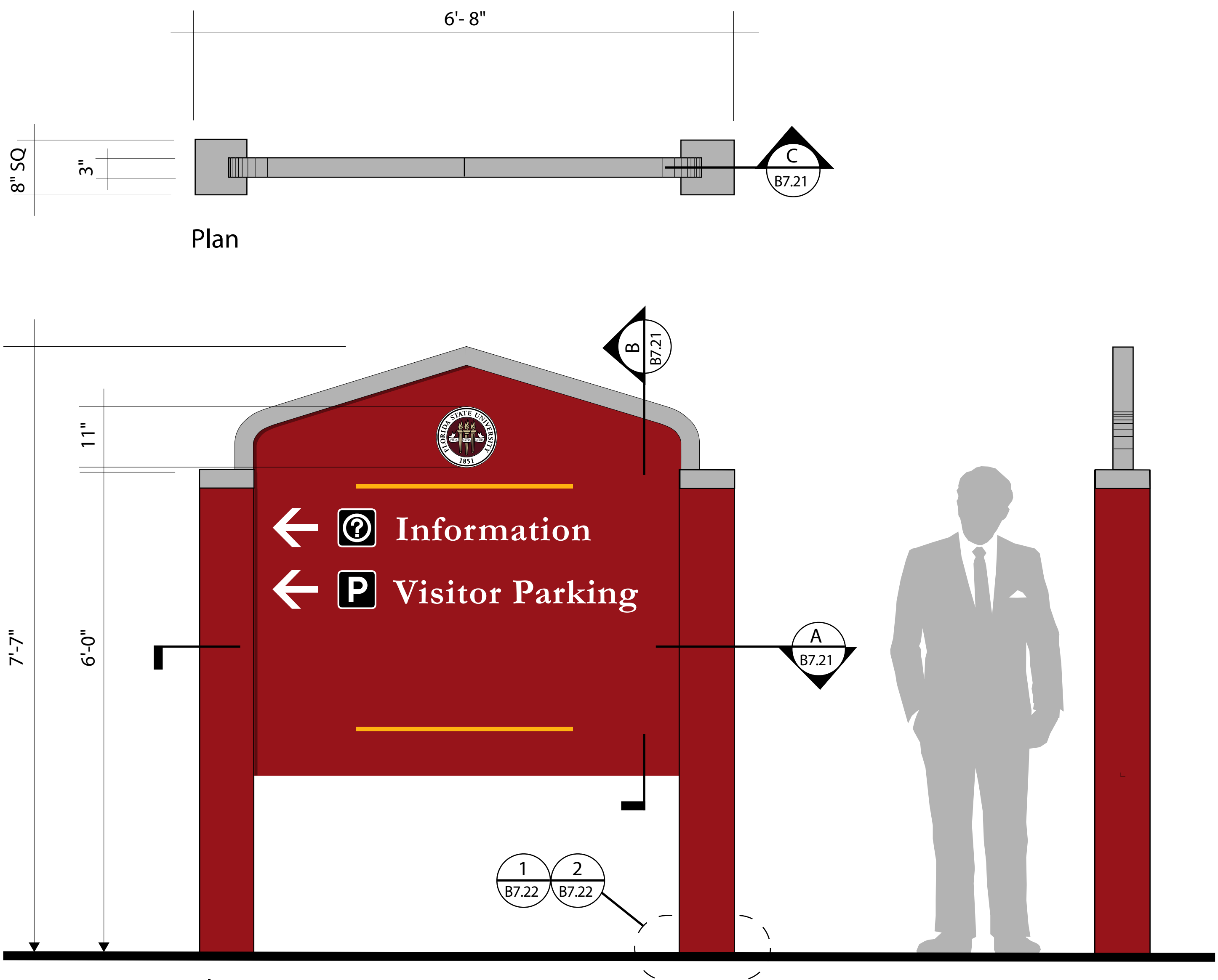


Detail 1
Scale: 1"=1'-0"

Secondary Vehicular Directive signs serve a similar function as the Primary Vehicular Directives. Due to their smaller size these signs are better suited for less congested areas with slower moving traffic. These non-illuminated signs can be single or double sided and display a maximum of four message lines per side.

Fabrication Guidelines: Posts, formed from interlocking solid plastic set into packed sand footings, burgundy posts and canyon granite caps ; Graphics Panel, solid plastic- burgundy color; Cornice; formed solid plastic shape with caps, Canyon Granite color; Graphics, reflective sheeting, gold university symbol and rules, white message and arrows, white and black pictograms.

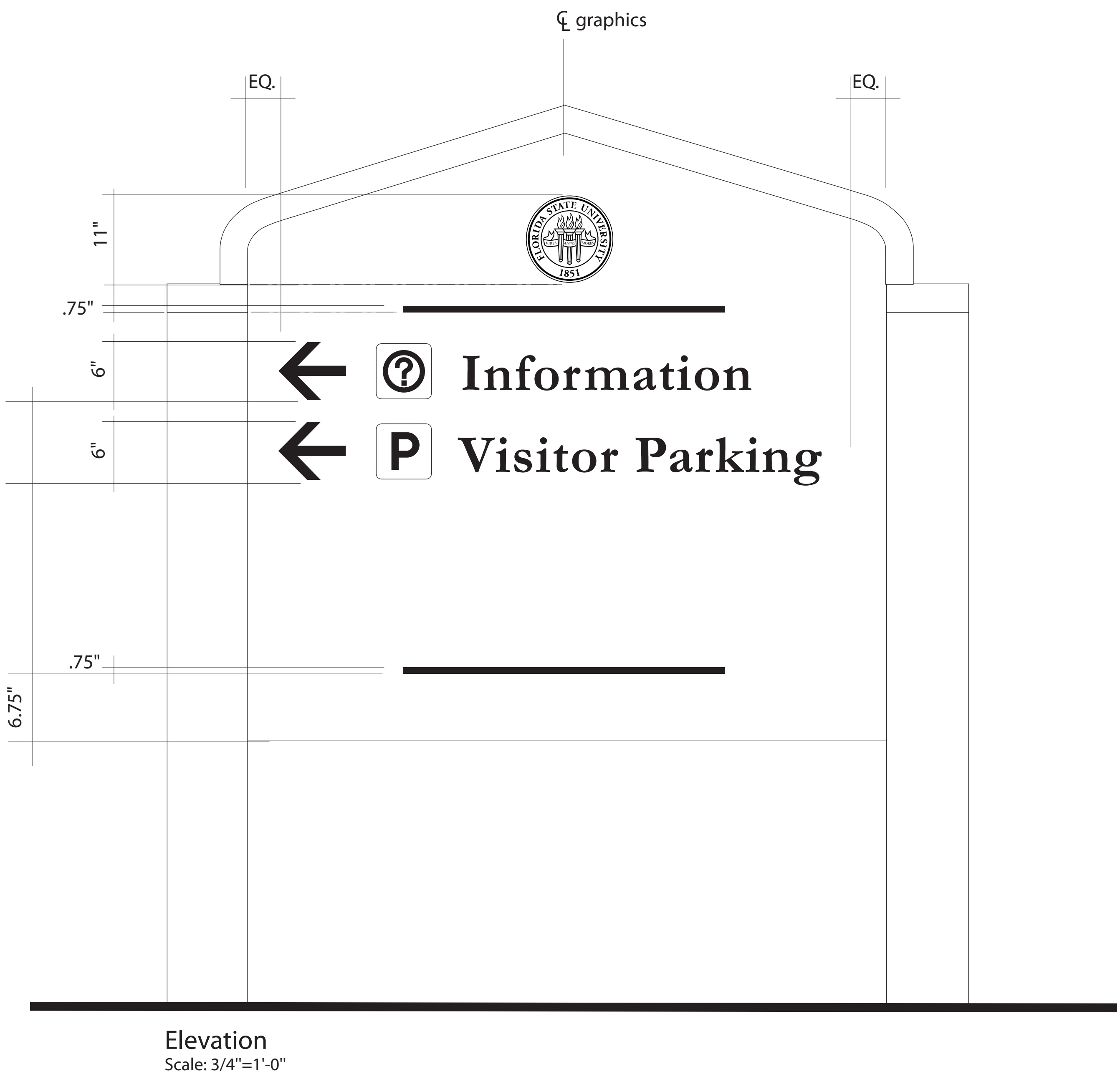
Refer to manual pages B 7.01 for graphics measurements, B 7.10 for placement guideline and B 7.20 for design intent drawings.



Plan

Elevation
Scale: 1/2"=1'-0"

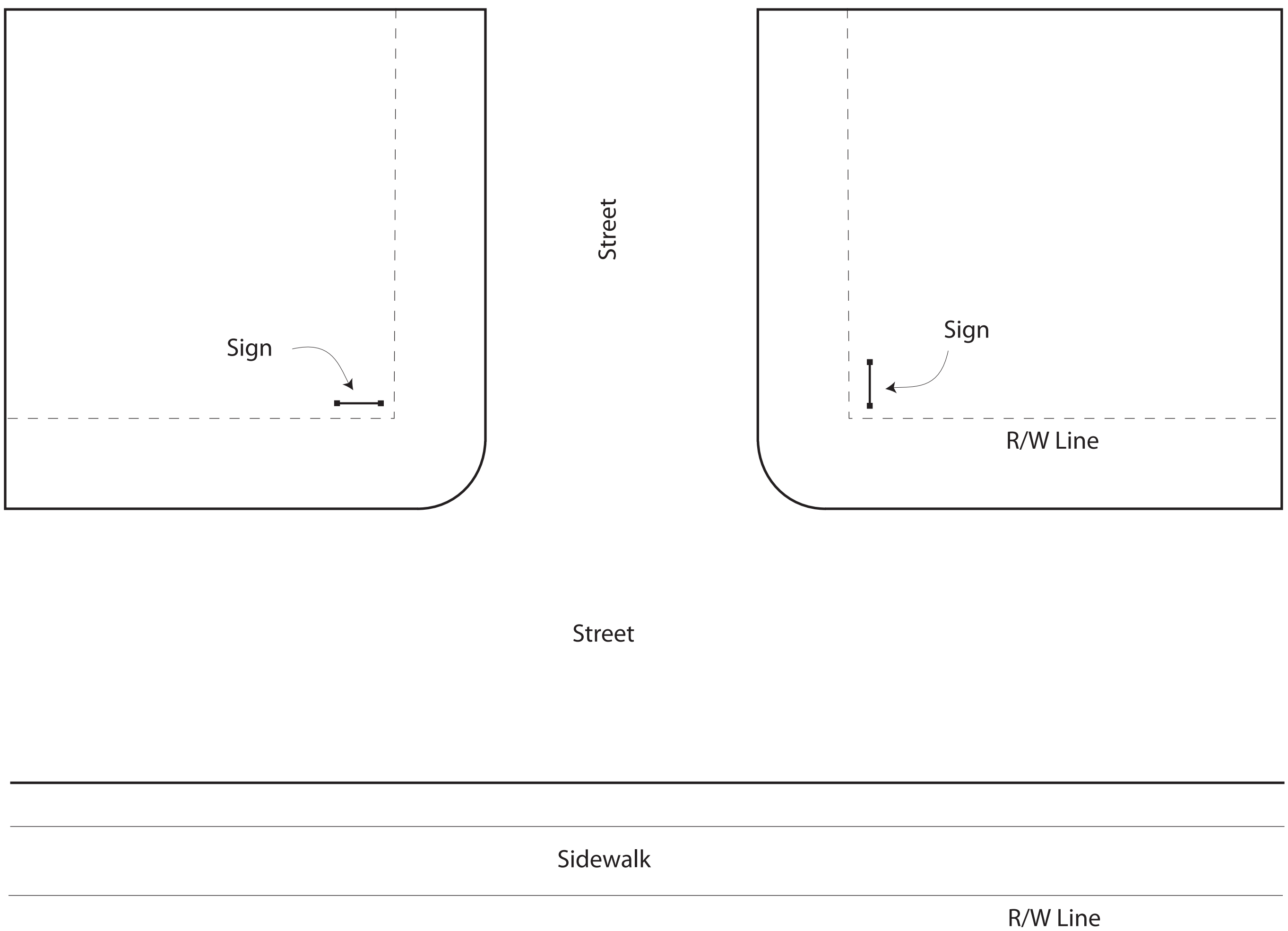
Profile



Elevation
Scale: 3/4"=1'-0"

Signs are to be positioned perpendicular to street from which they are to be viewed and behind street right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

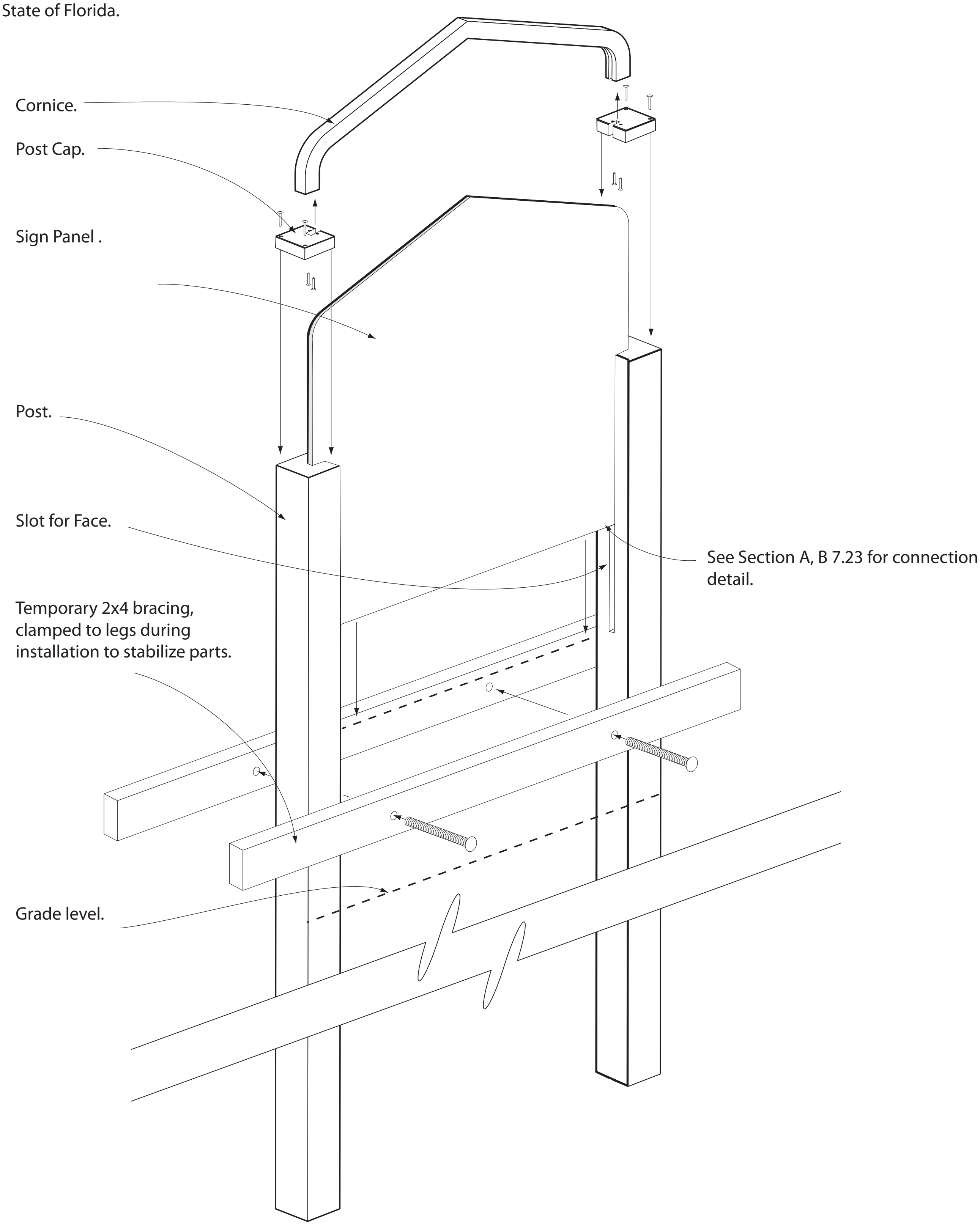
Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



Typical Plan

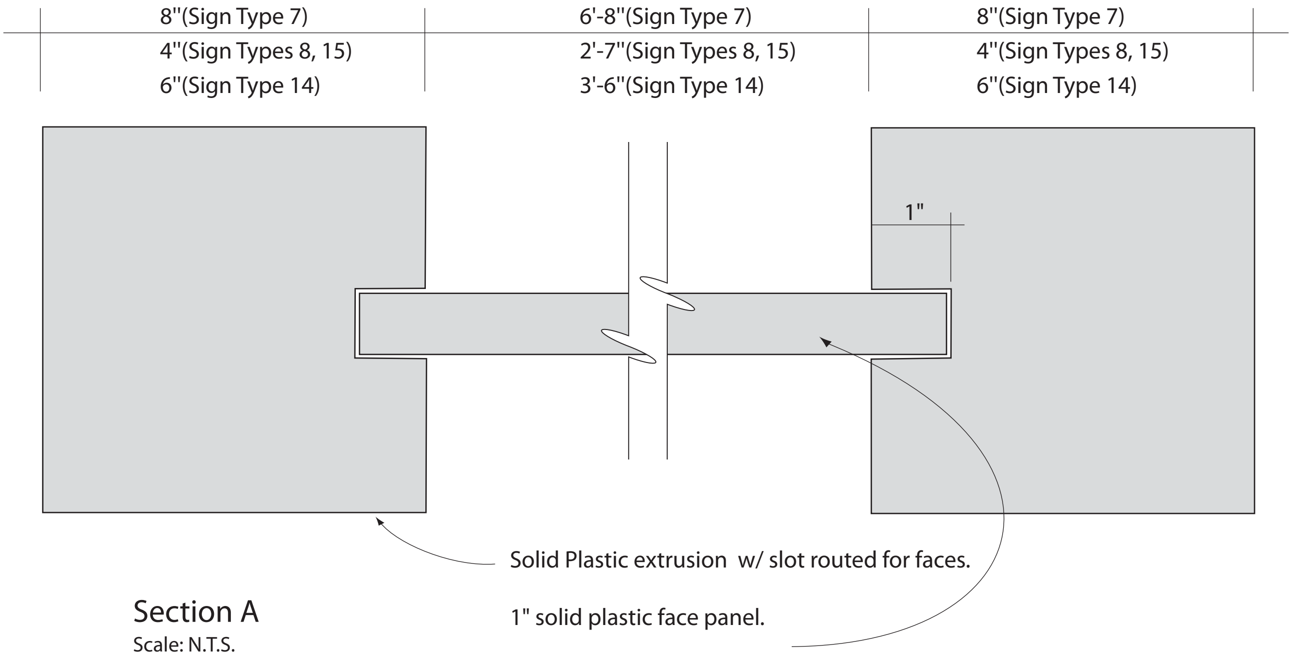
Scale: NTS

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

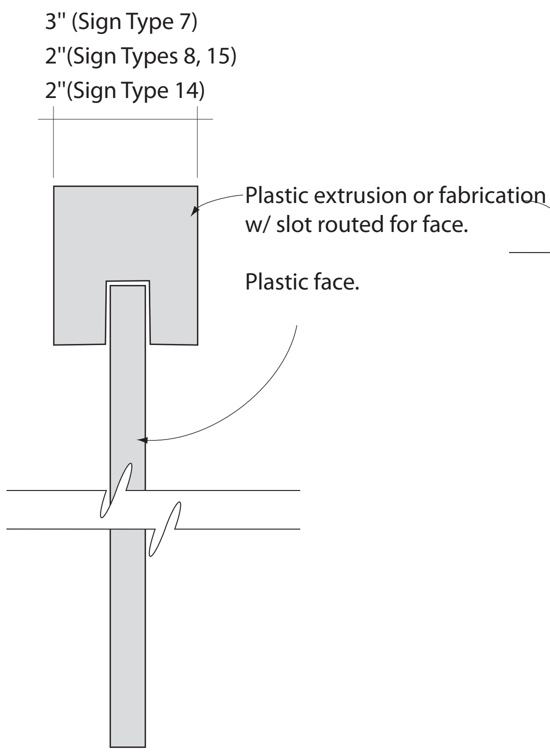


Exploded View
Scale: N.T.S.

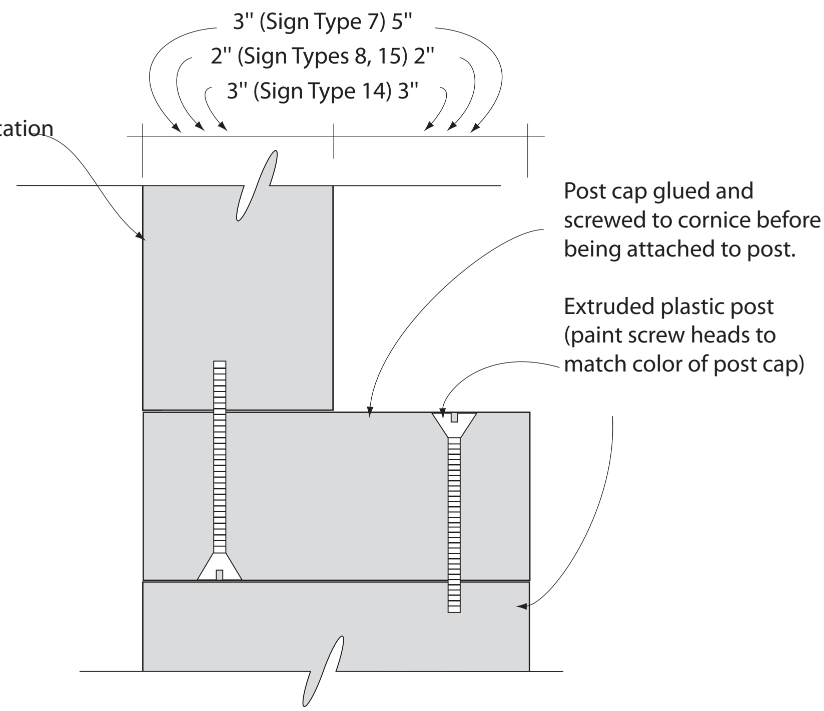
Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A
Scale: N.T.S.

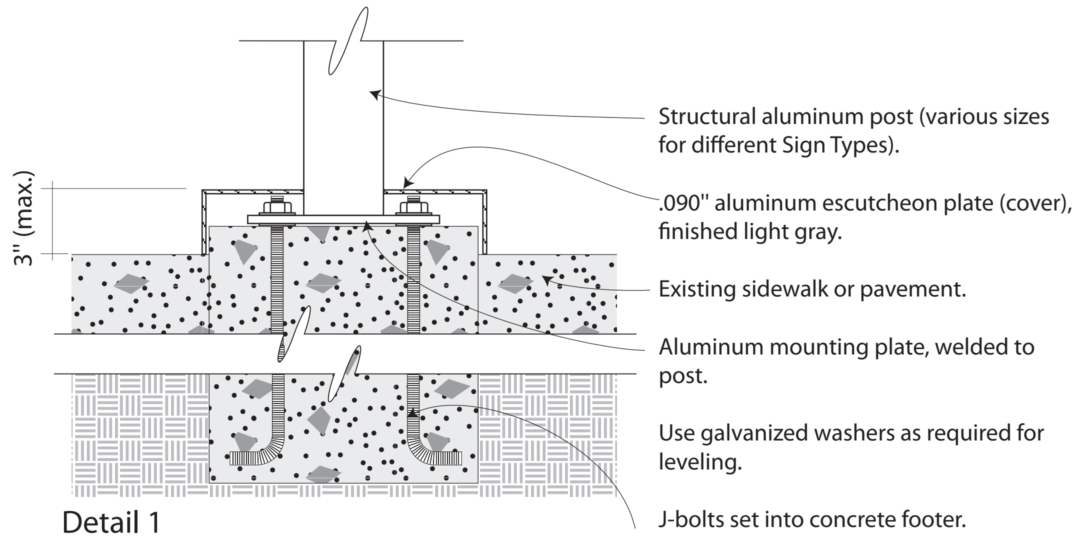


Section B
Scale: N.T.S.

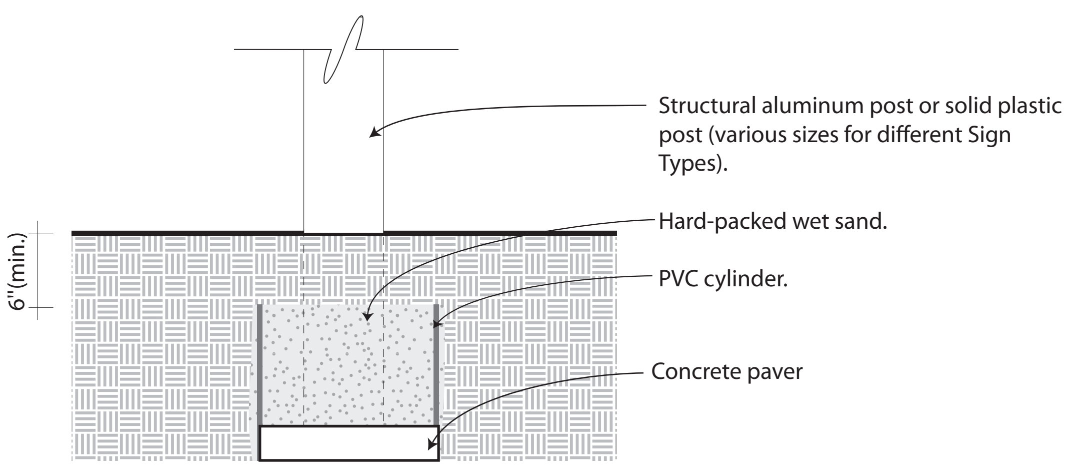


Section C
Scale: N.T.S.

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

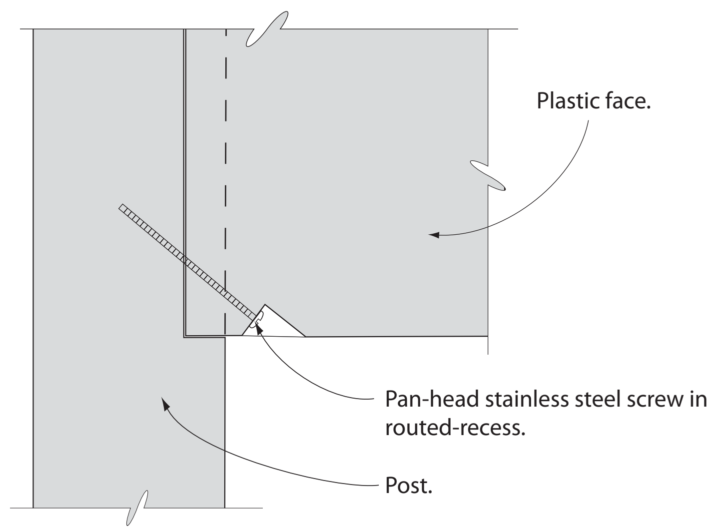


Detail 1
Scale: N.T.S.



Detail 2
Scale: N.T.S.

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

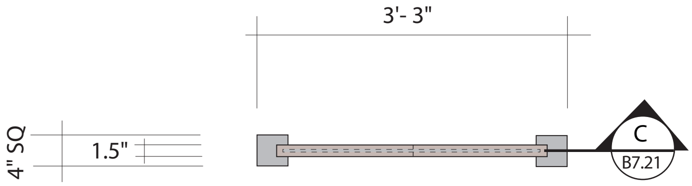


Section A
Scale: N.T.S.

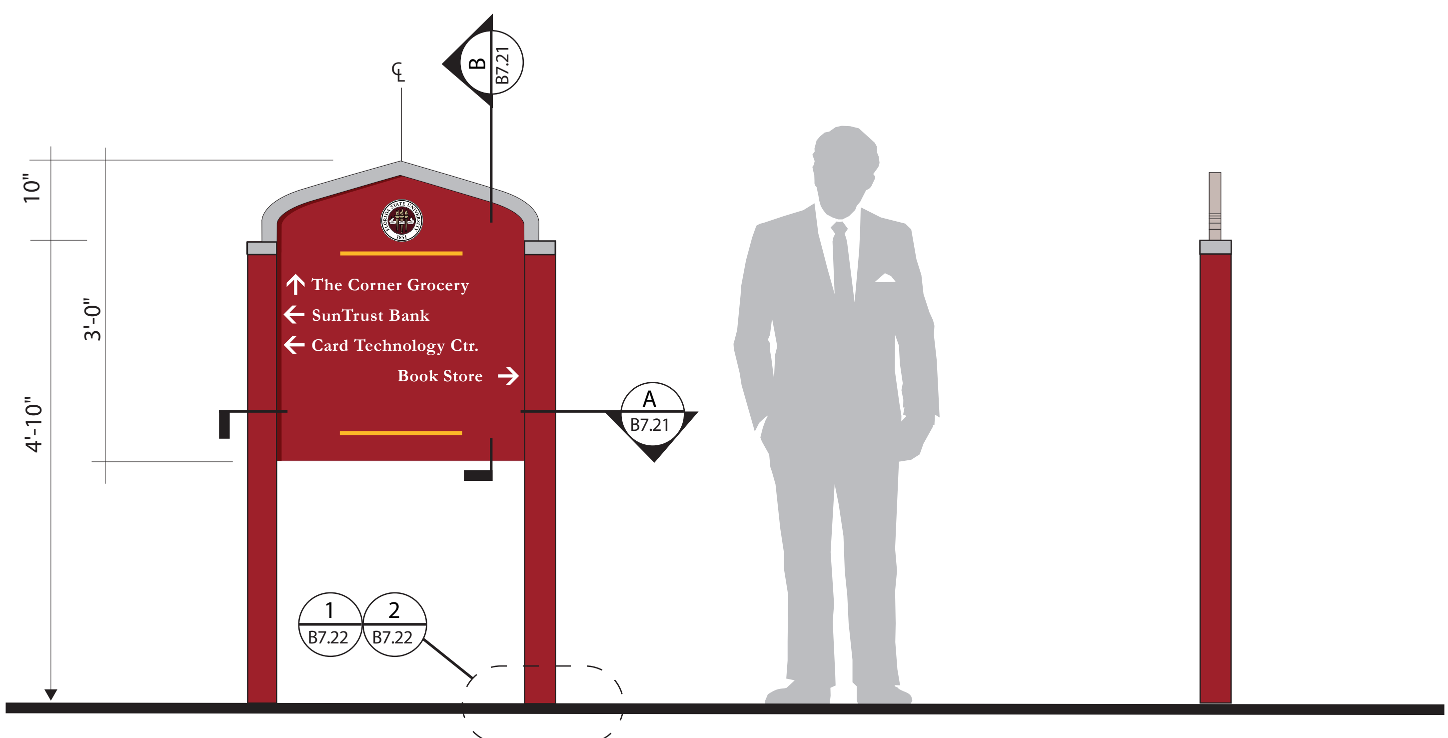
Small Building Identification Signs are scaled for pedestrian viewing and are recommended for placement along walkways. These non-illuminated signs can be single or double sided and display a maximum of five message lines per side.

Fabrication Guidelines: Posts, formed from solid plastic set into packed sand footings, burgundy posts and canyon granite caps; Graphics Panel, solid plastic-burgundy color; Cornice; formed solid plastic shape with caps, canyon granite color; Graphics, reflective sheeting, gold university symbol and rules, white message and arrows, white and black pictograms.

Refer to manual pages B 8.01 for graphics measurements, B 8.10 for placement guideline and B 7.20 for design intent drawings.

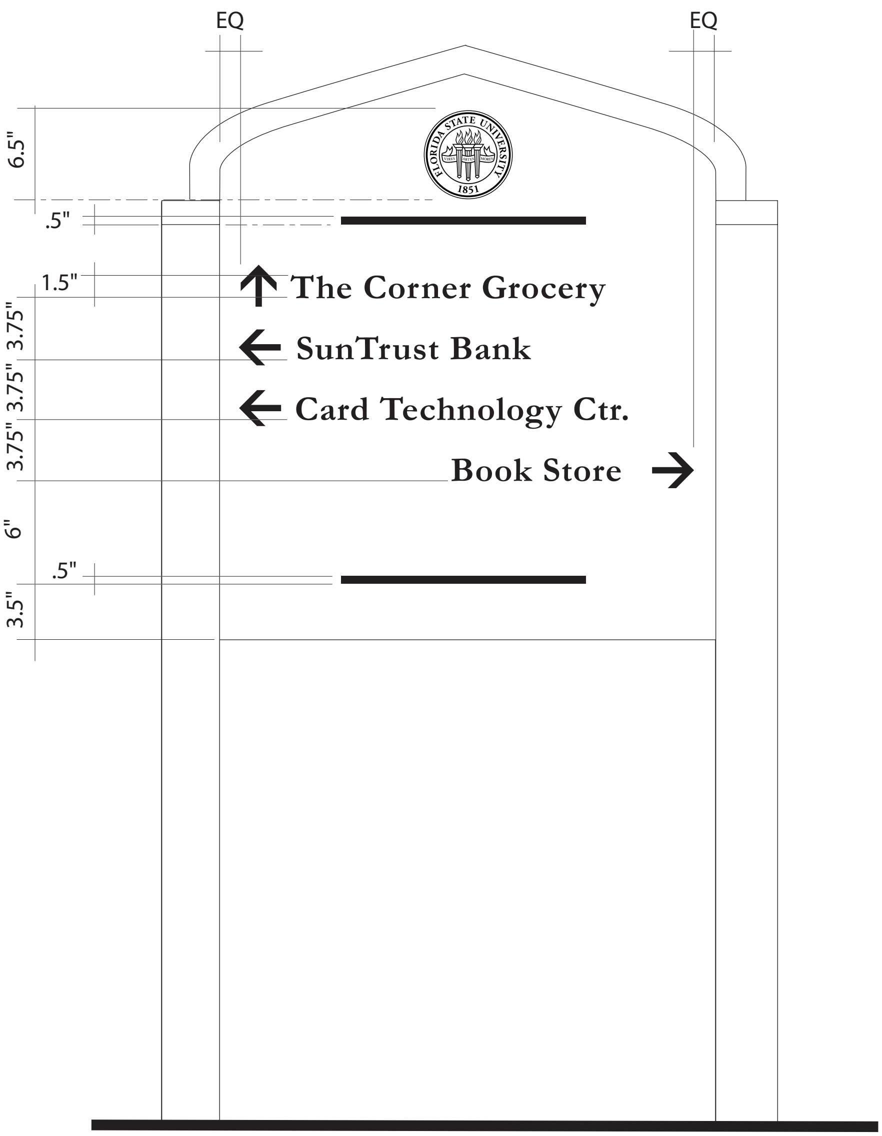


Plan



Elevation
Scale: 1/2"=1'-0"

Profile

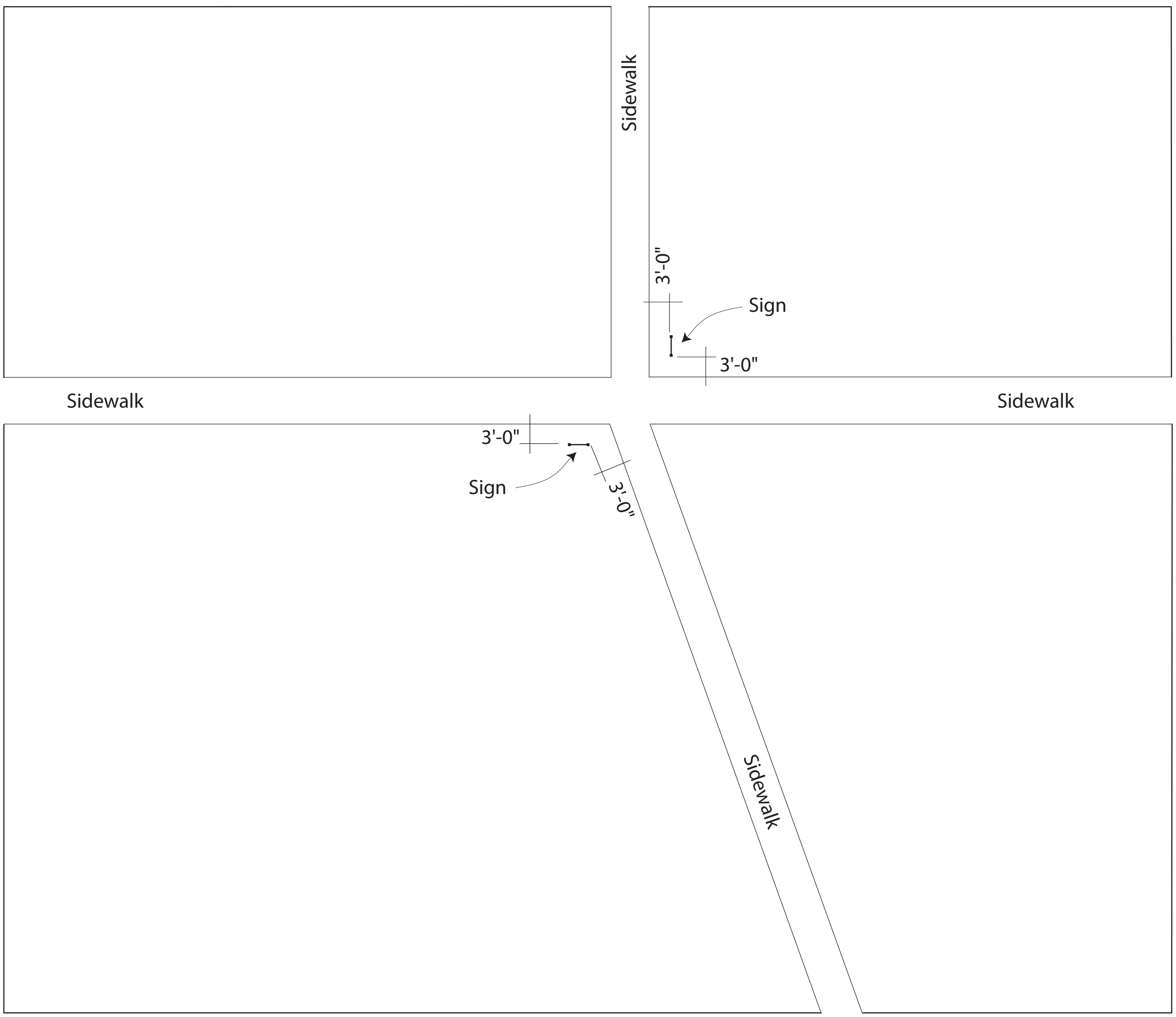


Elevation
Scale: 1"=1'-0"

Signs are to be located at primary pedestrian decision points and positioned perpendicular to the walkway from which they are to be viewed. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block them from viewers.

Since the location, quantity, and size of the signs may exceed local zoning ordinances, approval from the appropriate regulatory agency is recommended prior to fabrication.

It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximity prior to digging foundations.



Typical Plan

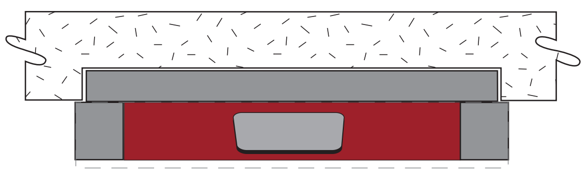
Scale: NTS

Interactive Information Kiosks are intended for use at sheltered pedestrian traffic decision points. They display overall campus and immediate area orientation maps, an on-line campus building/service directory accessed via a touchscreen monitor, plus an autodial telephone. Requires custom sofware.

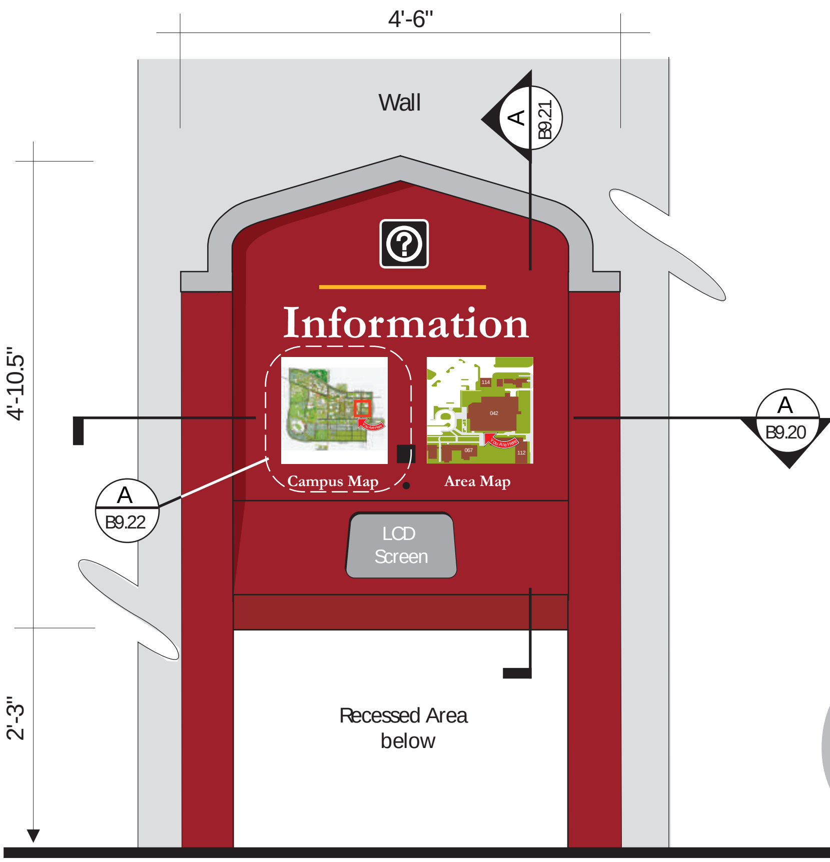
This sign type is intended to be installed into an existing wall having a recessed bottom space, as shown, for wheelchair access.

Fabrication Guidelines: Posts, extruded solid plastic-burgundy color; Graphics Cabinet, formed plastic with recessed pockets for maps, burgundy color, flush mounted to wall opening; Cornice; solid plastic section with caps, canyon granite color; Graphics, reflective sheeting, white and black pictogram, white messages, gold rule; Graphics Inserts, full color digital PSV prints adhered to second surface of clear polycarbonate cover; Monitor, active matrix thru glass LCD touch-screen hardwired to internal CPU and modem; Microphone and Speaker; flush mounted to vertical panel, internal modem.

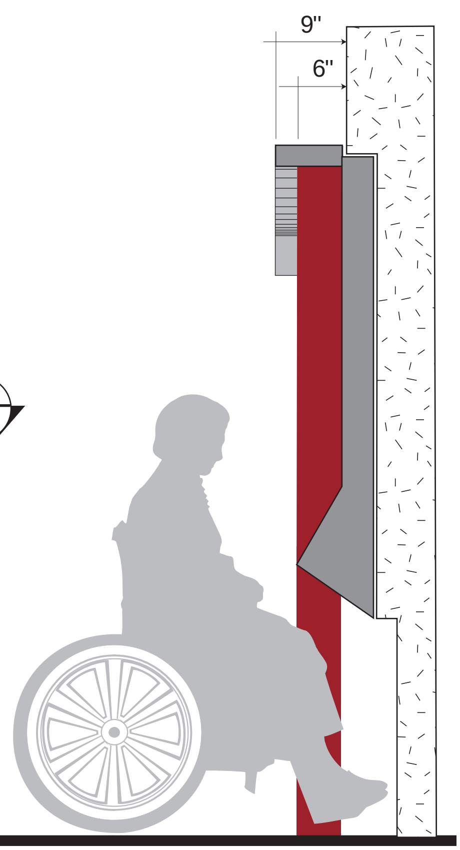
Refer to manual pages B 9.01 for graphics measurements, B 9.20 for design intent drawings, and B 9.22 for graphics insert dimensions.



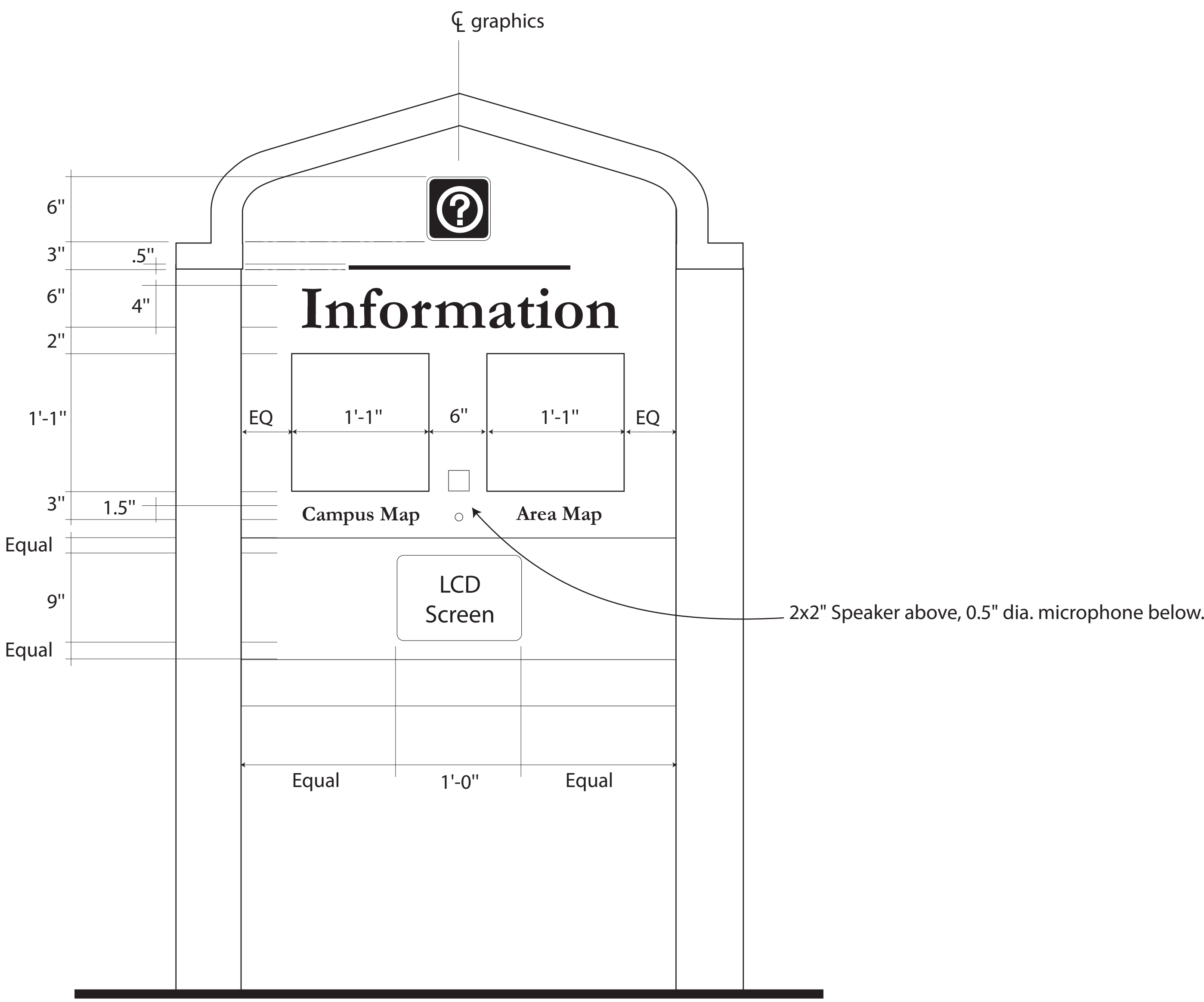
Plan Section



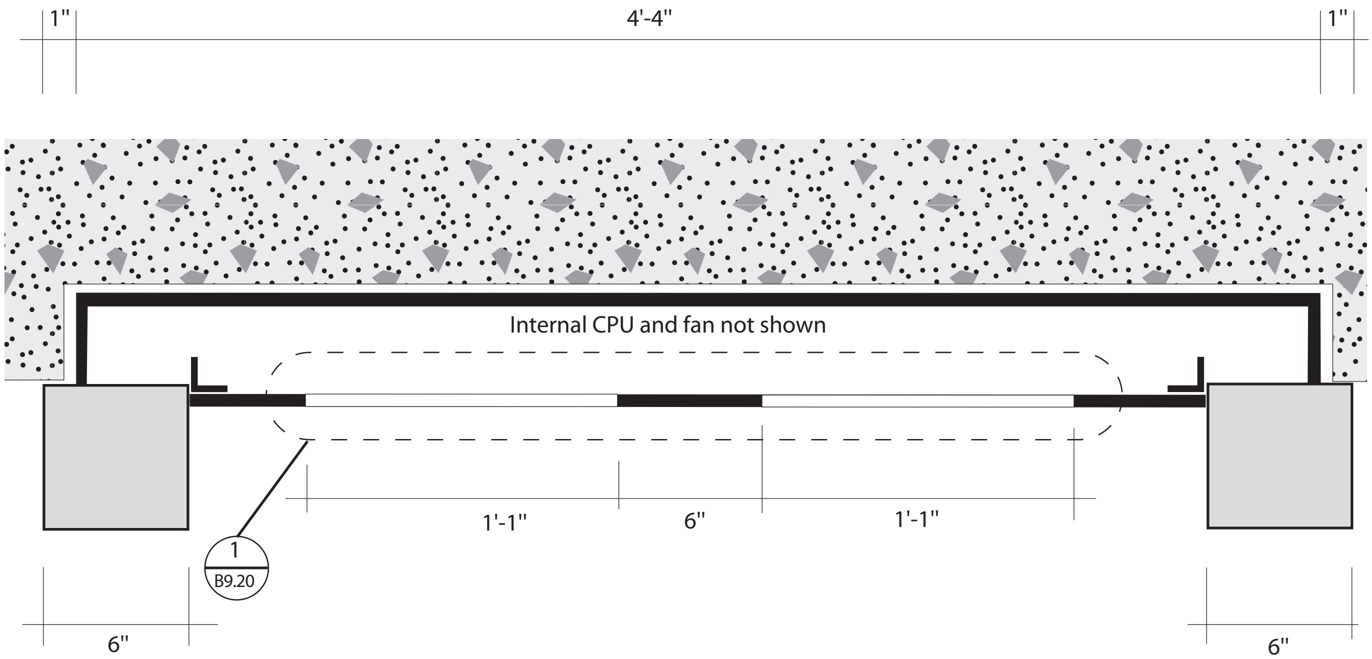
Elevation
Scale: 1/2"=1'-0"



Vertical Section

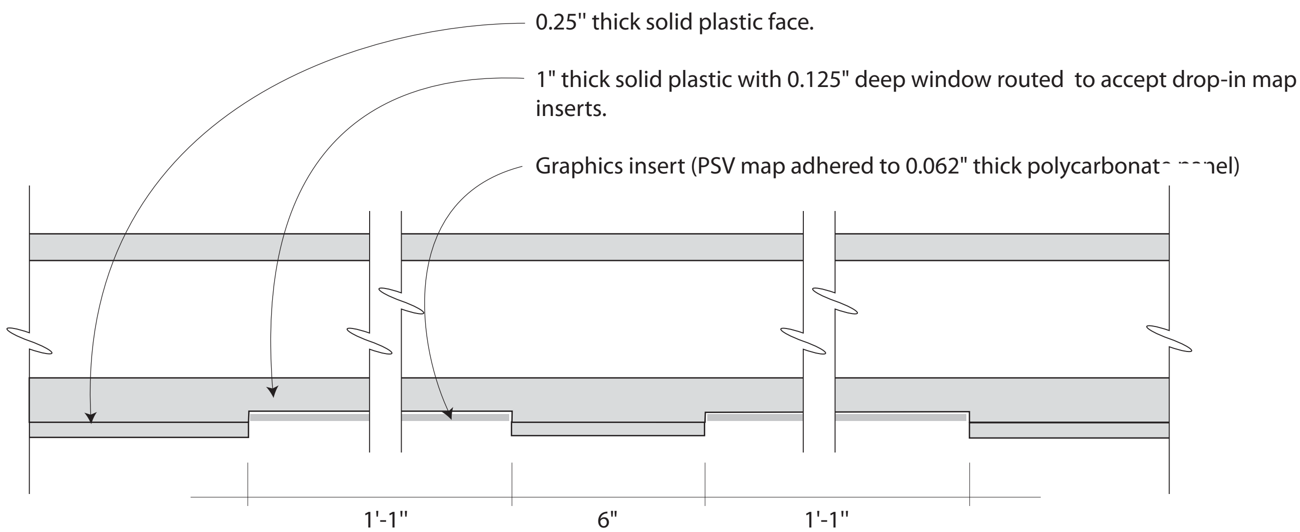


Elevation
Scale: 3/4"=1'-0"



Section A

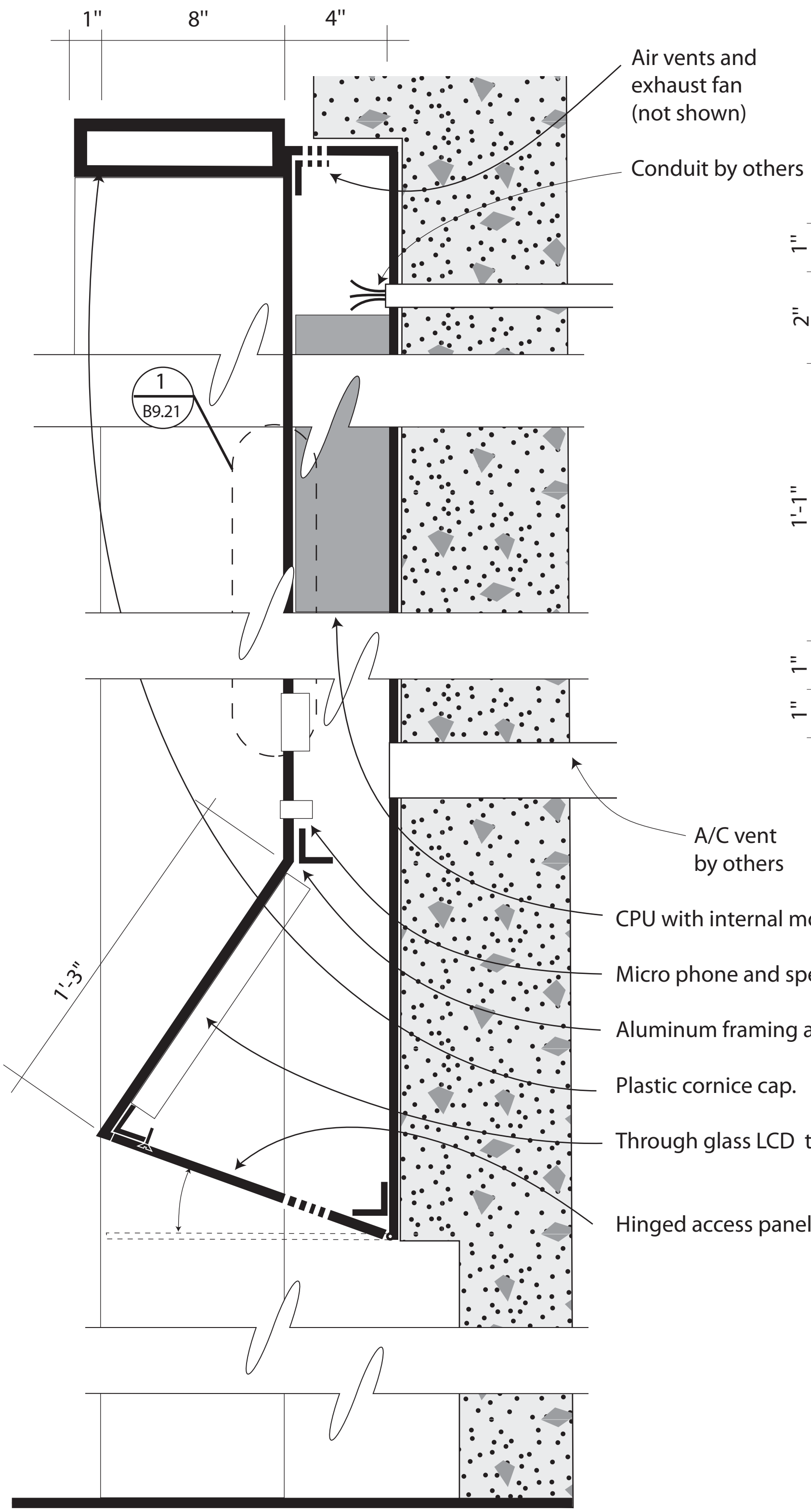
Scale: 1-1/2"= 1'- 0"



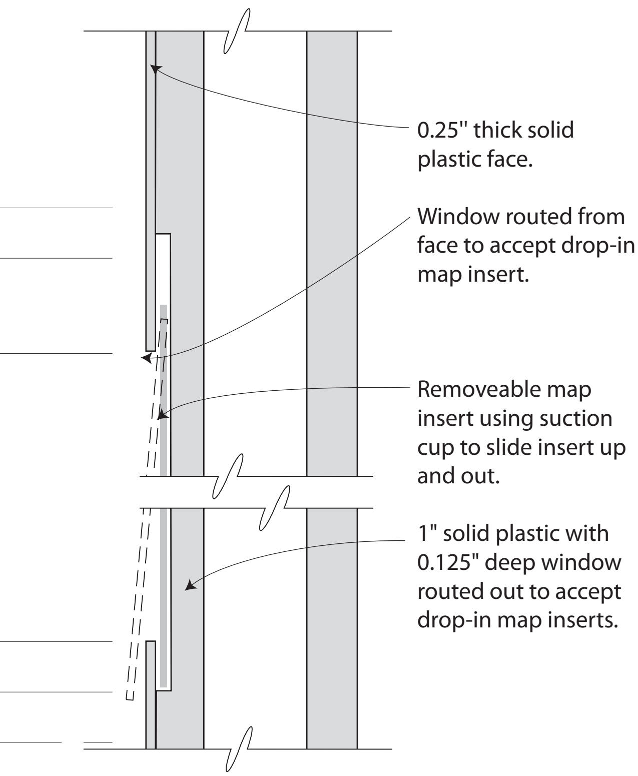
Detail 1

Scale: 3"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida. Required wiring and communication cables not shown.

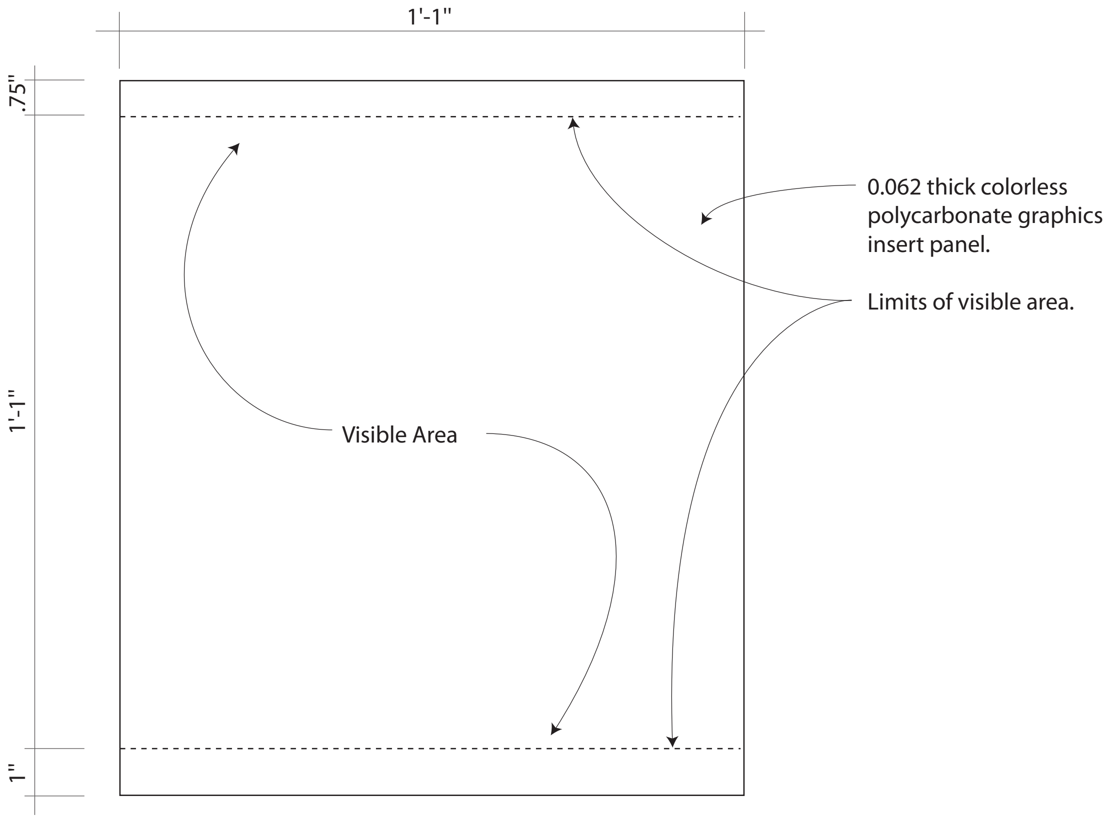


Section A
Scale: 1 1/2"=1'-0"



Detail 1
Scale: 3"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. Map artwork to be provided by Owner.

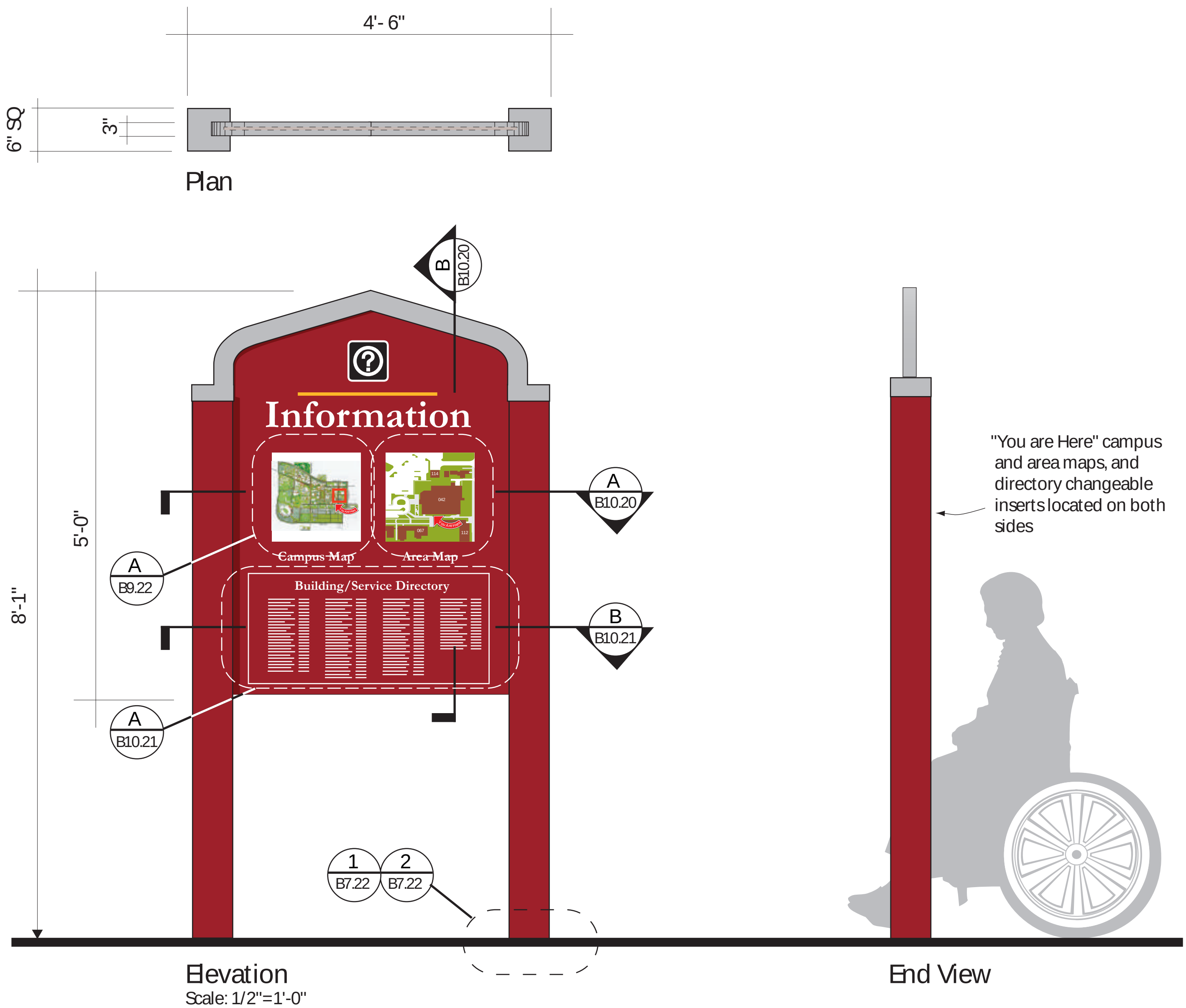


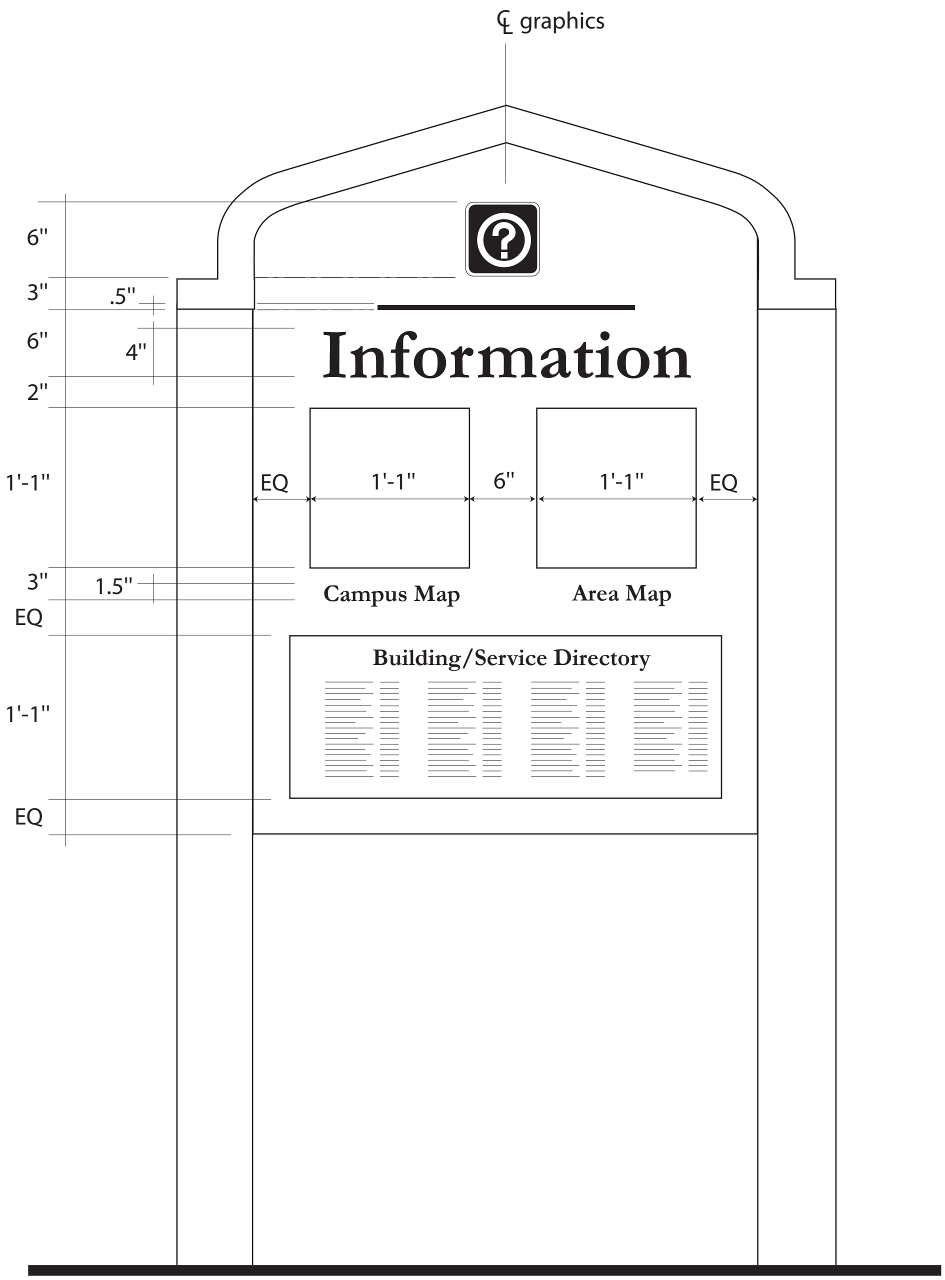
Layout A
Scale: 3"=1'-0"

Information Kiosks are intended for use at major pedestrian traffic intersections and decision points. These non- illuminated signs are double sided and contain changeable graphics inserts displaying "you are here" maps and building directories. Their purpose is to provide campus information and orientation.

Fabrication Guidelines: Posts, extruded plastic- burgundy color cored through concrete and set into packed sand footings; Graphics Panel, formed plastic with recessed pockets for maps, burgundy; Cornice; solid plastic section with caps, canyon granite color; Graphics, reflective sheeting, white and black pictogram, white messages, gold rule; Graphics Inserts, full color digital prints on PSV adhered to second surface of clear polycarbonate cover.

Refer to manual pages B 10.01 for graphics measurements, B 10.10 for placement guidelines, B 10.20 for design intent drawings, and B 9.22 and B 10.21 for graphics insert dimensions.



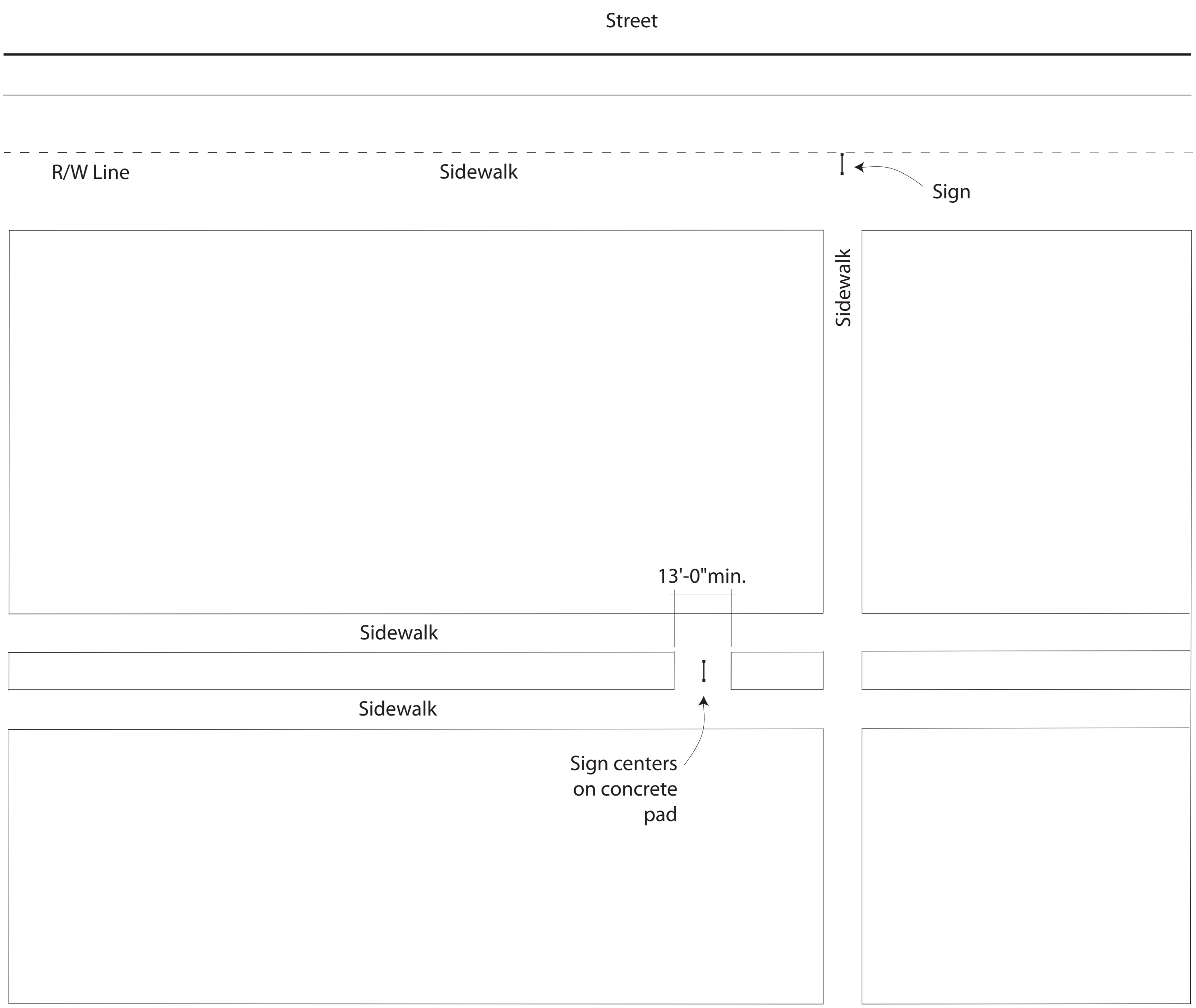


Elevation
Scale: 3/4"=1'-0"

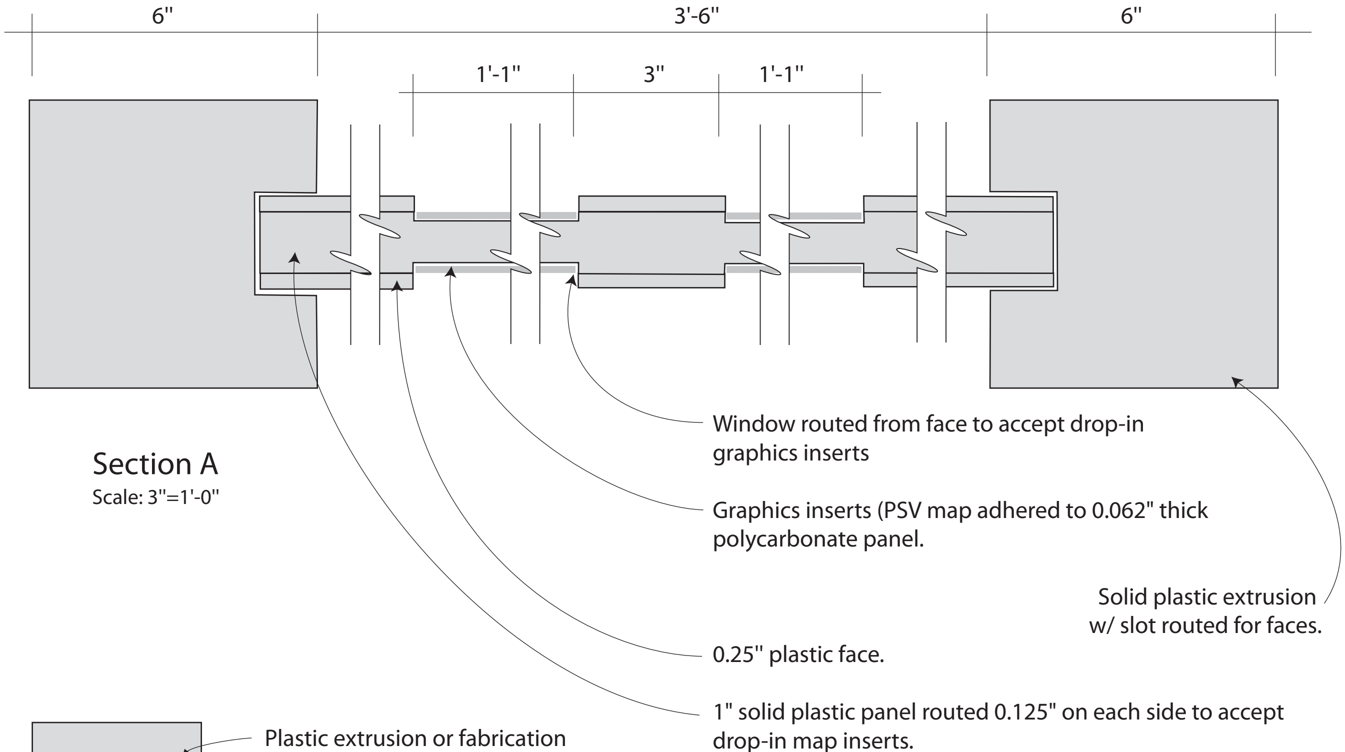
Kiosks are to be located in positions that will permit close viewing byboth abled and non-able bodied pedestrians. They need to be mounted to hard surfaces allowing wheelchair access. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block them from viewers.

Since the location, quantity, and size of the signs may exceed local zoning ordinances, approval from the appropriate regulatory agency is recommended prior to fabrication.

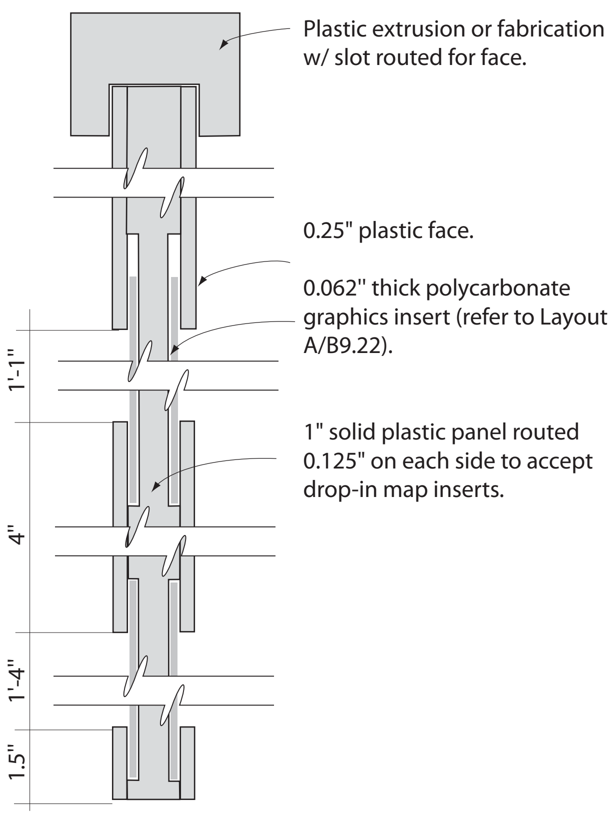
It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximity prior to digging foundations.



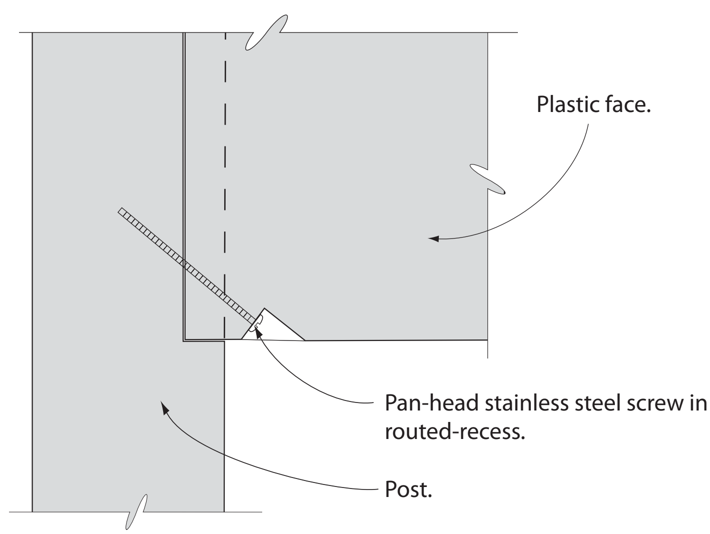
Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A
Scale: 3"=1'-0"



Section B
Scale: 3"=1'-0"

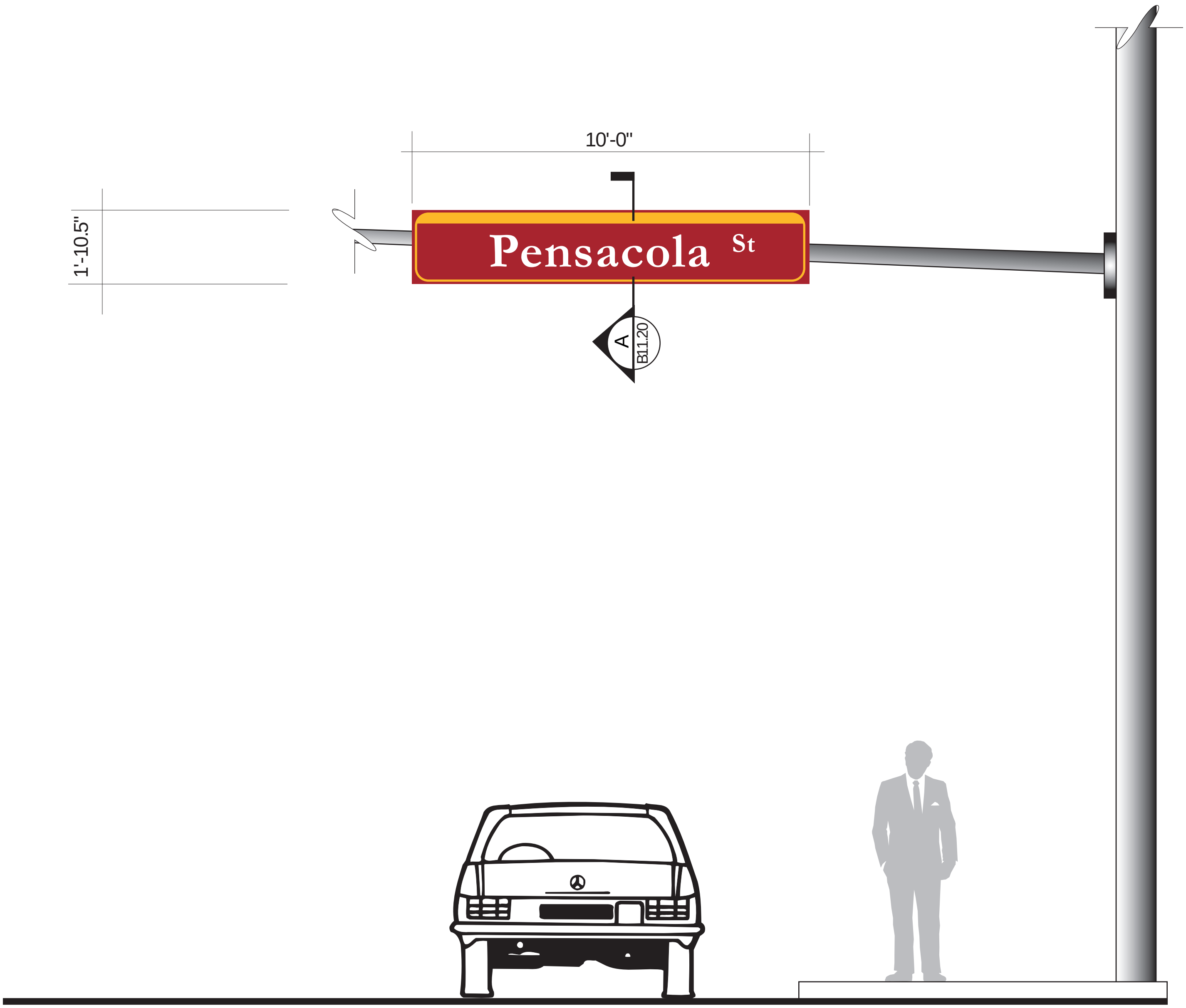


Section C
Scale: N.T.S.

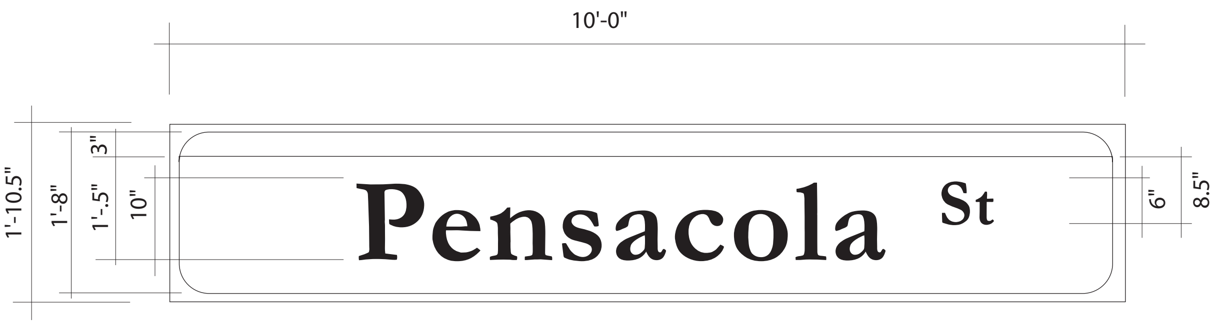
Street Identification Panels are to replace existing overhead panels and be mounted over the intersection on existing light standard arms. These non-illuminated signs consist of single sided panels that are mechanically mounted display either a one or two line streets name as shown.

Fabrication Guidelines: Graphics Panels, solid plastic plate-burgundy color attached to existing stanchion arm with adjustable metal straps; Graphics, reflective sheeting, white message, gold top band and border.

Refer to manual pages B 11.01 for graphics measurements, B 11.10 for placement guidelines, and B 11.20 for design intent drawings.



Elevation
Scale: 1/4"=1'-0"

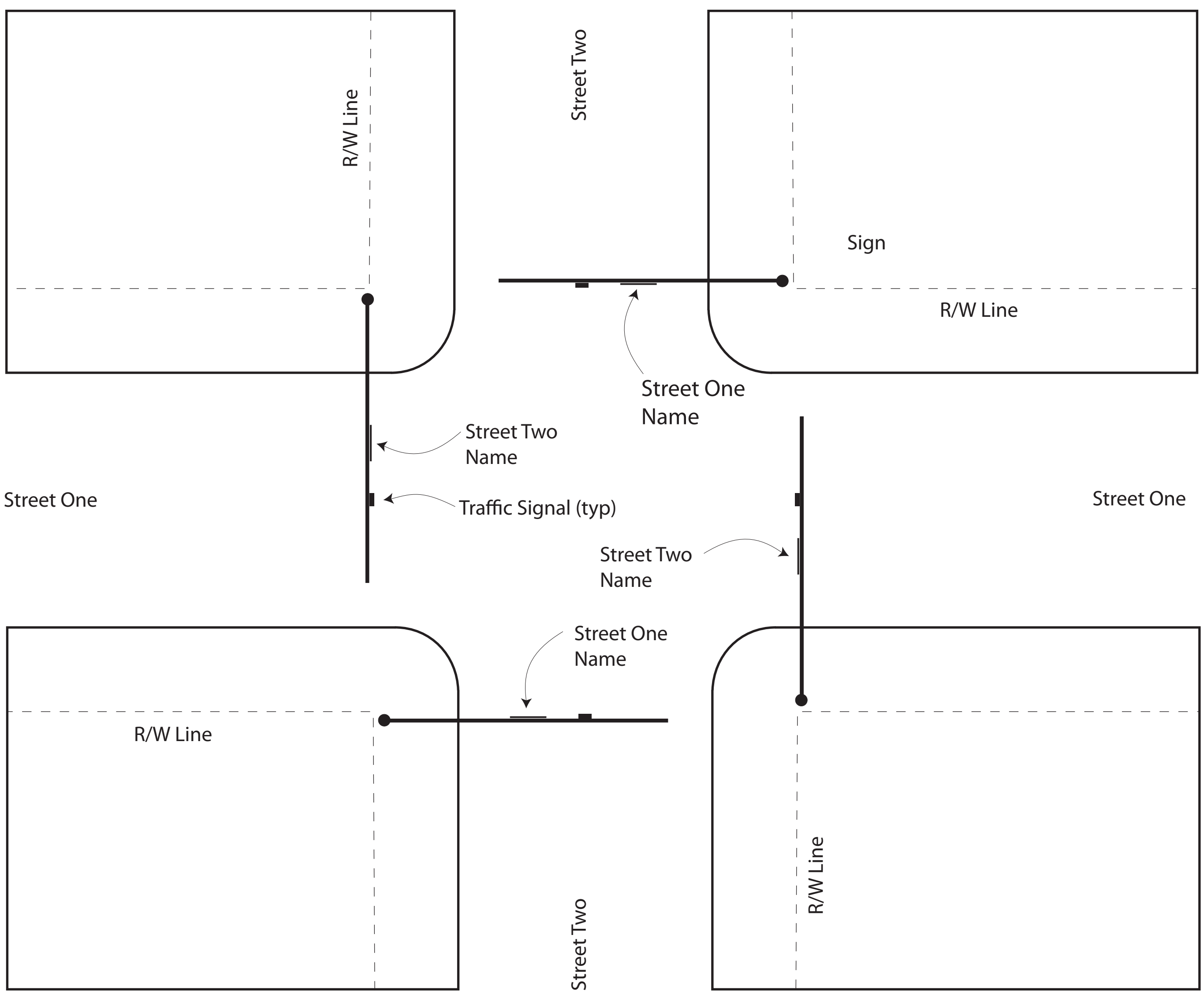


Elevation for Single Line Message
Scale: 1/2"=1'-0"

Elevation for Double Line Message
Scale: 1/2"=1'-0"

Signs are to be mounted to the intersection side of the arms of existing light standards and are to replace street identification panels provided by the City and/or the State. The purpose of these signs is to mark University boundaries at major inter-sections.

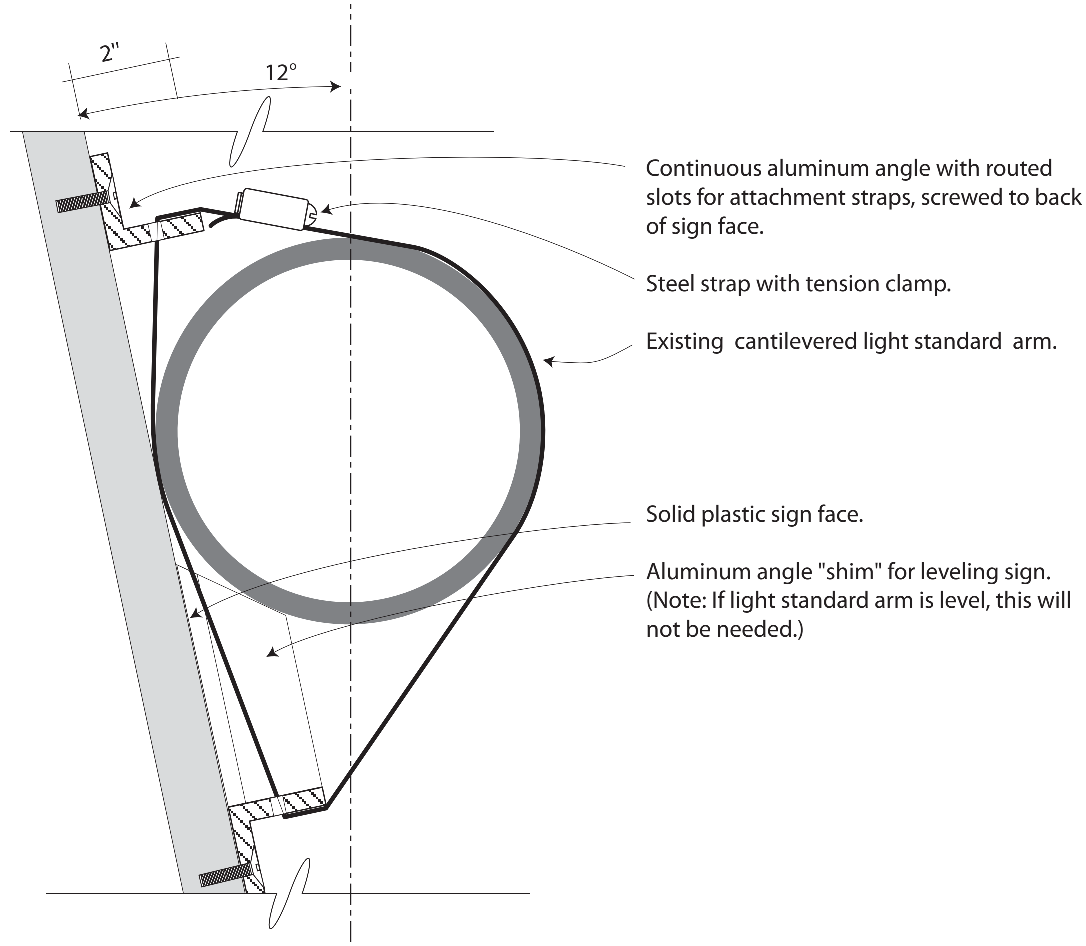
Since these signs are replacing existing signs and are located over City and/or State right-of-ways, approval to install these signs is recommended from the appropiate regulatory agencies prior to fabrication.



Typical Plan

Scale: NTS

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

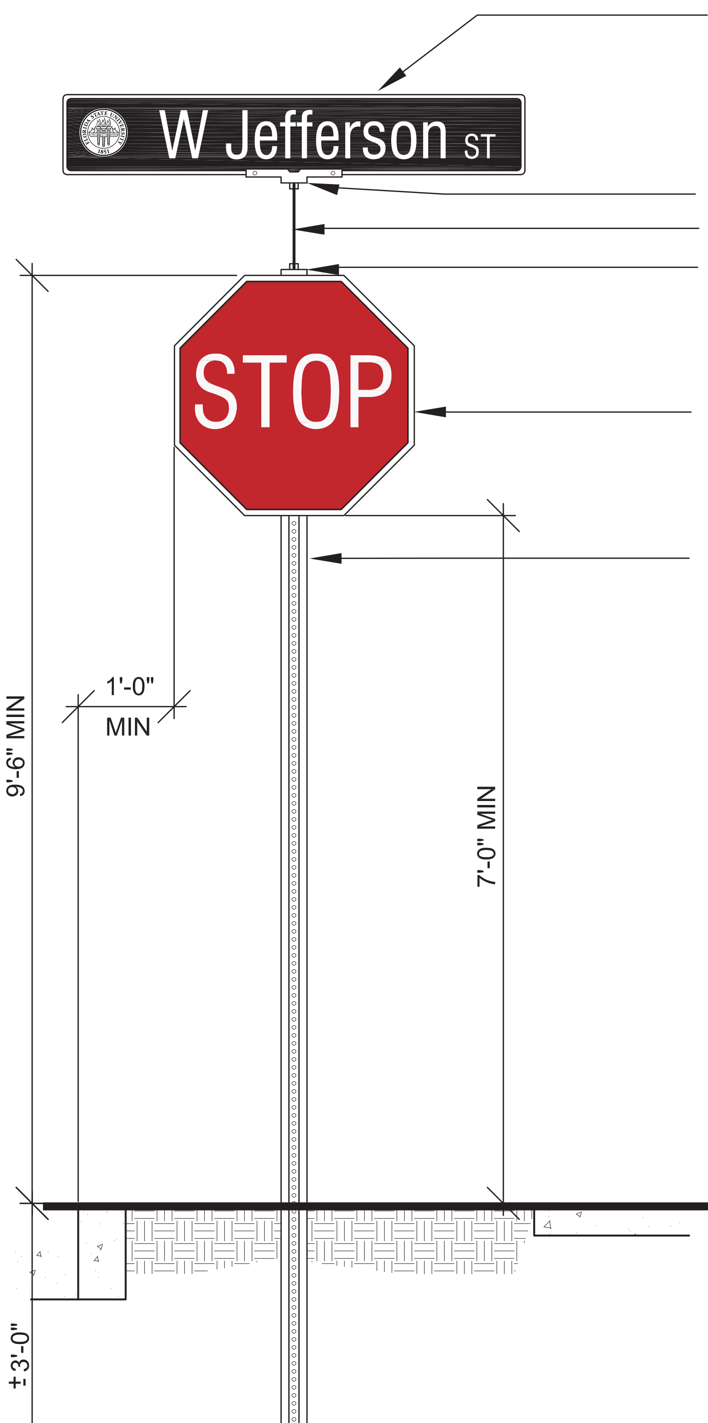


Section A

Scale: 3"=1'-0"

Street Indentification Signs are used throughout the campus to name all vehicular and pedestrian traffic thoroughfares These non-illuminated signes are double sided and can display two single line street names on separate panels set perpendicular to each other.

Fabrication Guidelines: Post, steel u-channel with powder coat black paint finish Graphics Panels, aluminum - black color; Graphics, reflective sheeting, white messages, FSU seal decal. Refer to manual pages B 12.01 for graphics measurements, B12.10 for placement guidelines.



.80 GA aluminum sign

9" flat cross piece bracket, Tapco No.203-00003

.80 GA aluminum sign

9" flat u-channel bracket cap, Tapco No.203-00023

30" DIA. Stop sign, back to have premium vinyl black finish. Comply with MUTCD standards.

12'-0" steel rib-bak u-channel post by Nucor Steel Marion, Inc or approved equal. Post to be powder coated black finish. Post should be driven into the ground a minimum of 1/4 of the overall length. Comply with manufacturers recommendations for linear weight, provide min. 2 1/2 plf.

Notes:

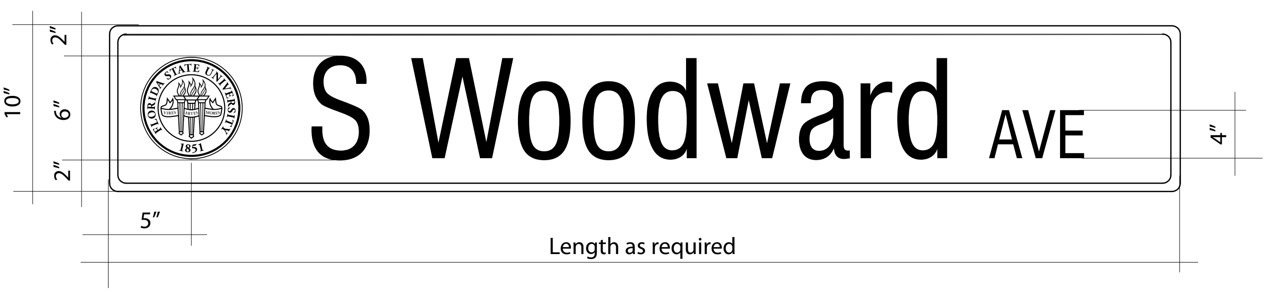
1. Brackets are 9" in width for signage 5'-0" and less. If signage is greater than 5'-0" in length, 12" brackets should be used:

   12" flat u-channel bracket cap, Tapco No. 037-00222
   12" flat cross piece bracket, Tapco No. 037-00226

2. The lower street ID sign will typically be oriented perpendicular to the orientation of the stop sign. The upper street ID sign will be oriented parallel to the orientation of the the stop sign. In the event one sign is substantially larger than the other, the shorter sign shall be placed on top.

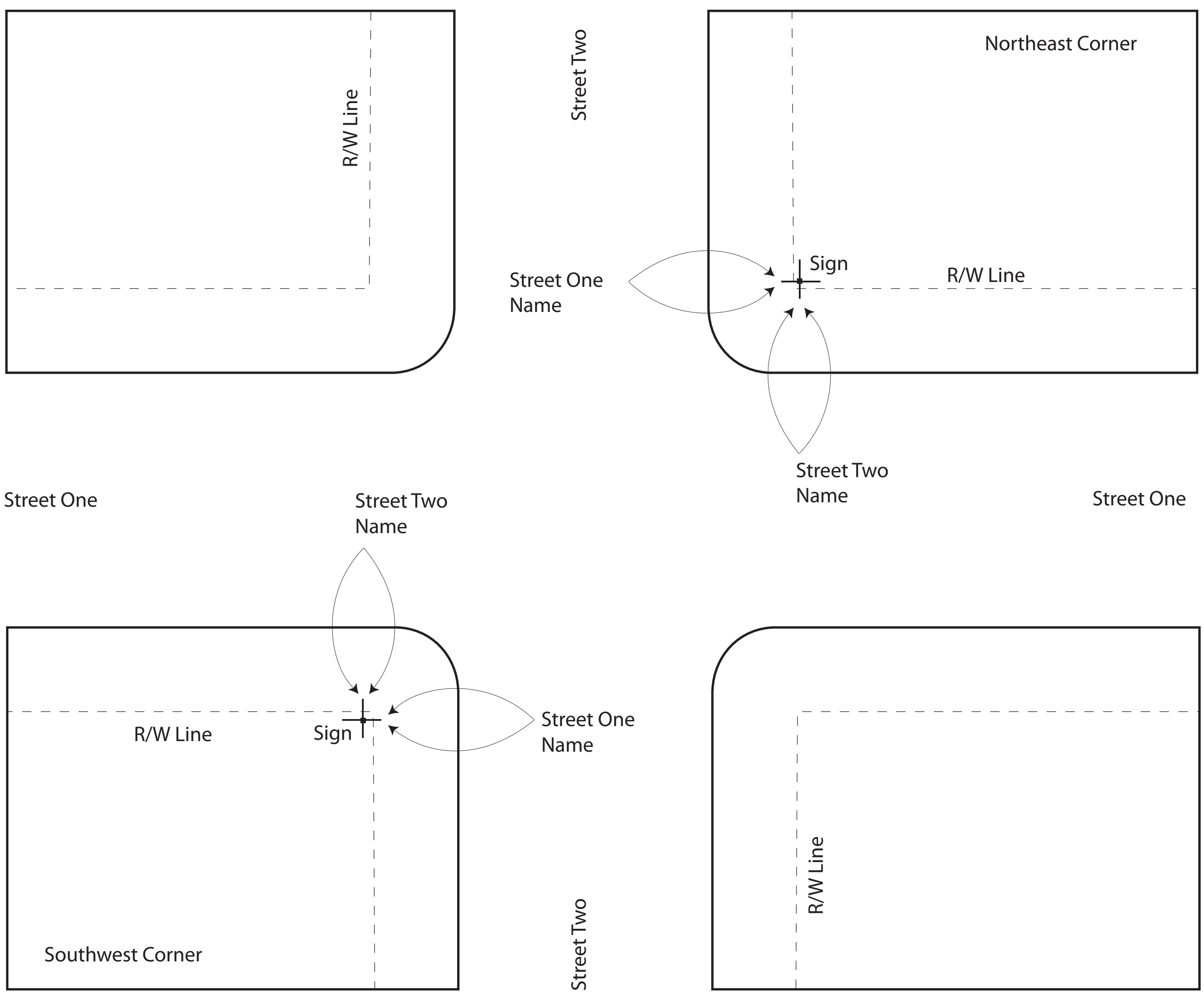
Elevation
Scale: 1/2"= 1'-0"

Font to be Swiss 721 CN BT, upper & lower case.



Signs are to be located consistently on the NE and SW corners of the street intersection with sign panels positioned parallel to the street that the sign is identifying. Sign posts are to be located behind street right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

Since these signs may replace existing street identification signs installed by the City, approval to replace existing City signs is recommended prior to fabrication.



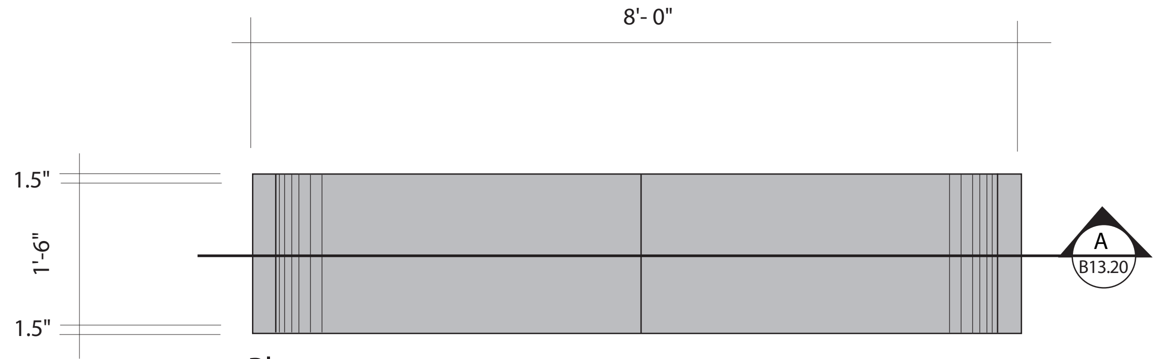
Typical Plan

Scale: NTS

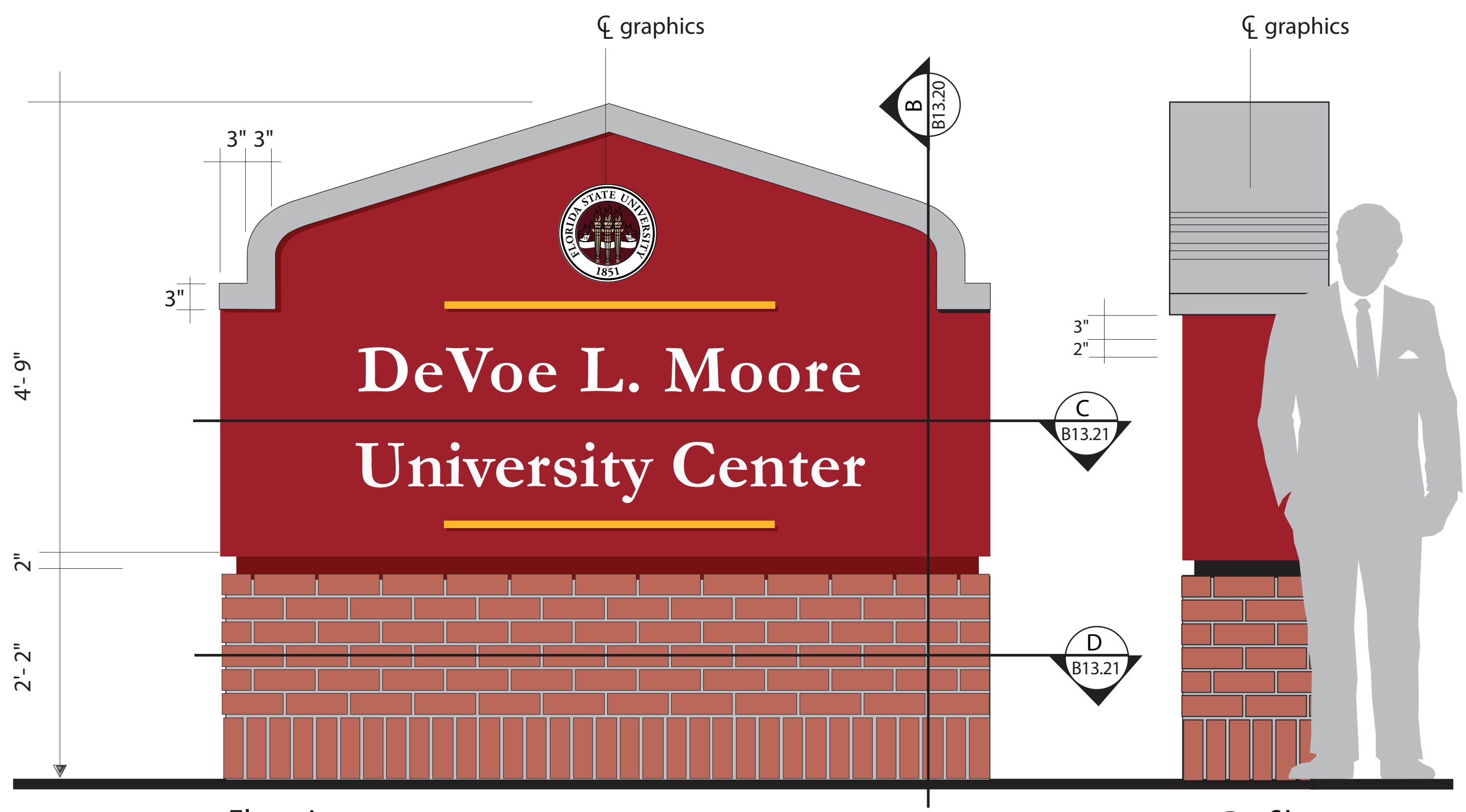
Type 13 signs are intended for identifying building clusters, major campus areas, and quadrangles located along vehicular routes or as subject to approval by Administration. Signs may be single sided or double sided, internally illuminated or non-illuminated. If illuminated, only the message is to be lit.

Fabrication Guidelines: Base, CMU substrate with face brick veneer; Foundation, formed concrete footing; Sign Cabinet, formed aluminum with garnet polyurethane finish and internal structure with internal light track behind copy; Cornice, formed aluminum with light gray textured coating; Graphics; reflective sheeting, gold university symbol and rules; Interior Illumination, 277v., white message; Lamps,
H.O. fluorescent daylight.

Refer to manual pages B 13.01 for graphic measurements, B 13.10 for sign placement guidelines, and B 13.20 for design intent drawings. Refer to A 2.10 for illuminated signs letter spasing.

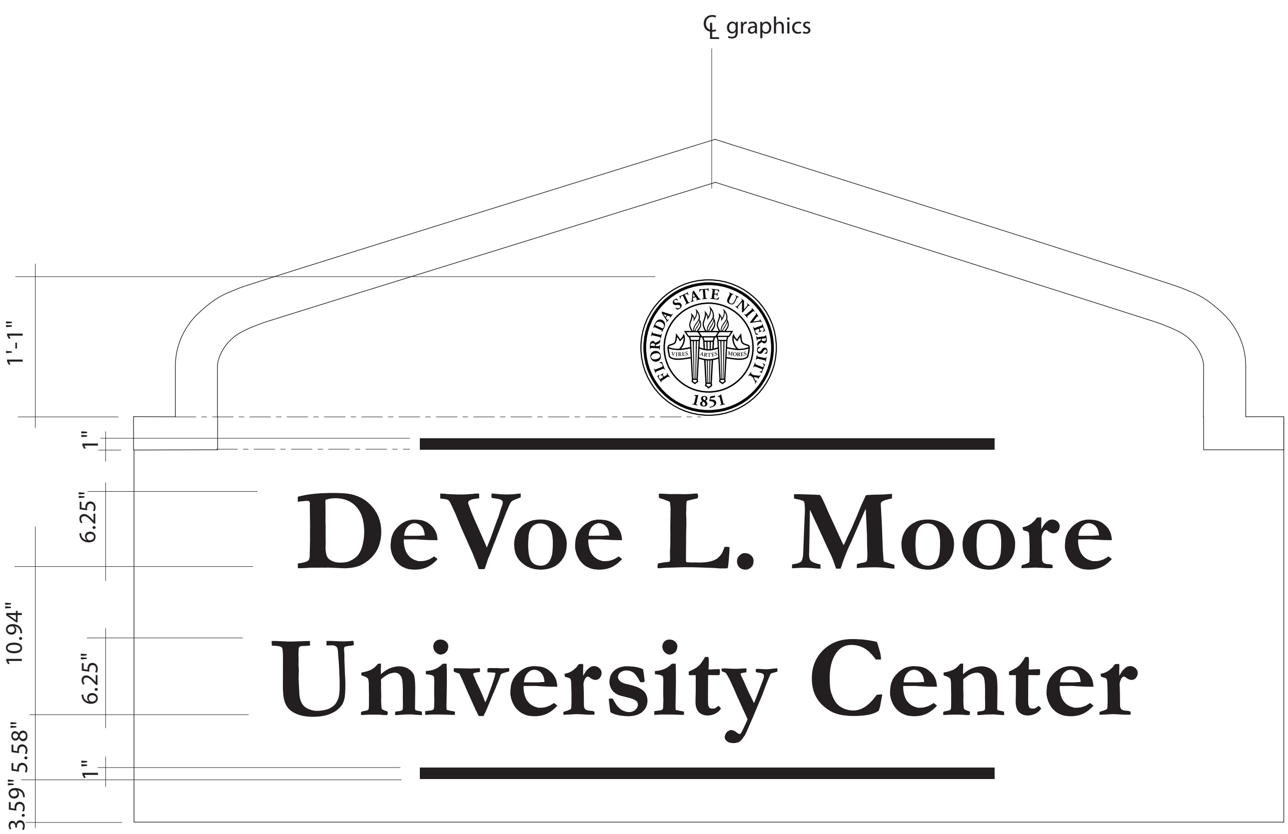


Plan

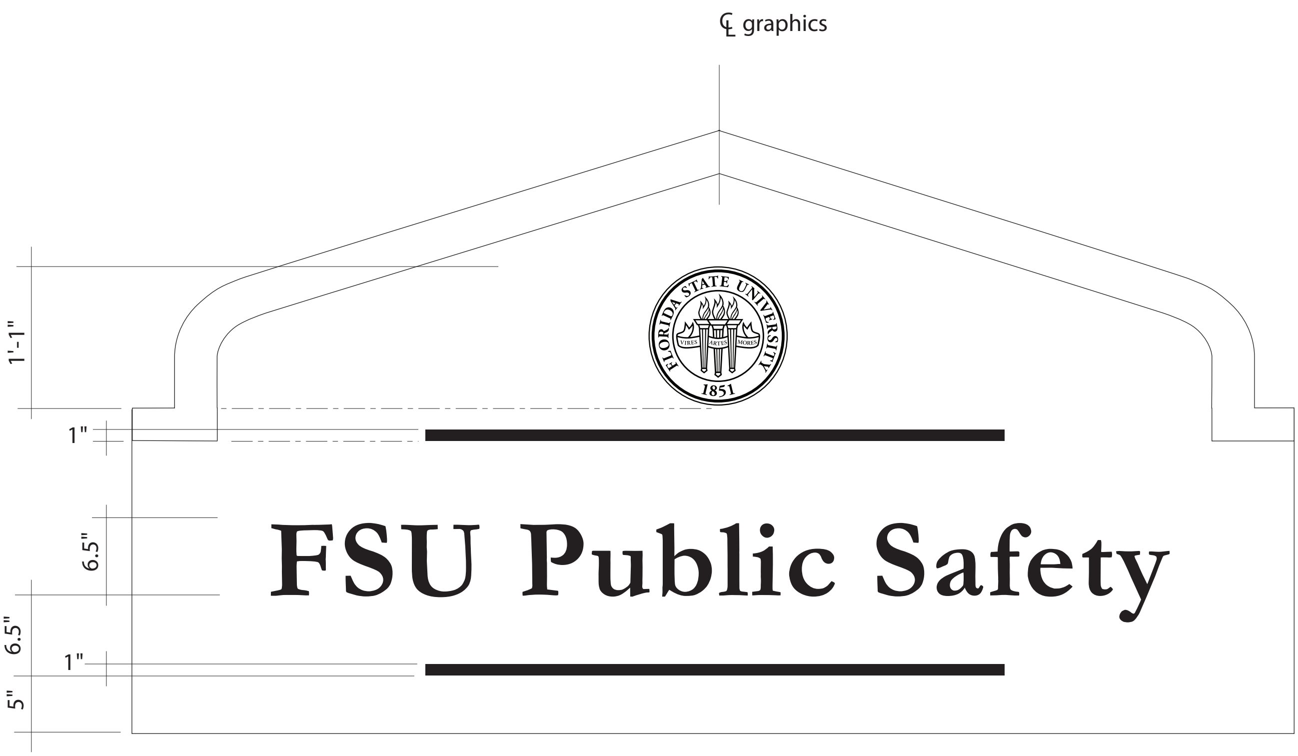


Elevation
Opposite side similar
Scale: 1/2" = 1'-0"

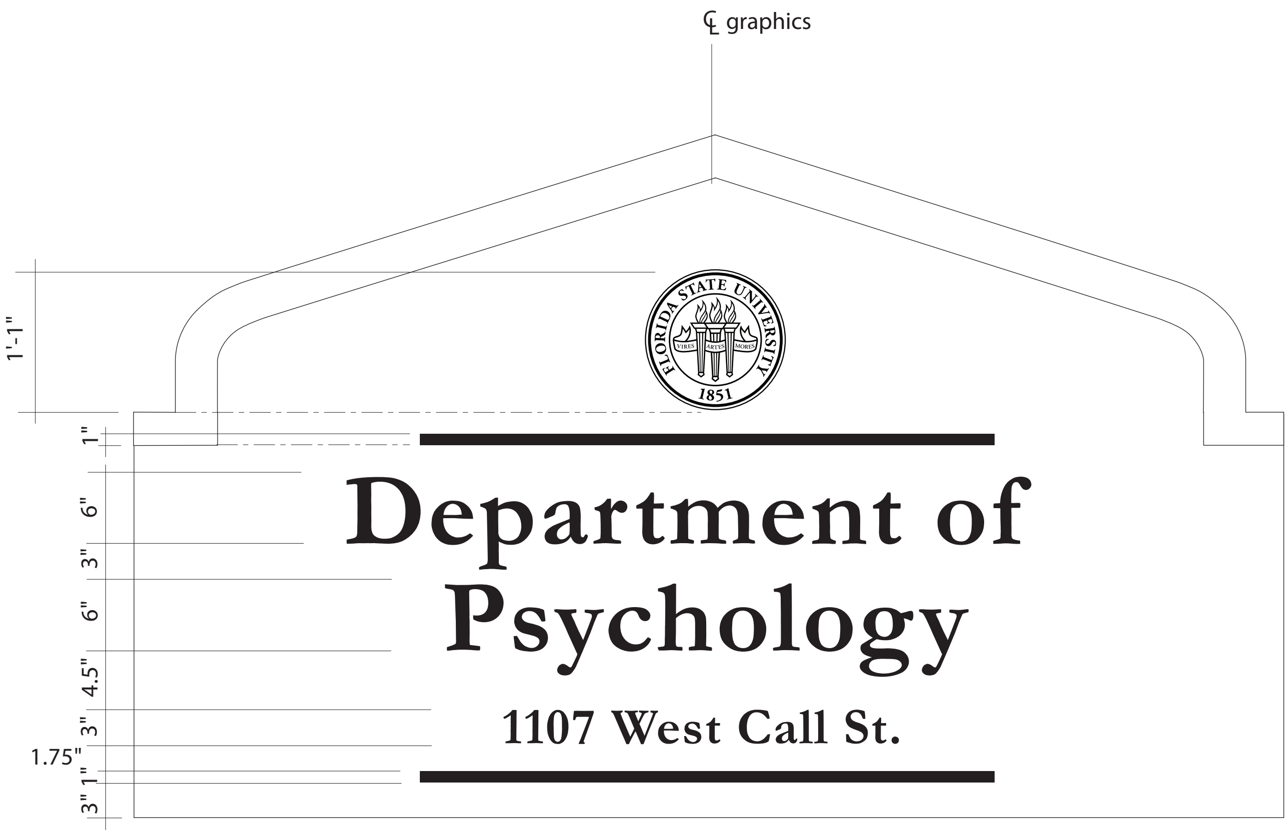
Profile
Number faces street



Elevation
Scale: 3/4"=1'-0"



Elevation
Scale: 3/4"=1'-0"



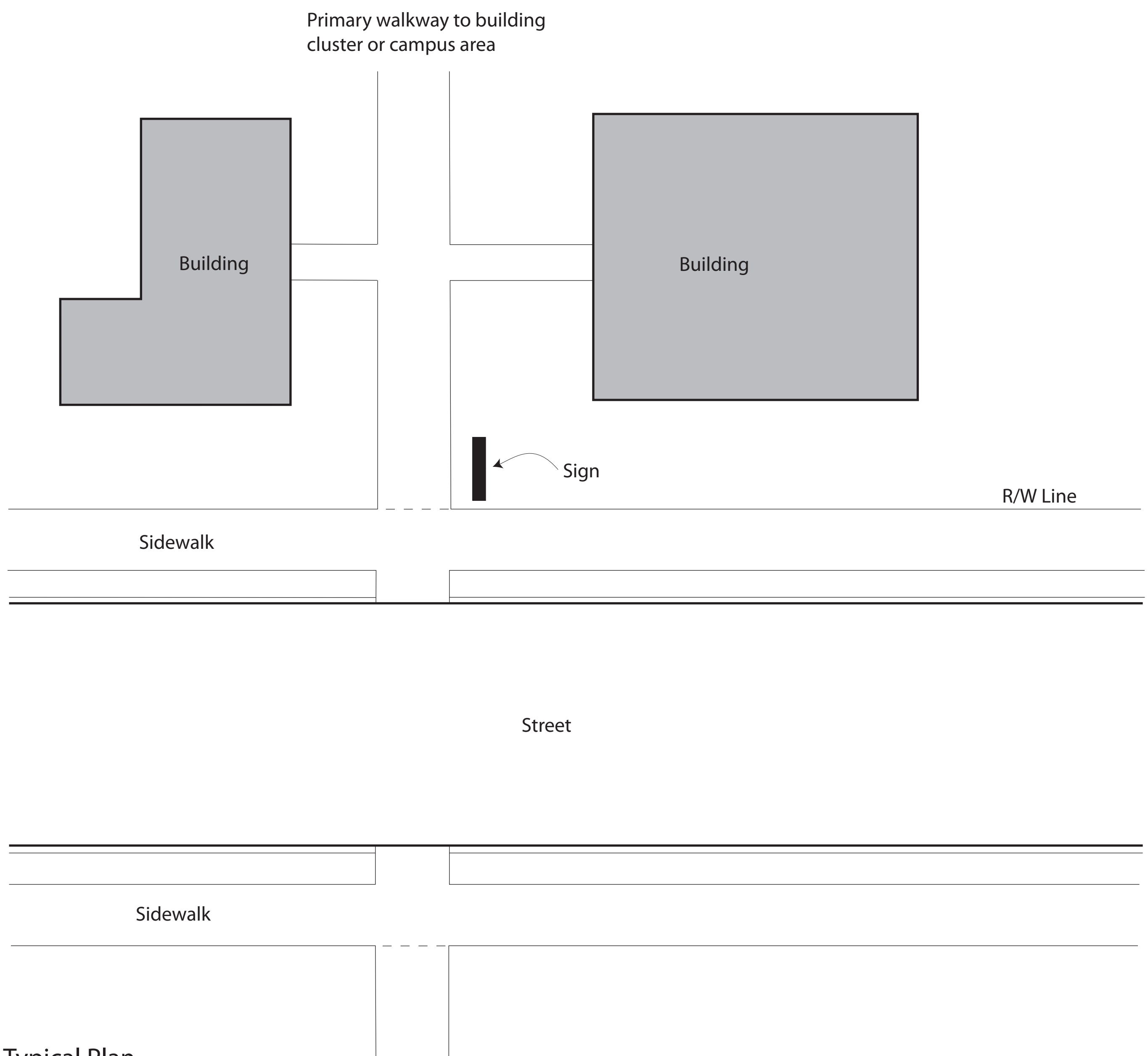
Elevation with Street Address
Scale: 3/4"=1'-0"

Type 13 signs are to be positioned perpendicular to the street from which they are to be viewed and behind street right-of-way and setback lines. If the building or area to be signed is located at a street intersection, the sign is to be located along the major artery. Two signs may be used if both roads are equally important.

Sign locations are site specific; therefore, care must be taken to place signs in areas free from obstructions that would block them from viewers.

Since the location, quantity, and size of these signs may ex-ceed local zoning ordinances, approval from the appropriate regulatory agencies is recommended prior to fabrication.

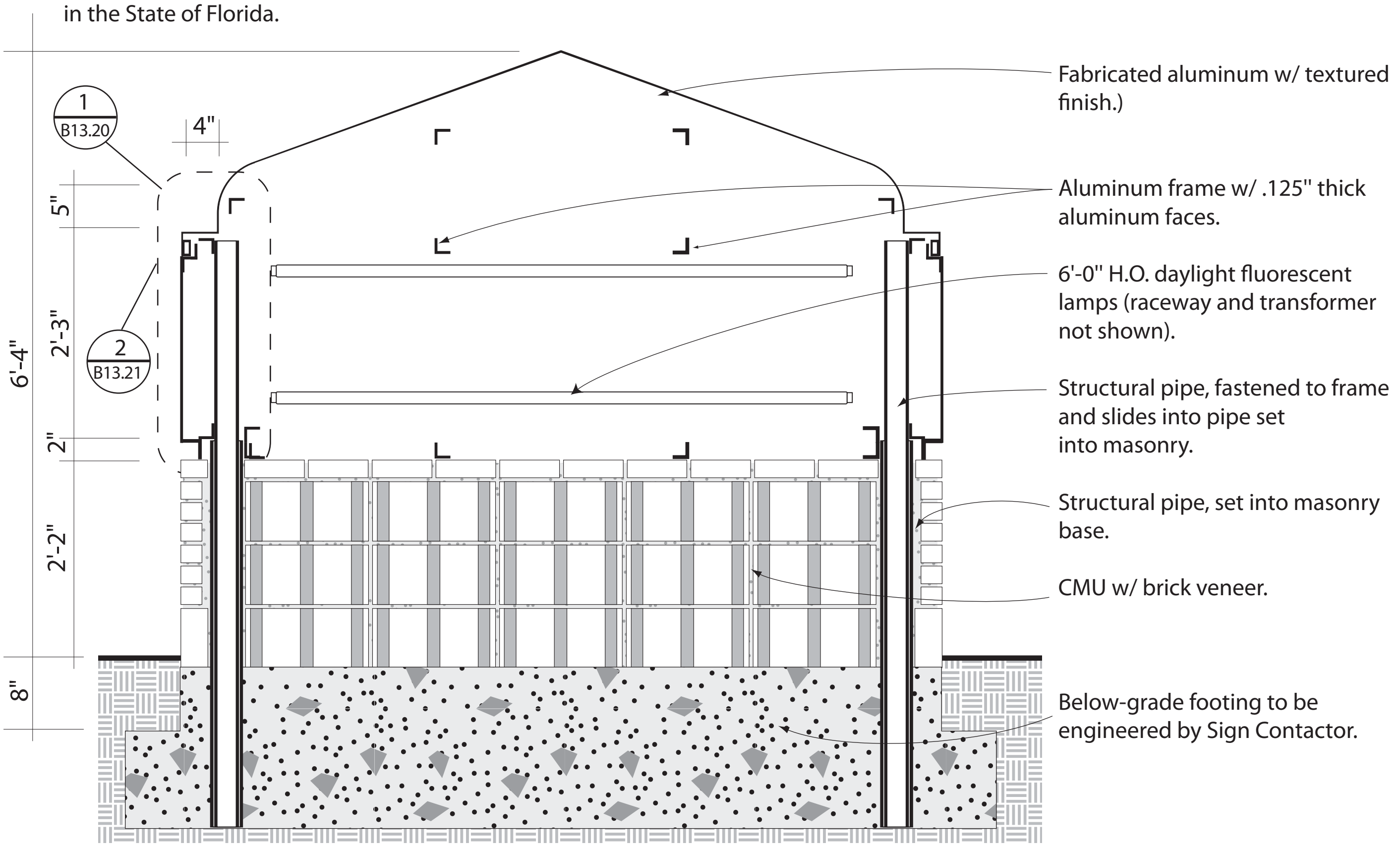
It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximities prior to digging foundations.



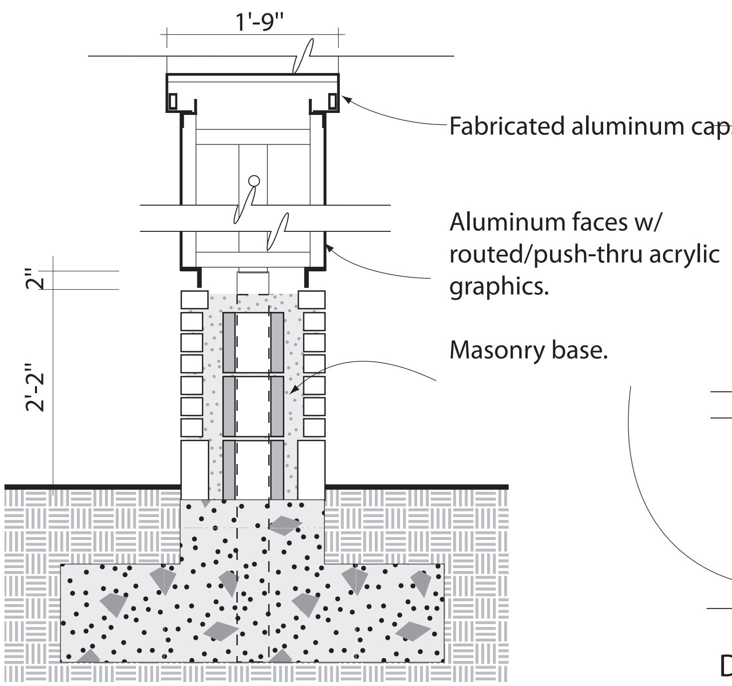
Typical Plan

Scale: NTS

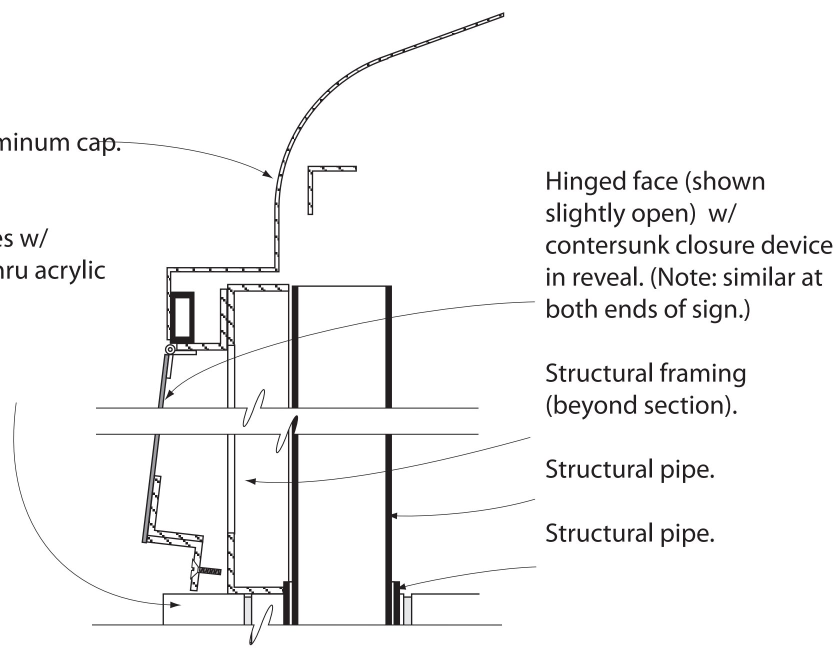
*Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A
Scale: 1/2"=1'-0"

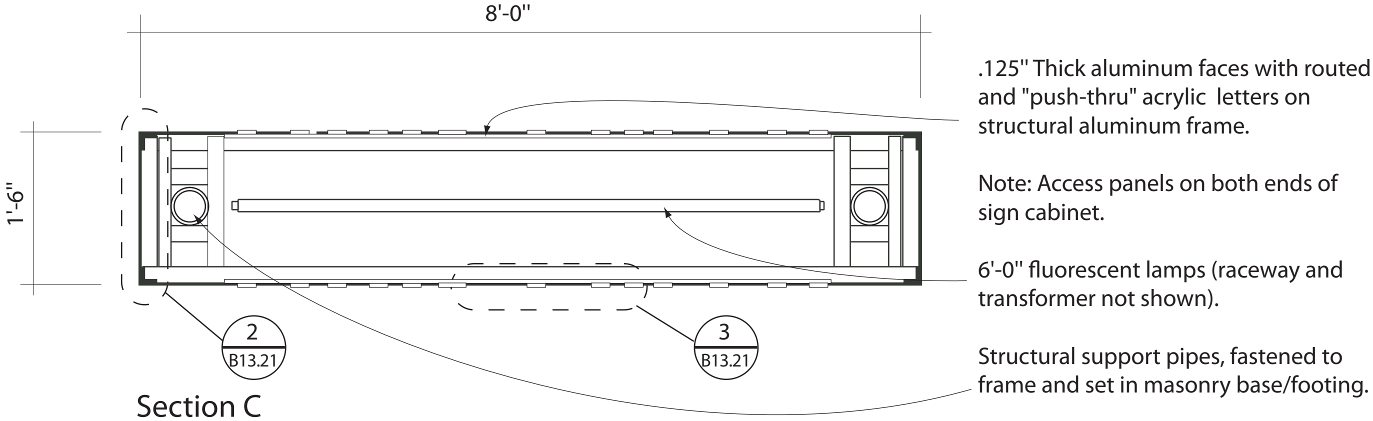


Section B
Scale: 1/2"=1'-0"



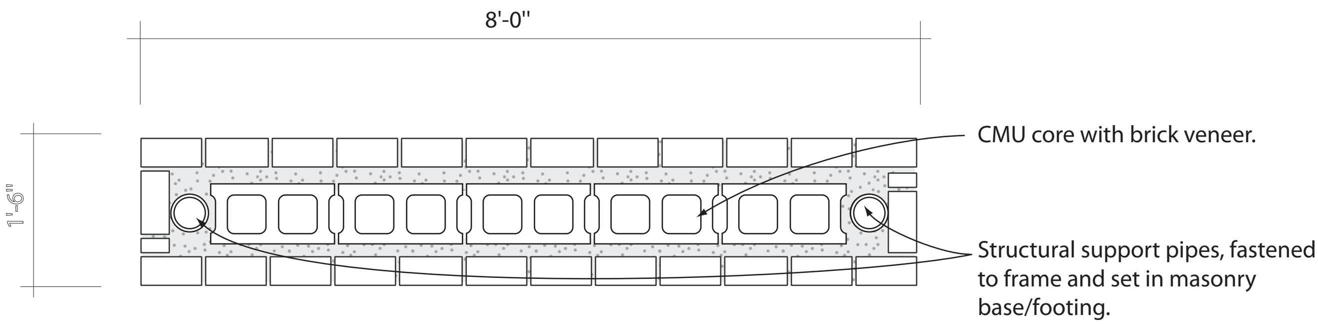
Detail 1
Scale: 1 1/2"=1'-0"

*Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



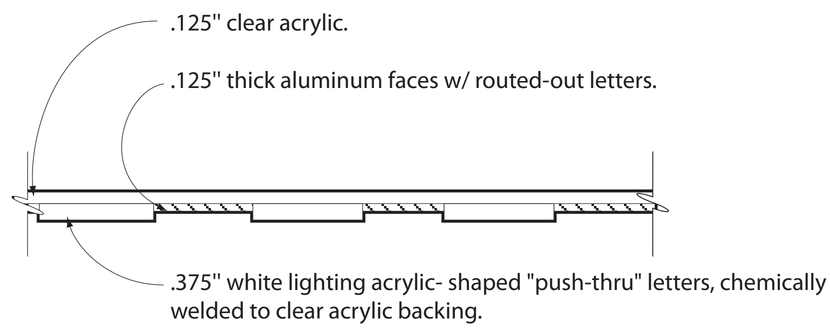
Section C

Scale: 1/2"=1'-0"



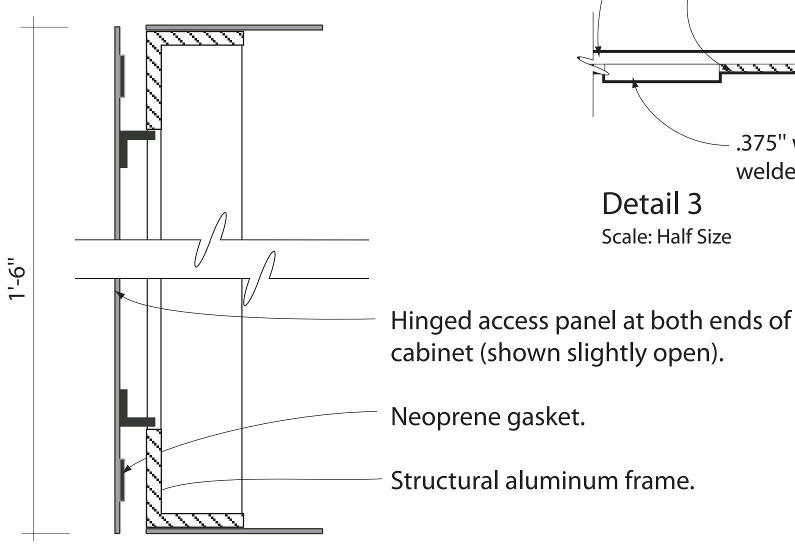
Section D

Scale: 1/2"=1'-0"



Detail 3

Scale: Half Size



Detail 2

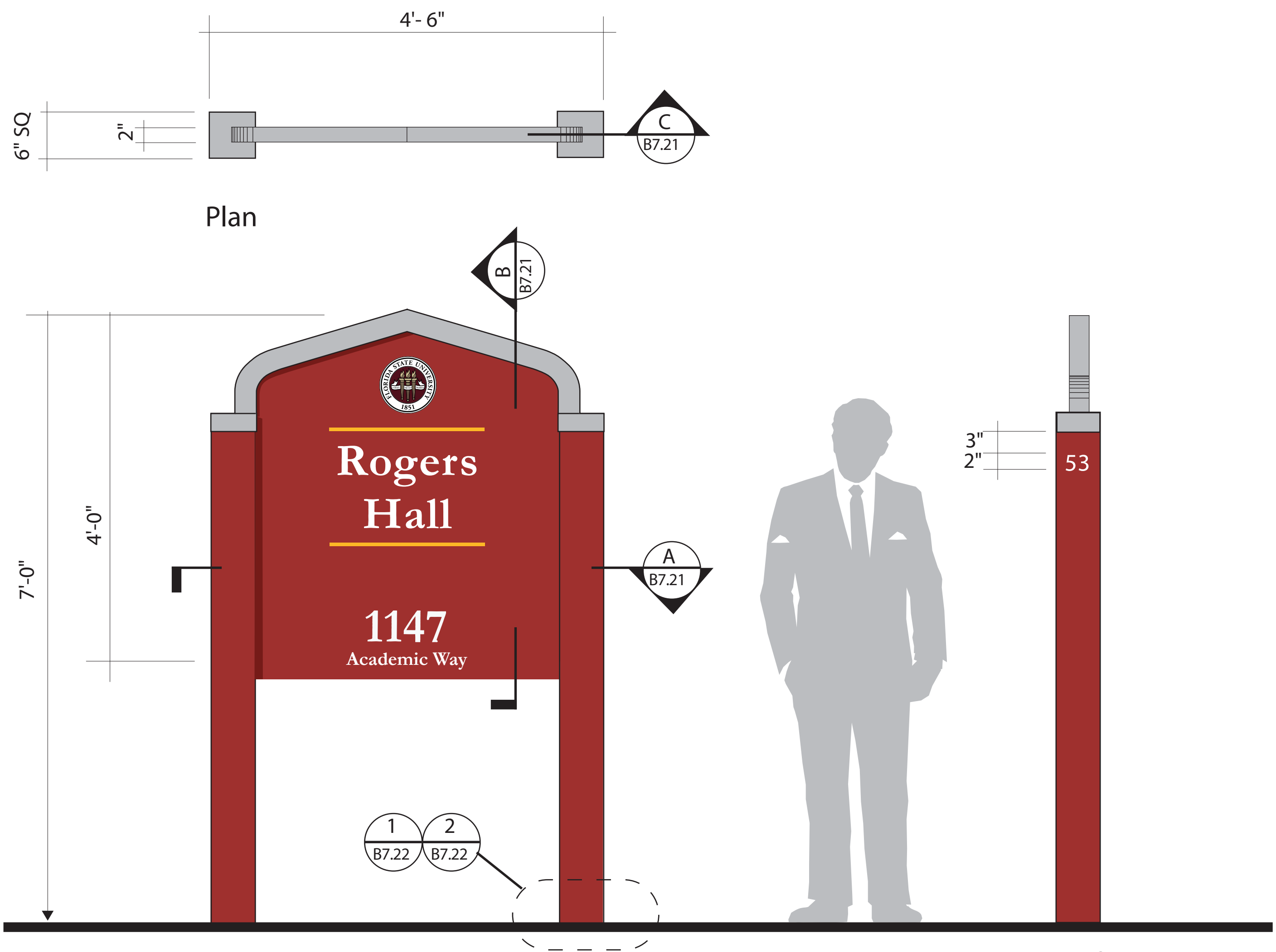
Scale: 3"=1'-0"

Large Building Identification Signs are intended for build-ings that have direct access from the street and available space to locate a free-standing sign.

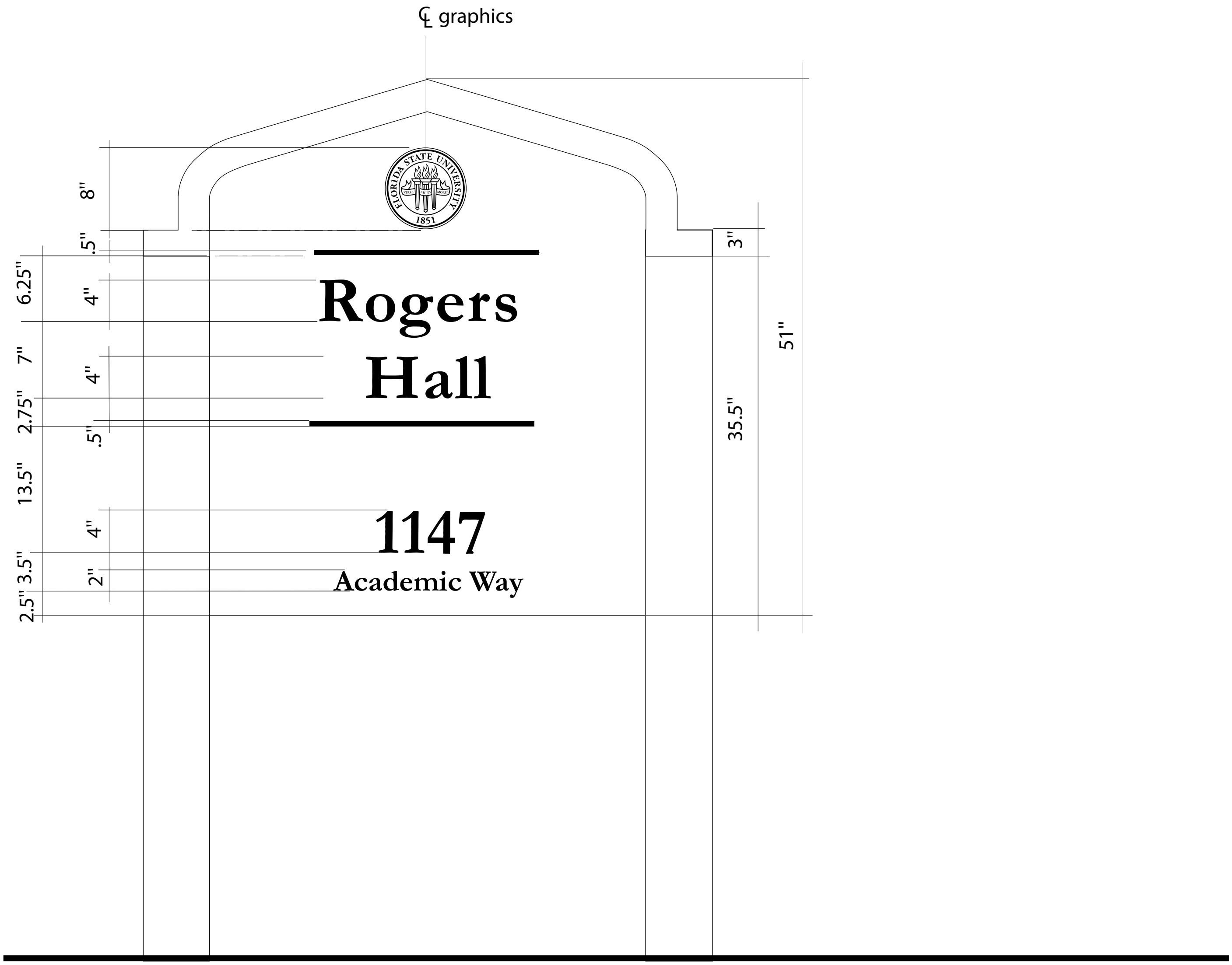
Two graphics panel sizes are provided. The shorter panel is recommended for displaying the building name only, as shown below. The taller panel is for displaying the build-ing name, plus a listing of the major colleges, schools, and departments that are located within.

Fabrication Guidelines: Posts, formed from extruded solid plastic into packed sand footings, burgundy posts and canyon granite caps ; Graphics Panel, solid plastic-burgundy color; Cornice; formed solid plastic shape with caps, canyon granite color; Graphics, reflective sheeting, gold university symbol and rules, white message and arrows, white and black pictograms.

Refer to manual pages B 14.01 for graphics measurements, B 14.10 for sign placement guide-lines, and B 7.20 design intent drawings.



Elevation with Building Name
Scale: 1/2" = 1'-0"



Elevation with Building Name
Scale: 3/4" = 1'-0"

When the building name does not clearly indicate its aca-demic function or functions, then the taller panel is to be used. The taller graphics panel permits the additional display of individual listing of colleges, schools, and major campus departments that are located within the building being identified.

Buildings having inaccessible entrances, must display a route map to an accessible entrance below the building name.

See manual pages B 14.06 and B 14.07 for graphic measurements and B 14.10 for sign placement guidelines.
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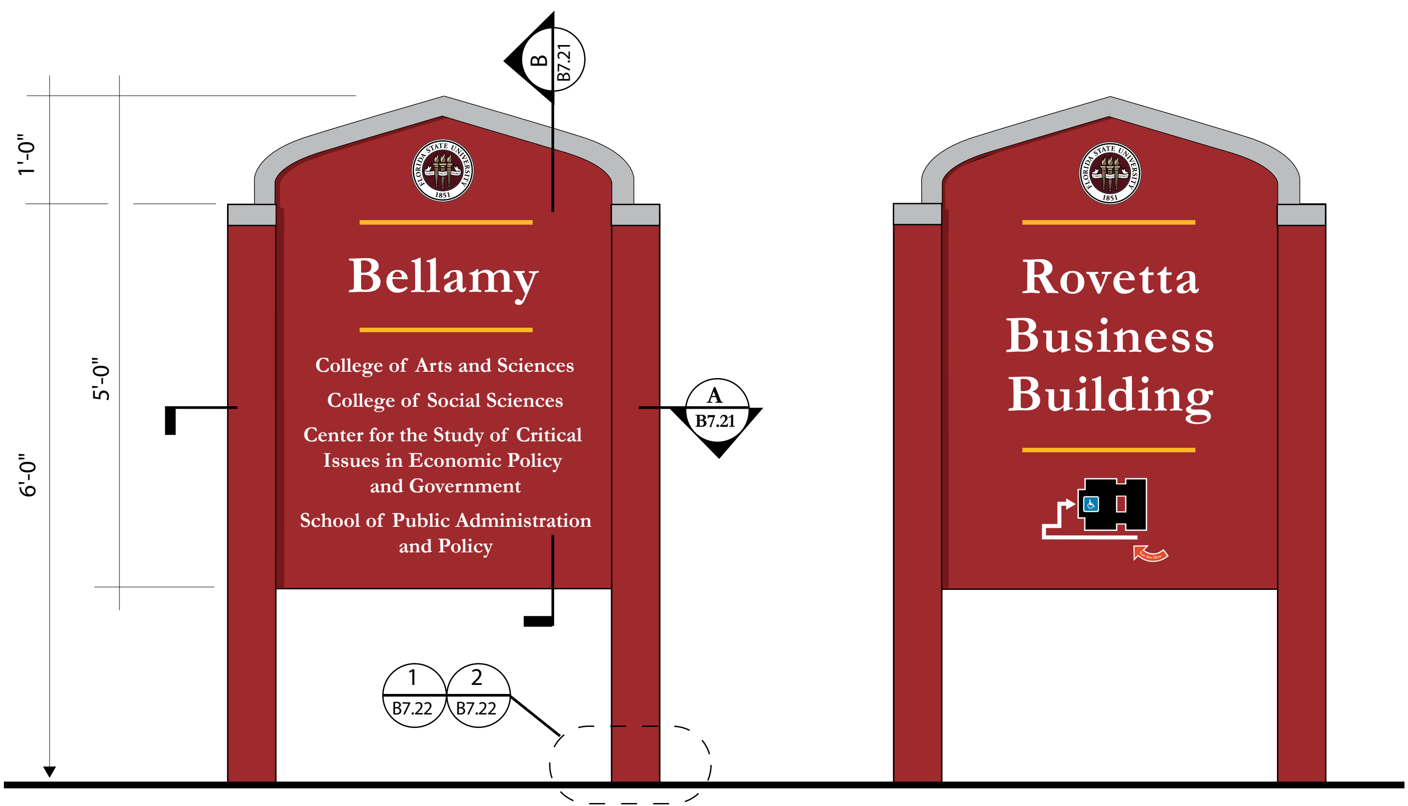
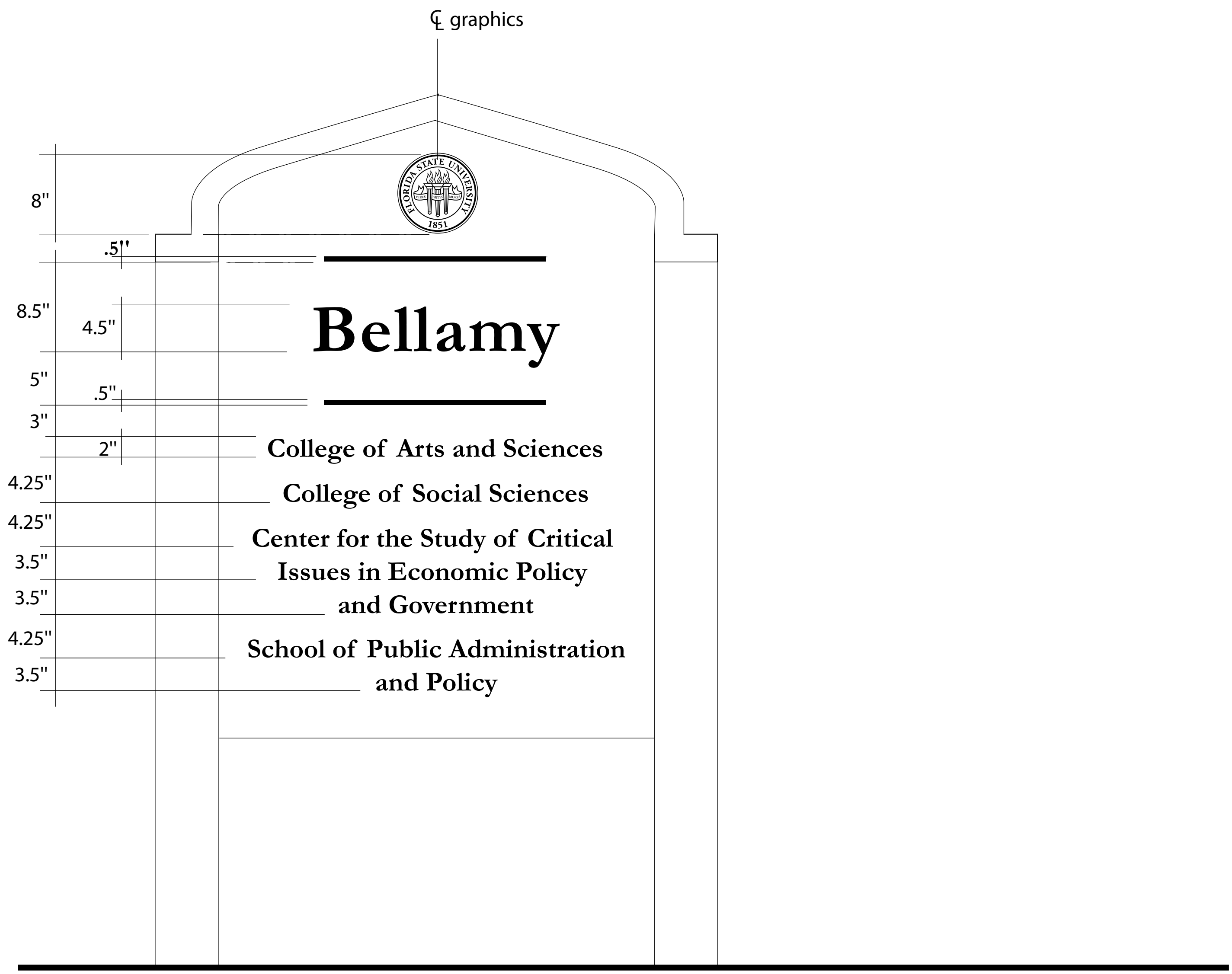
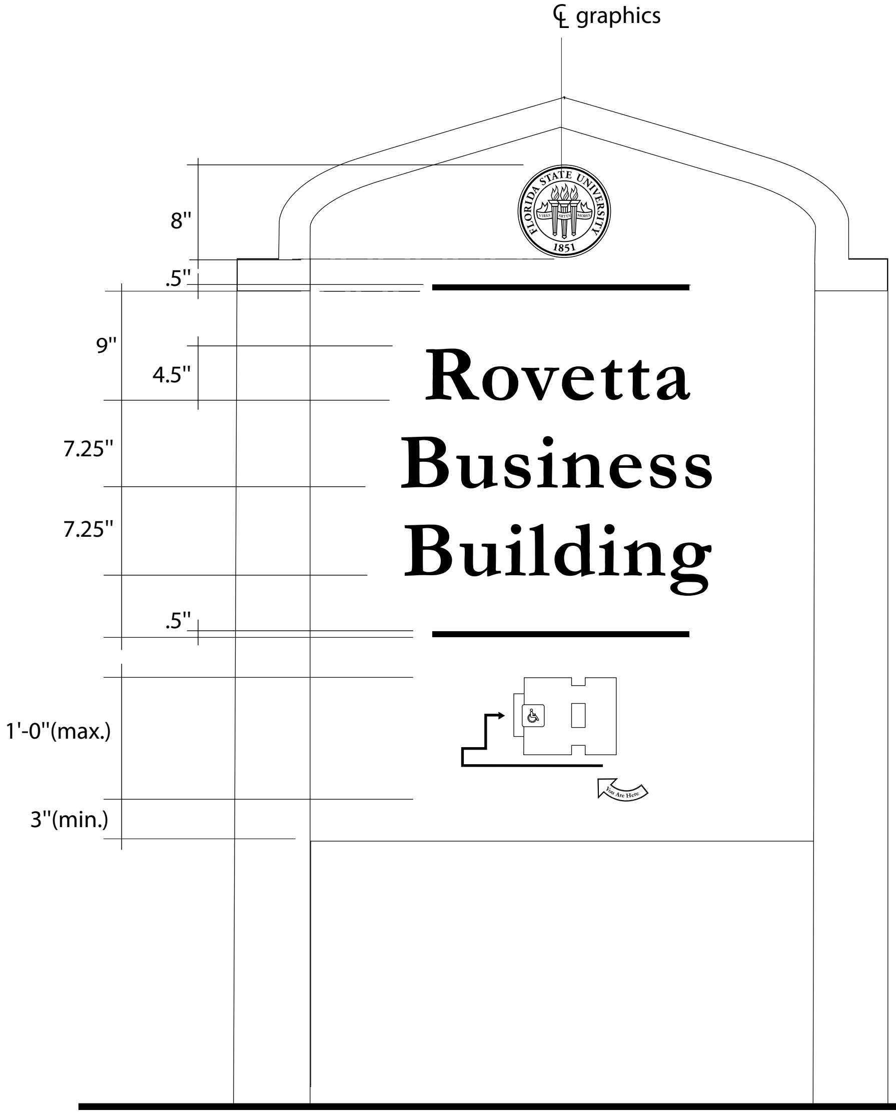


Elevation with Building Name and Internal Destinations
Scale:1/2"=1'-0"

Elevation with Accessible Route Map

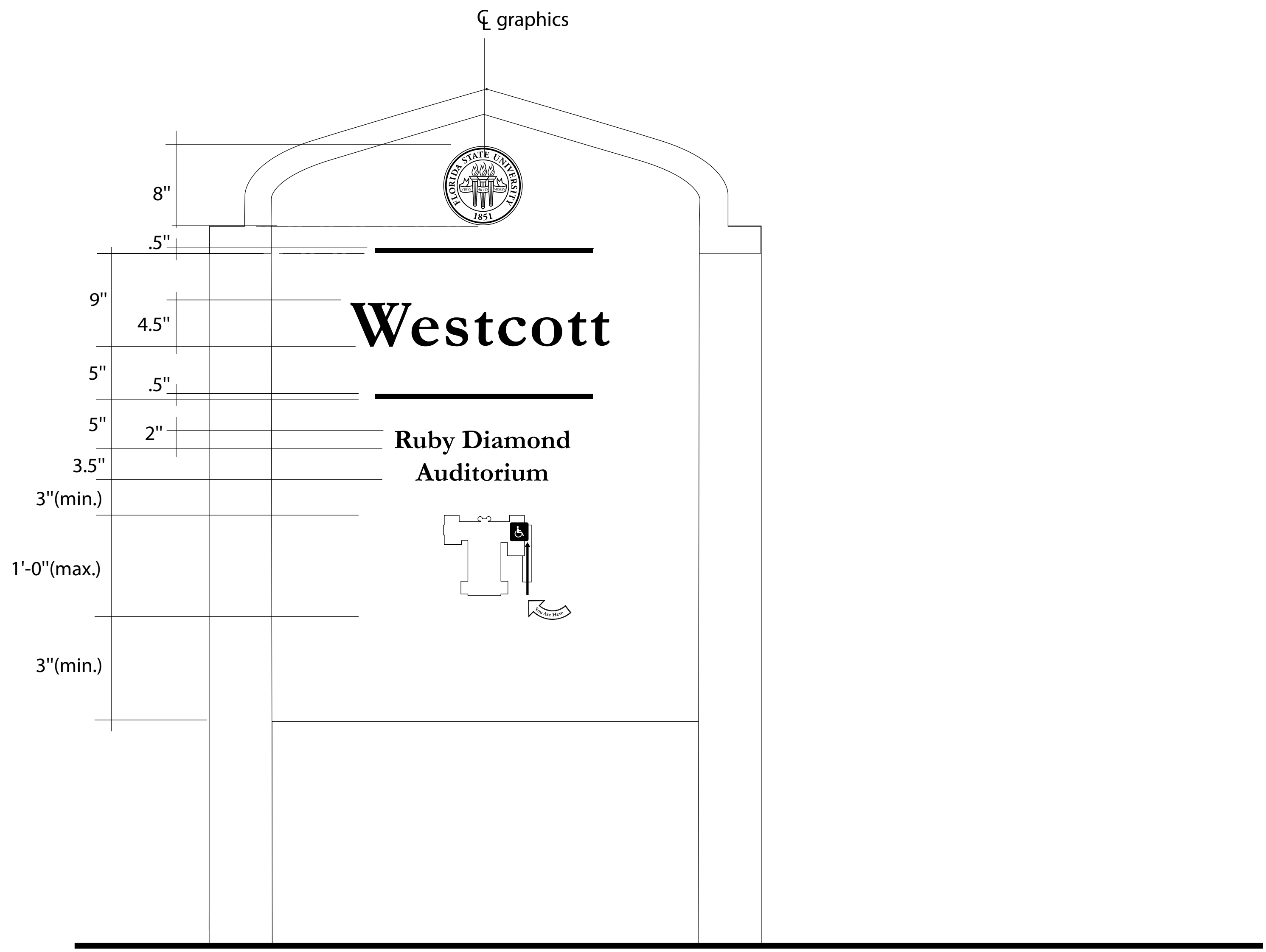


Elevation with Building Name
and Internal Destinations
Scale: 3/4" = 1'-0"



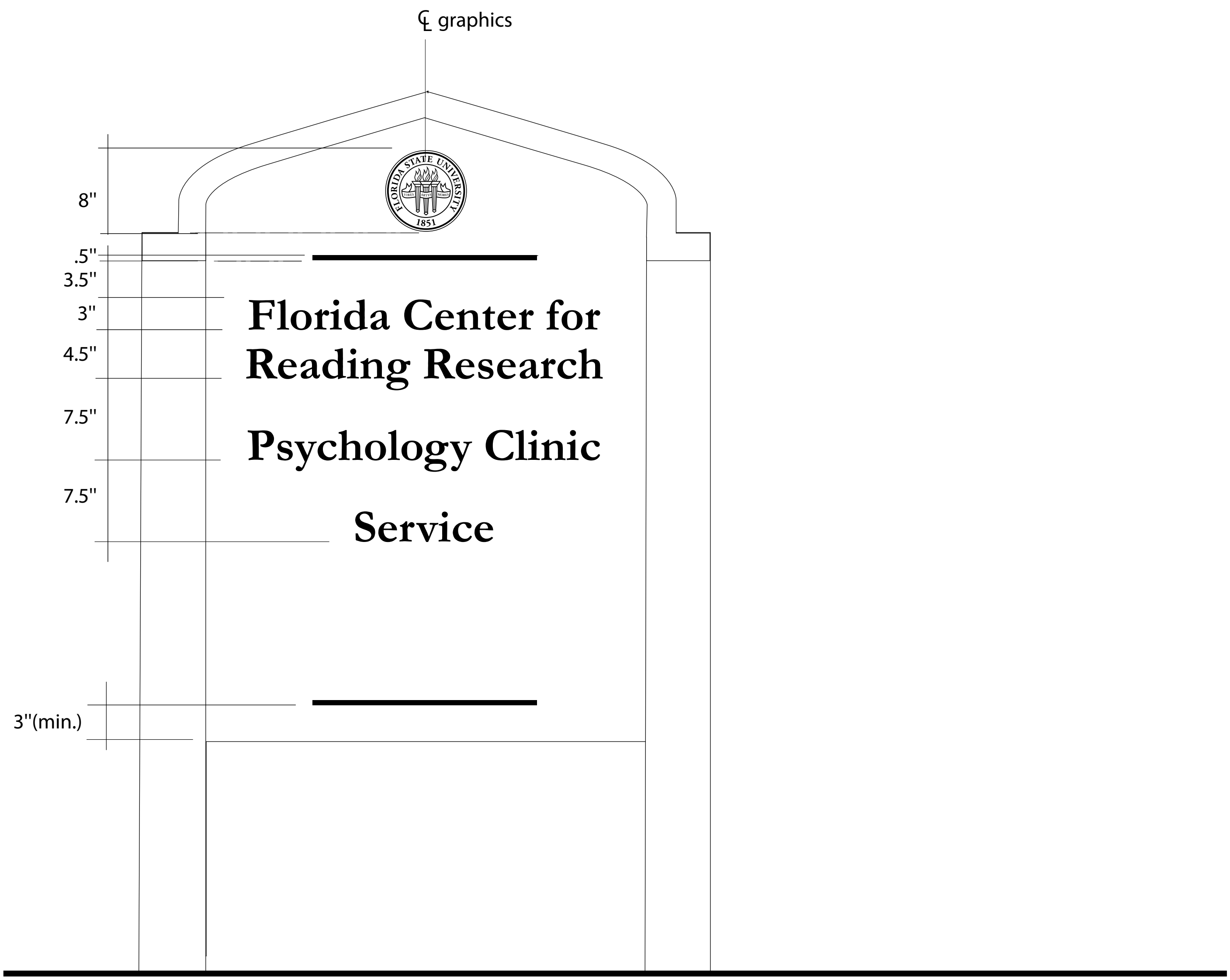
Elevation with Elevation with Accessible Route Map

Scale: 3/4" = 1'-0"



Elevation with Elevation with Accessible Route Map

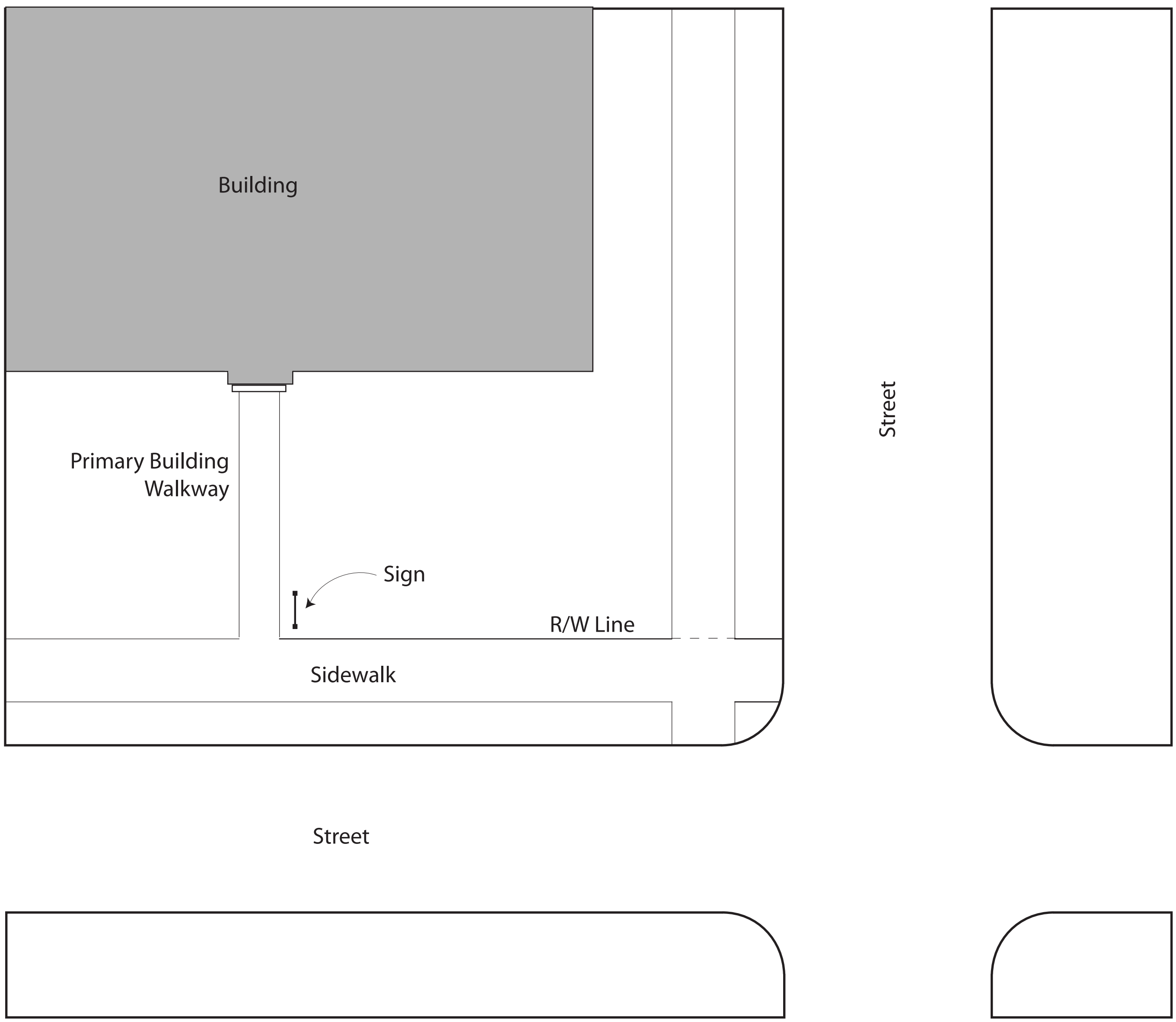
Scale: 3/4" = 1'-0"



Elevation with Multiple Destination Listings
Scale: 3/4" = 1'-0"

Signs are to be positioned perpendicular to street next to the primary building walkway and behind property right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



Typical Plan

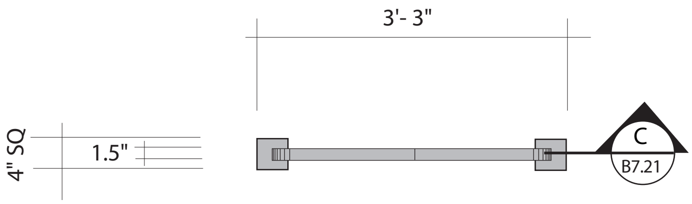
Scale: NTS

Small Building Identification Signs are scaled for pedestrian viewing and are recommended for placement along walk-ways.

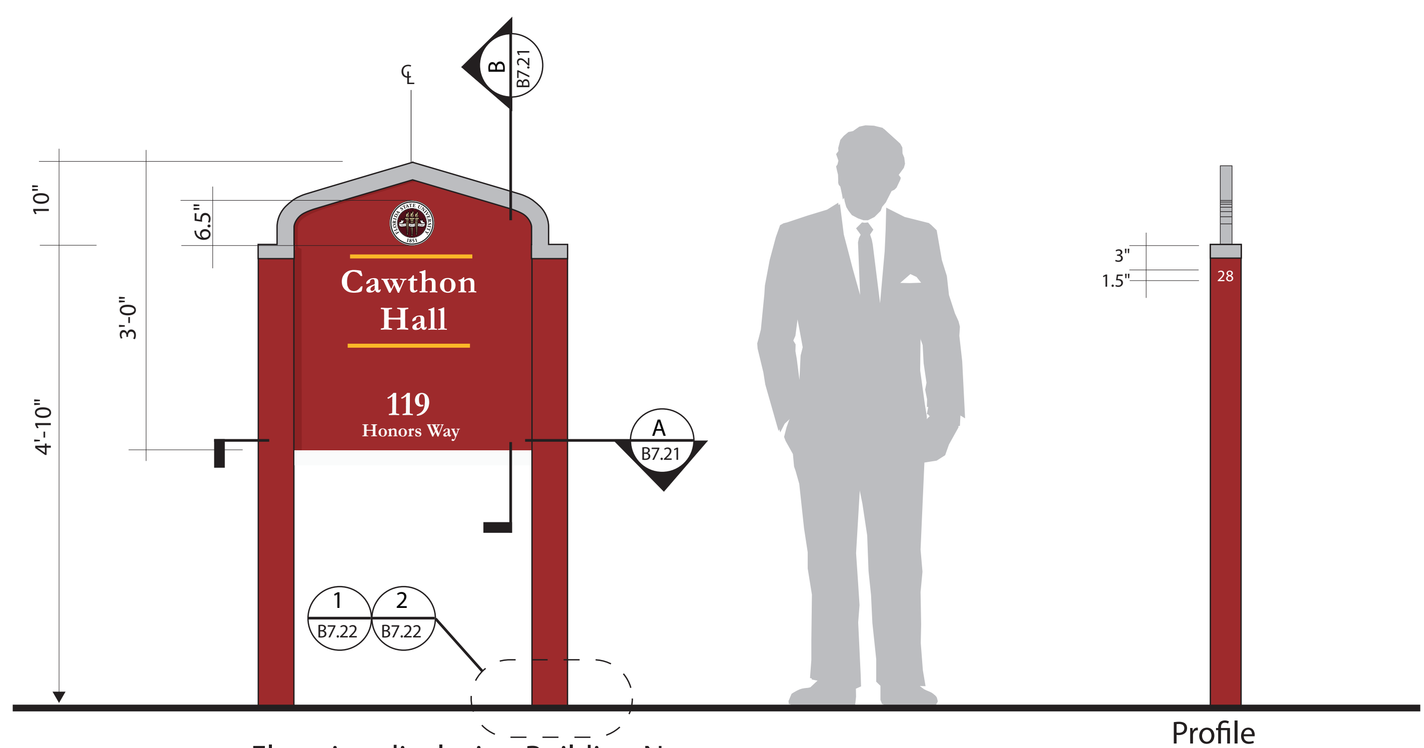
Two graphics panel sizes are provided. The shorter panel is recommended for displaying the building name only, as shown below. The taller panel is for displaying the building name, plus a listing of the building's interior major colleges, schools, and departments.

Fabrication Guidelines: Posts, Extruded solid plastic set into packed sand footings, burgundy color; Graphics Panel, solid plastic-burgundy color; Cornice; formed solid plastic shape with caps, canyon granite color; Graphics, reflective sheeting, gold university symbol and rules, white message.

Refer to manual pages B 15.01 for graphic dimensions, B 15.02 for layout variations, B 15.10 for placement guidelines, and B 7.20 and B 7.21 for design intent drawings.



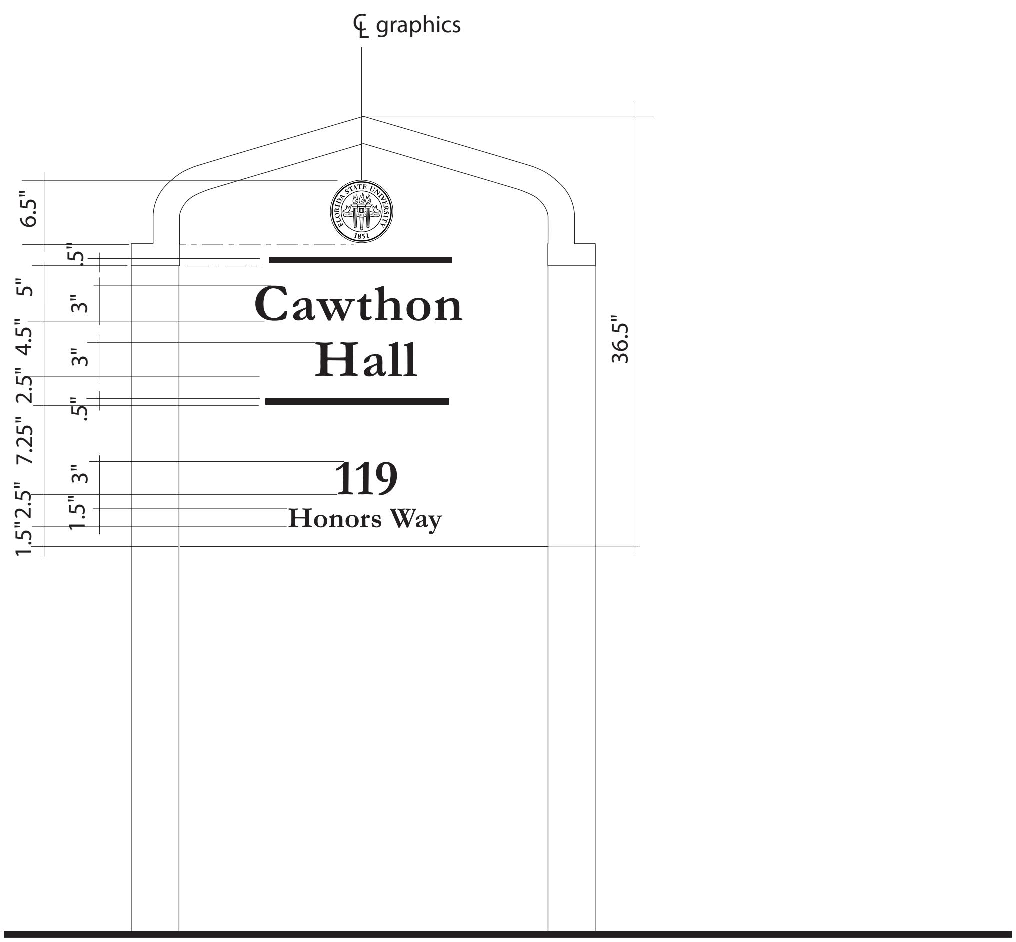
Plan



Elevation displaying Building Name
Opposite side similar

Scale: 1/2" = 1'-0"

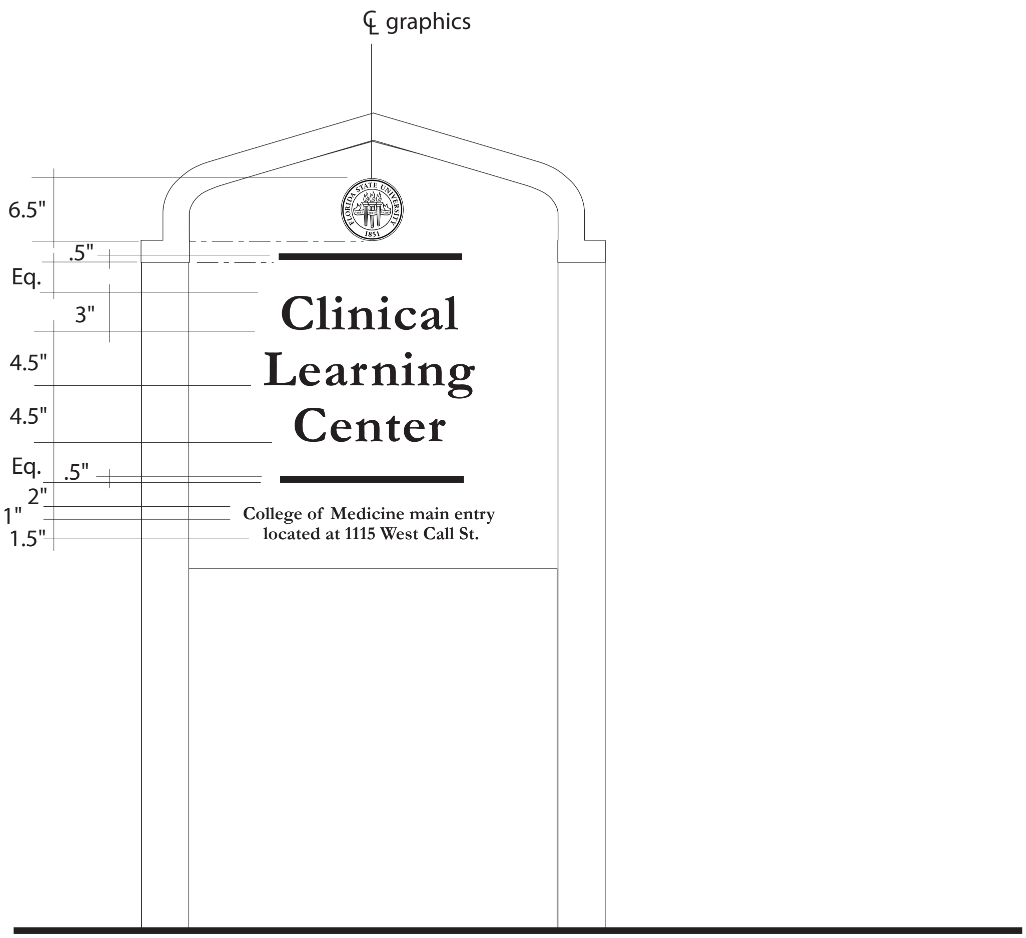
Profile
Number faces street



Elevation displaying Building Name

Opposite side similar

Scale: 3/4" = 1'-0"



Elevation with Building Name
and Secondary Message

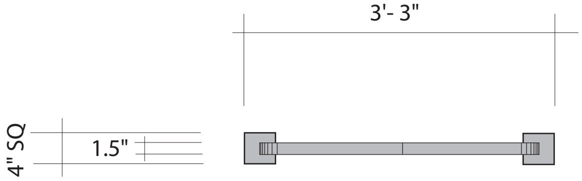
Opposite side similar

Scale: 3/4" = 1'-0"

When the building name does not clearly indicate its academic function or functions, or if the entrance being signed requires an accessibility map, then the taller panel is to be used. The taller graphics panel permits the additional display of individual listing of colleges, schools, and major campus departments that are located within the building being identified.

Buildings, having inaccessible entrances, must display a route map to an accessible entrance on both sides of the graphics panel.

See manual pages B 15.06 for graphics measurements and B 15.10 for sign placement guidelines.



Plan

Elevation with Building Name and Internal Destinations

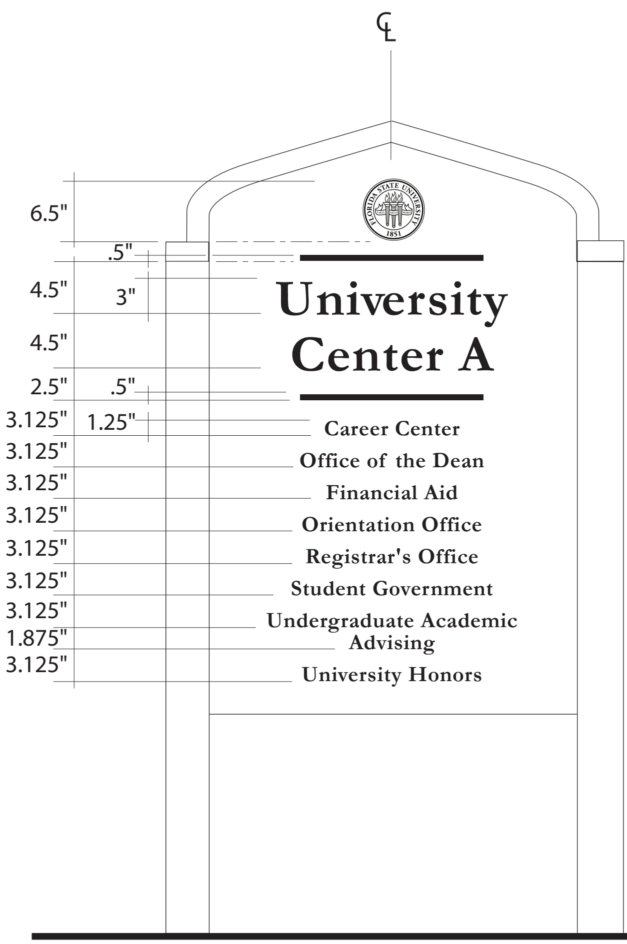
Scale: 1/2" = 1'-0"

Elevation with Accessible Route Map

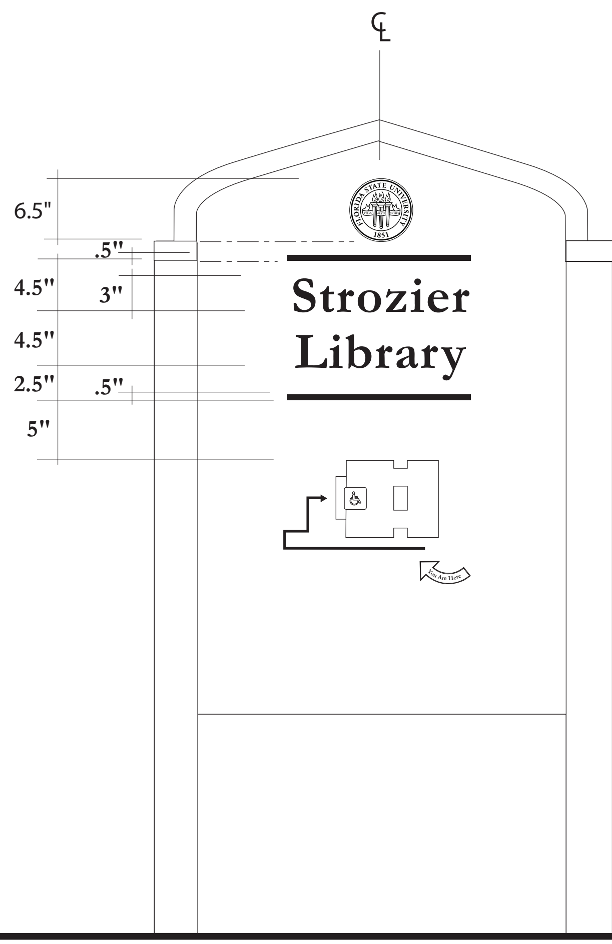
When the building name does not clearly indicate its academic function or functions, or if the entrance being signed requires an accessibility map, then the taller panel is to be used. The taller graphics panel permits the additional display of individual listing of colleges, schools, and major campus departments that are located within the building being identified.

Buildings, having inaccessible entrances, must display a route map to an accessible entrance on both sides of the graphics panel.

Refer to manual pages B 15.06 for graphics measurements and B 15.10 for sign placement guidelines.



Elevation with Building Name and Internal Destinations
Scale: 3/4" = 1'-0"

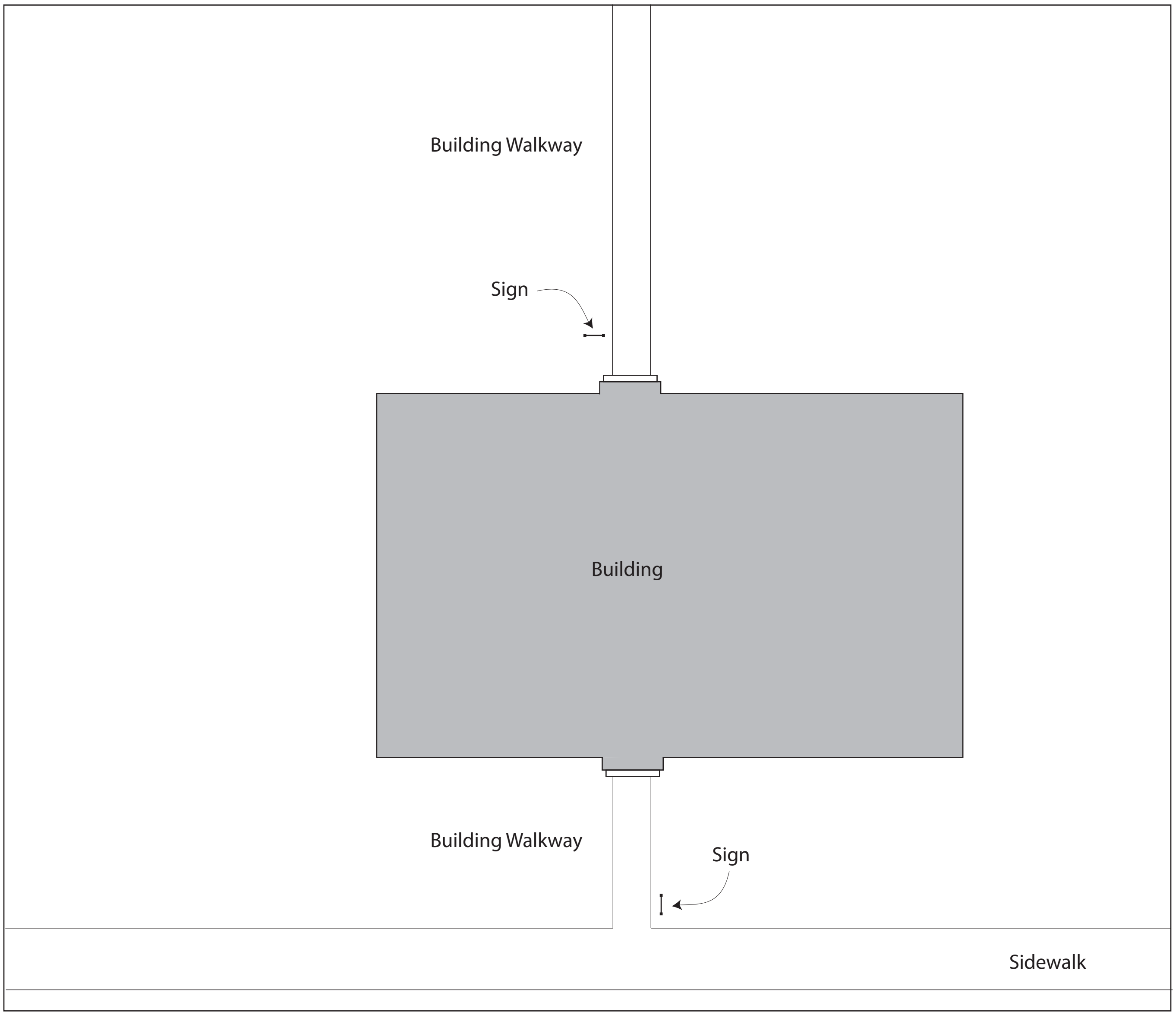


Elevation with Accessible Route Map

Signs are to be positioned perpendicular to primary building walkway. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

Since the location, quantity, and size of the signs may exceed local zoning ordinances, approval from the appropriate regulatory agency is recommended prior to fabrication.

It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximity prior to digging foundations.



Typical Plan

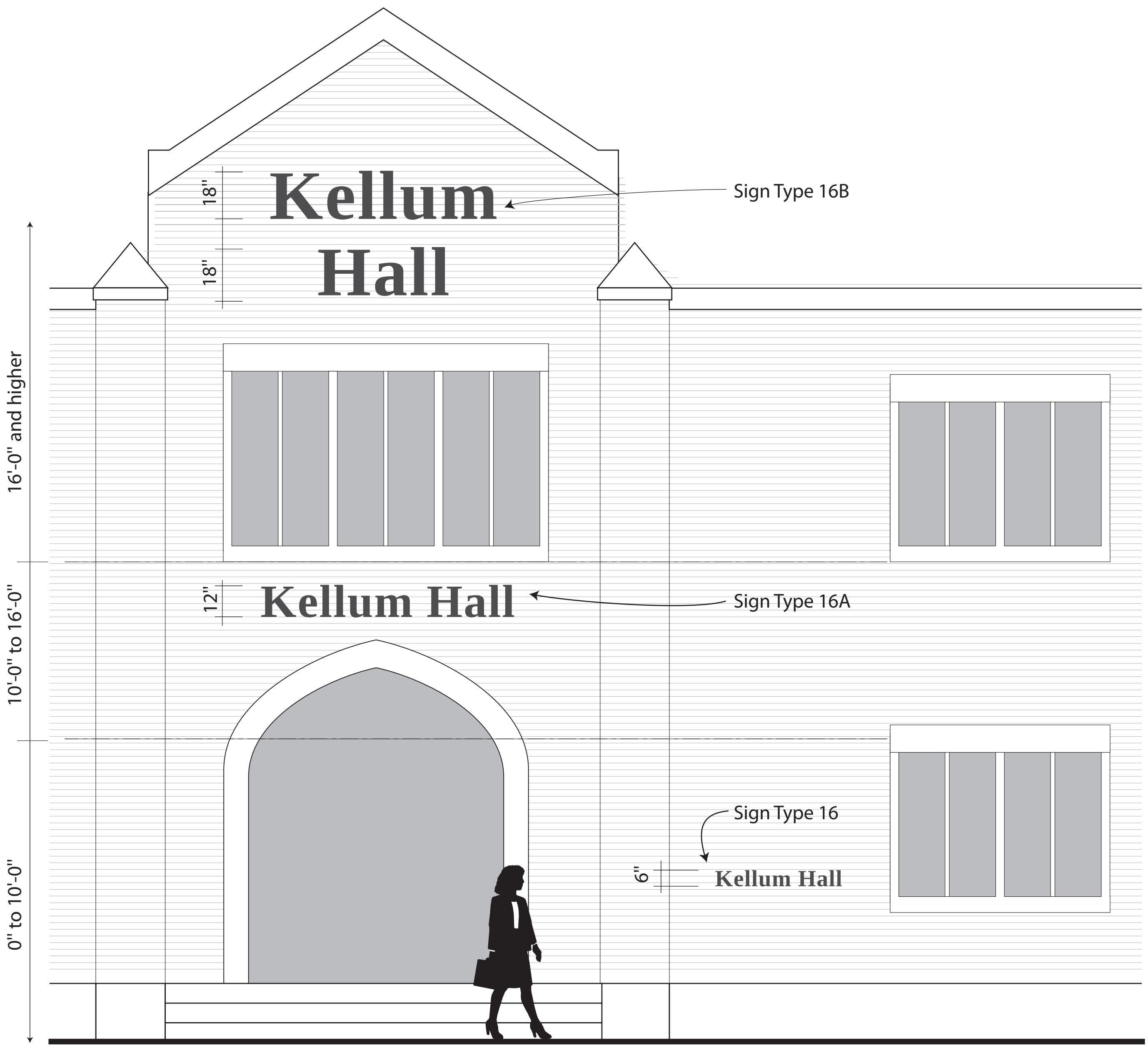
Scale: NTS

These sign types are recommended for buildings that do not have available space to locate a free-standing sign or do not have the need to list internal destinations.

These signs are non-illuminated and consist of individually mounted letters and symbols. Since the graphics will be read against the building fascia, care must be taken to locate the sign in an isolated area free of any strong architectural statements. The color of the graphics must provide sufficient contrast with the building color. When available, refer to the building's program and/or construction documents for proposed signage location and related requirements.

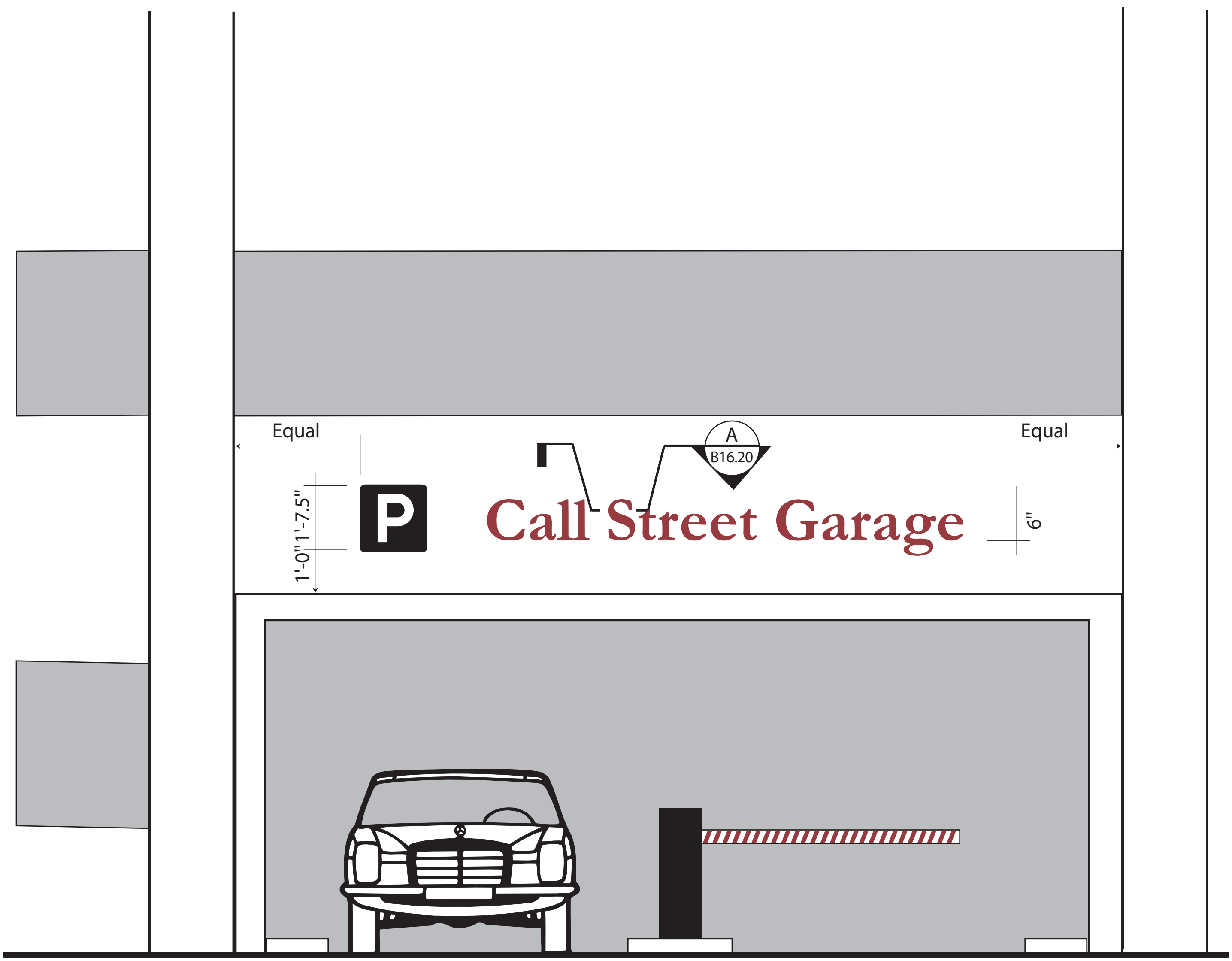
Fabrication Guidelines: Letters and symbols, cast aluminum with black returns with clear polyurethane finish on brick surfaces, or anodized dark bronze cast aluminum with clear polyurethane finish on precast concrete or stucco surfaces; Mount: blind s.s. threaded studs and spacers. Letters are provided at capital letter heights of 6" (Type 16), 12" (Type 16 A), and 18" (Type 16 B).

Refer to manual pages B 16.01 for layout examples and B 16.20 for installation details. Refer to page A 2.03 for alphabet requirements.



Typical Elevation

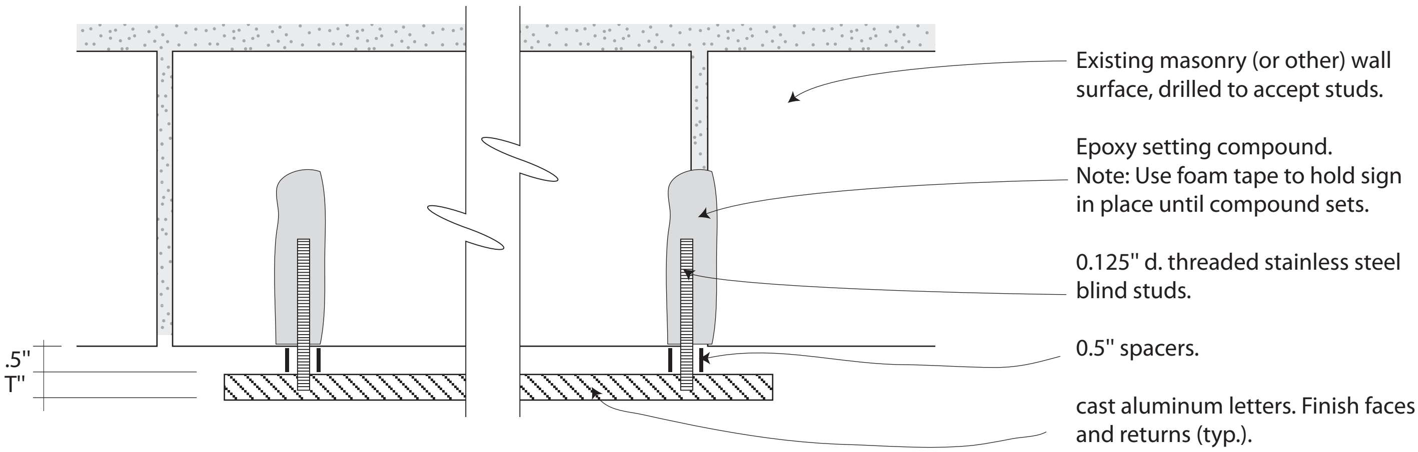
Scale: 3/16" = 1'-0"



Typical Elevation

Scale: 1/4" = 1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A

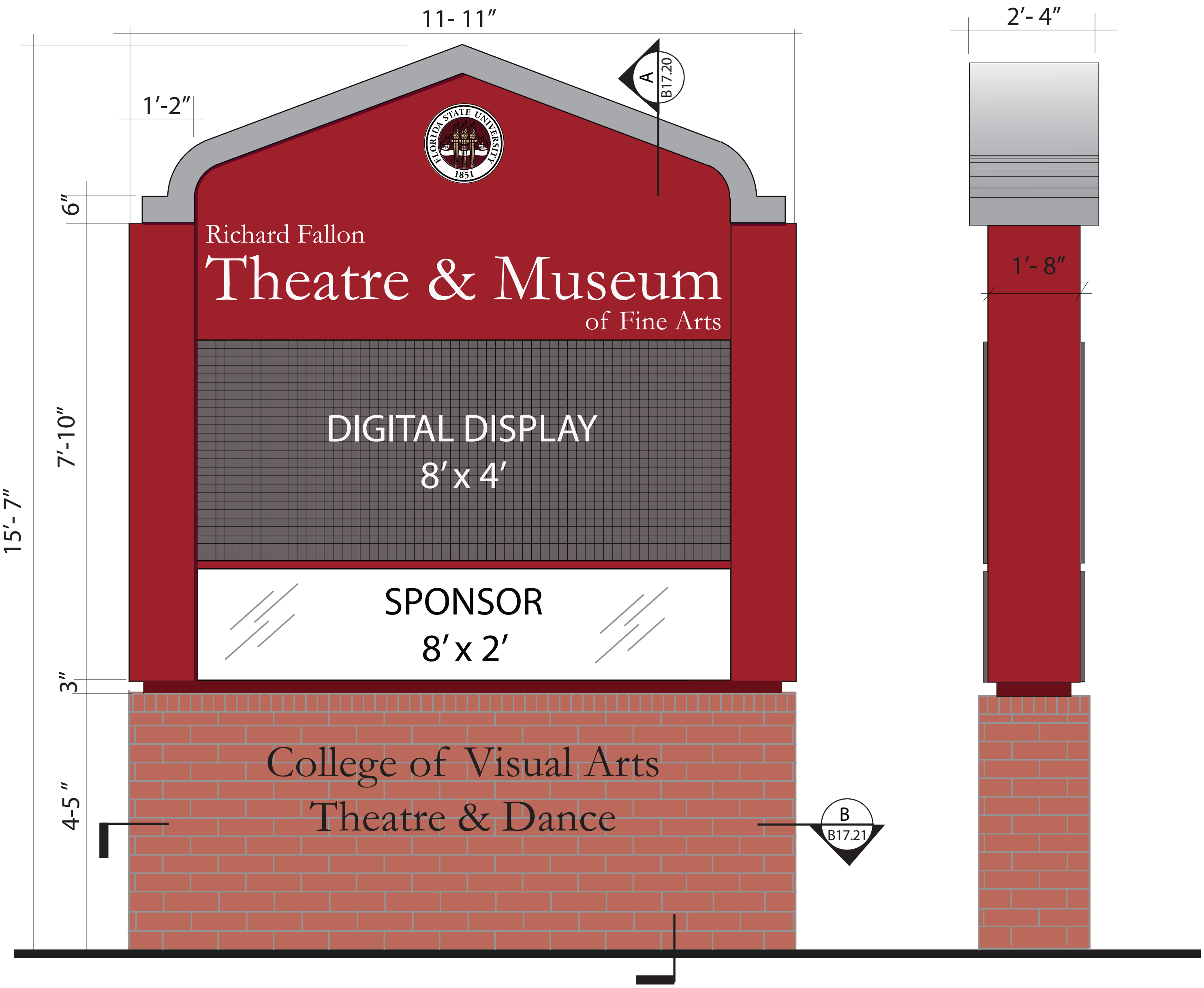
Scale: Half Size

T	Letter height
3/4"	6"
1"	12"
1-1/4"	18"

Marquee Signs are double sided internally illuminated signs that are intended for areas where programmable messages are desired. Signs display the building or area name, plus a changeable electronic message panel which can be programmed from a remote location.

Fabrication Guidelines: Base, CMU substrate with brick veneer; Foundation, formed concrete footing; Sign Cabinet, formed aluminum with garnet polyurethane finish and internal structure with internal light track behind routed graphics area (above Reader Board); Cornice, formed aluminum with light gray textured coating; Interior Illumination, 120 v., white message; Lamps, H.O. fluorescent daylight; Reader Board, change-able matrix with internal modem; Sponsor message (below Reader Board), white polycarbonate sheet.

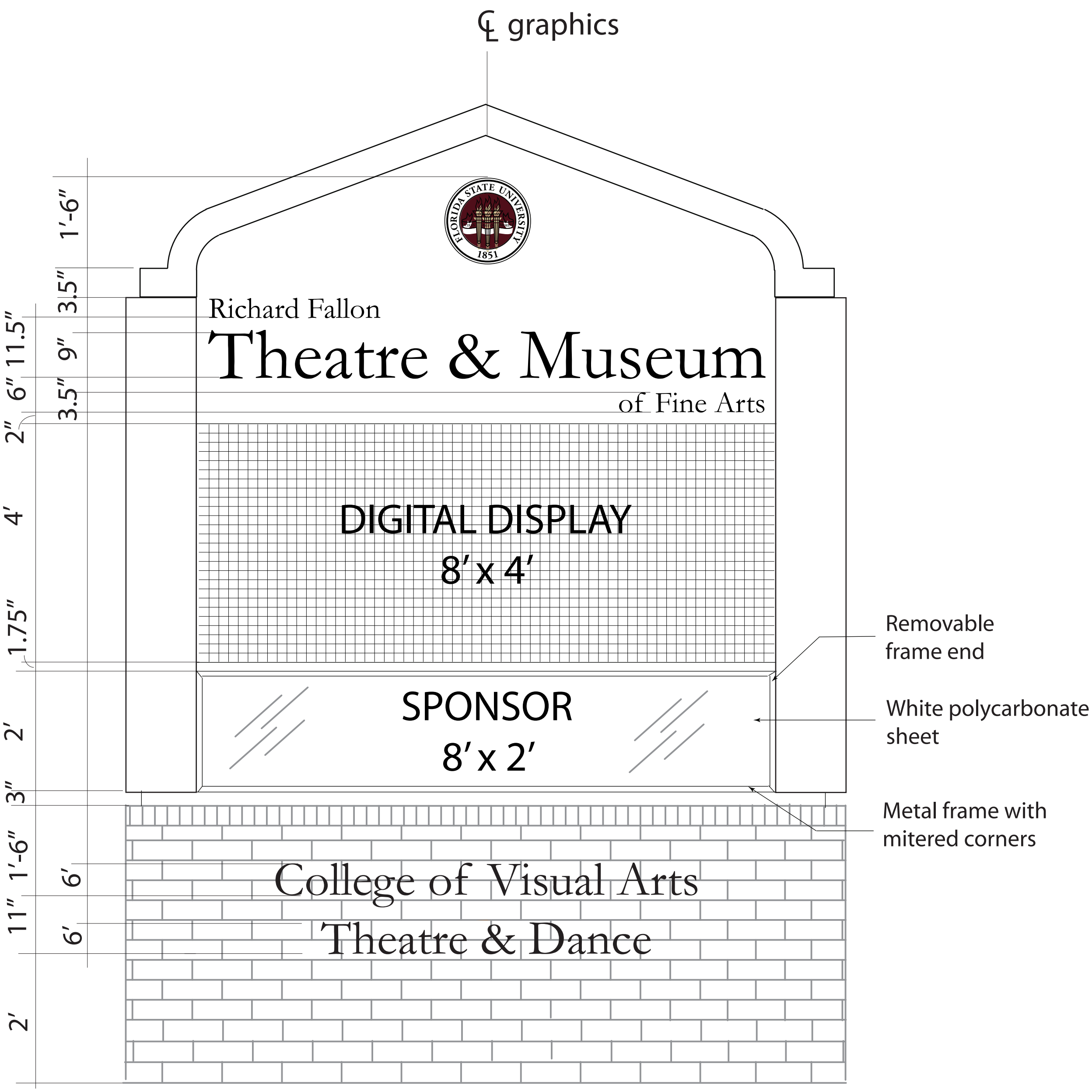
Refer to manual pages B 17.01 for graphics measurements, B 17.10 for placement guidelines and B 17.20 for design intent drawings .



Elevation

Scale: 3/8" = 1'-0"

Profile

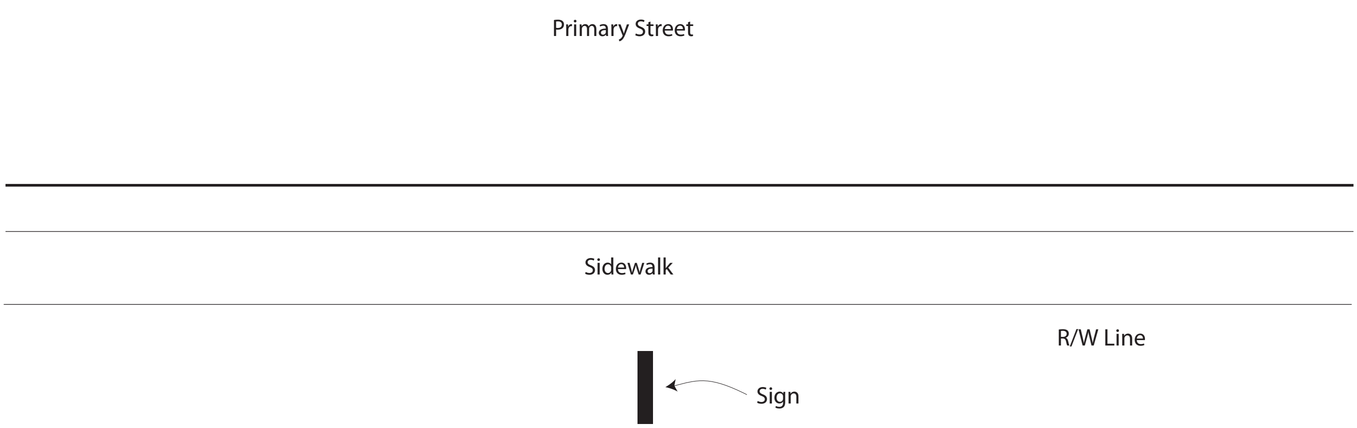


Elevation
Scale: 3/8"=1'-0"`

Signs are to be positioned perpendicular to street from which they are to be viewed and behind street right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.

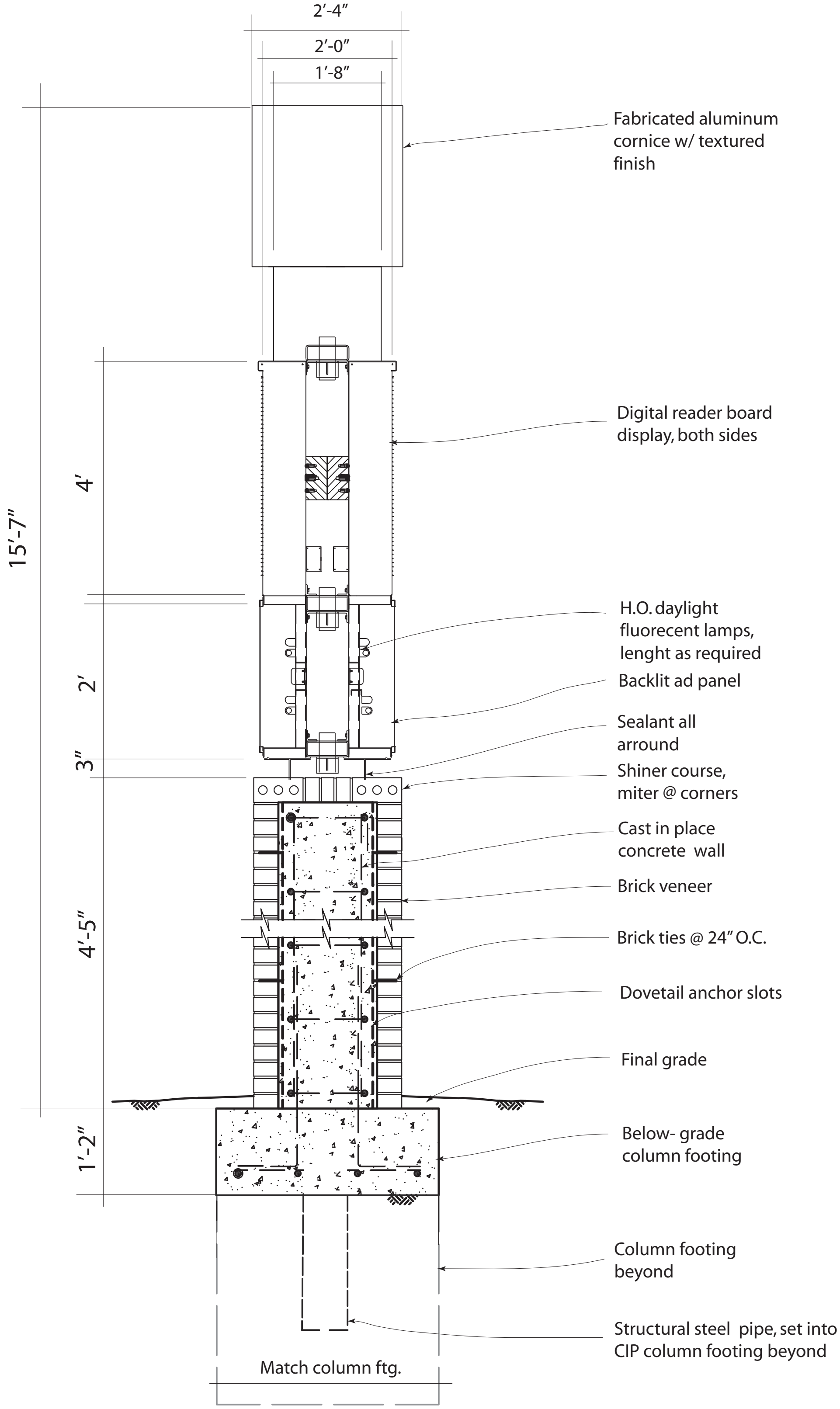
It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximity prior to digging foundations.



Typical Plan

Scale: NTS

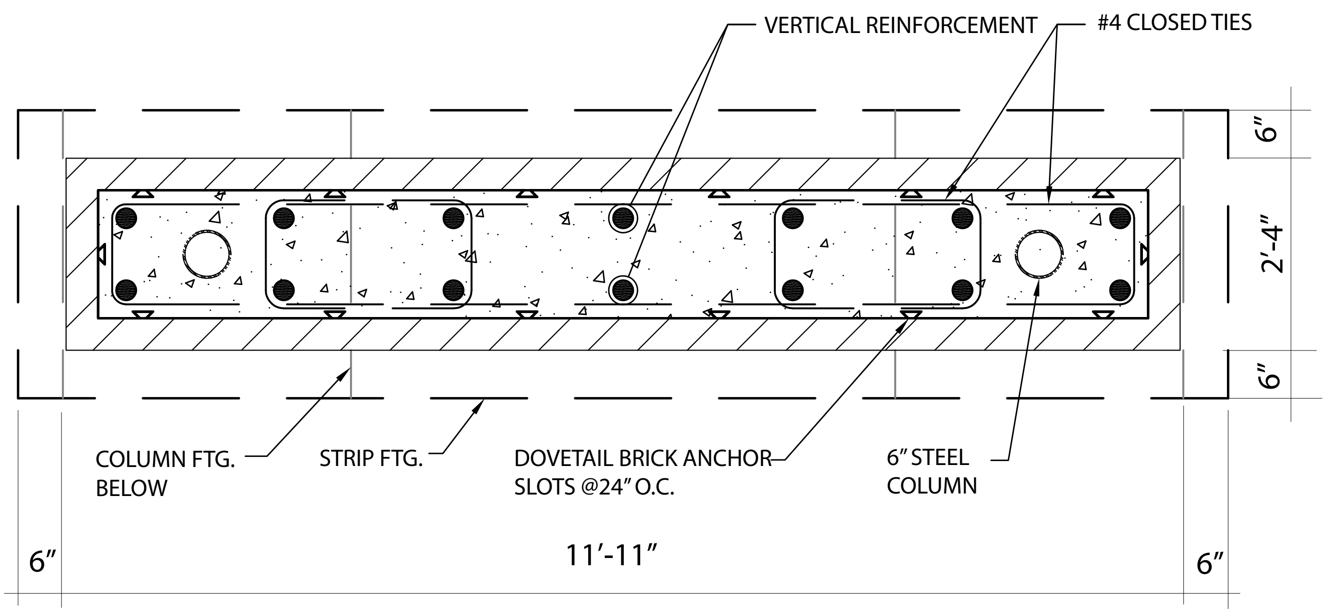
Note: Material dimentions and configurations shown are for design intent only. All materials, dimentions, configurations and specificstions must be signed and stamped by a registered engineer licened in the Stete of Florida.



Section A

Scale: 3/8"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.

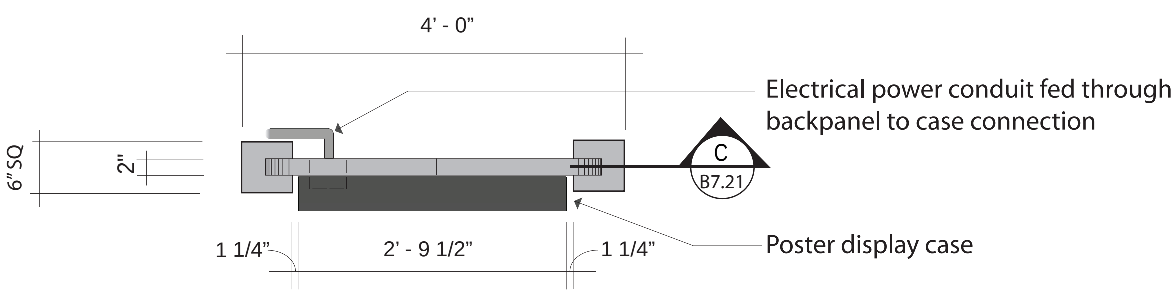


Section B
Scale: 1/2"=1'-0"

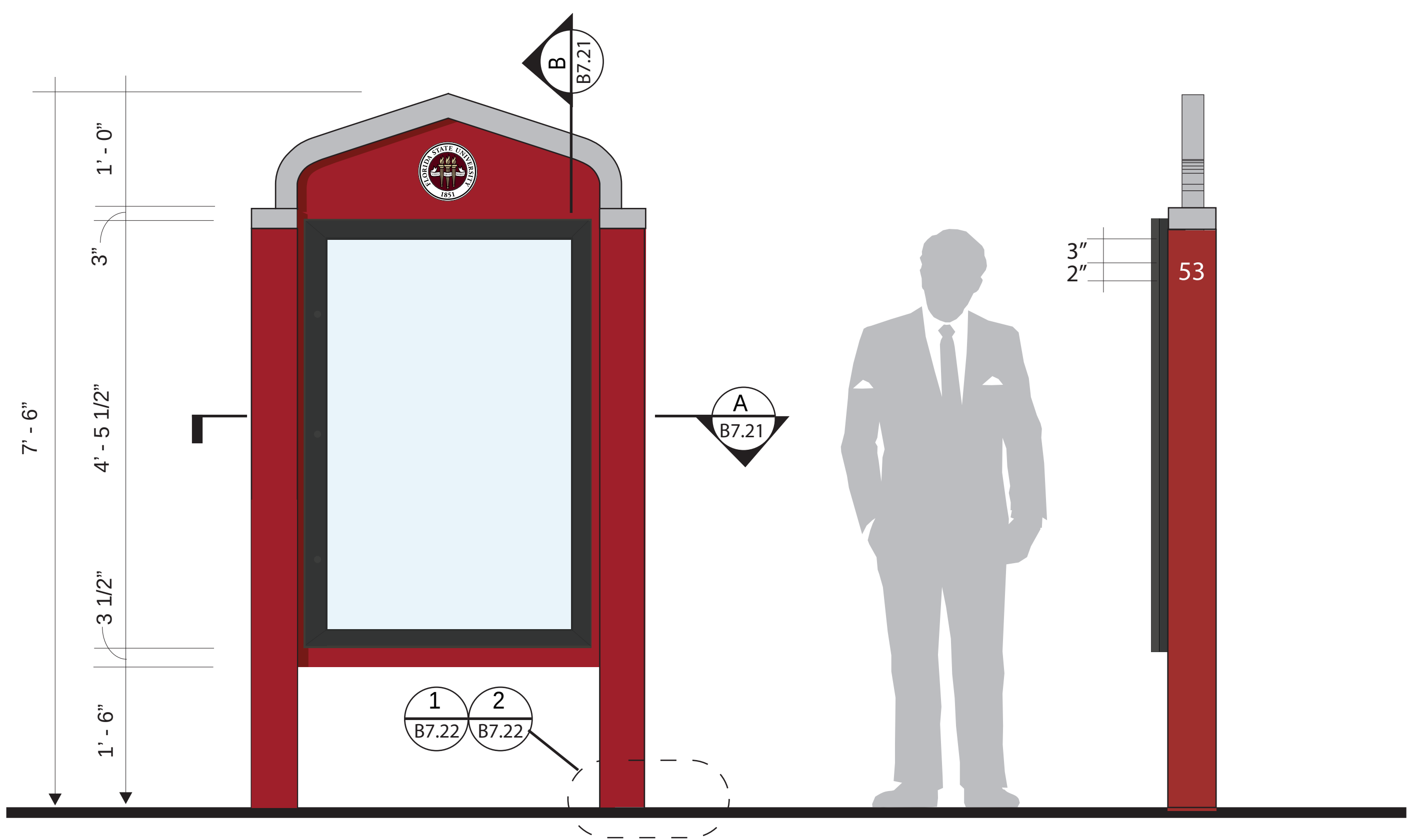
Posting Display Signs are intended for the display and protection of printed media related to campus activities.

Fabrication Guidelines: Posts, formed from extruded solid plastic into packed sand footings, burgundy posts and canyon granite caps; Graphics Panel, solid plastic-burgundy color; Cornice; formed solid plastic shape with caps, canyon granite color; Graphics, full color university seal; Poster Display Case: internal illumination, satin black frame and door, black backing.

Refer to manual page B 7.20 for design intent drawing.



Plan



Elevation with Posting Display Case
Scale: 1/2" = 1'-0"

Profile

Entrance Identification Plaques can be used to label selected public entrances. They can display the building name, floor identification, regulatory messages, an historical brief about the building, or other information as needed.

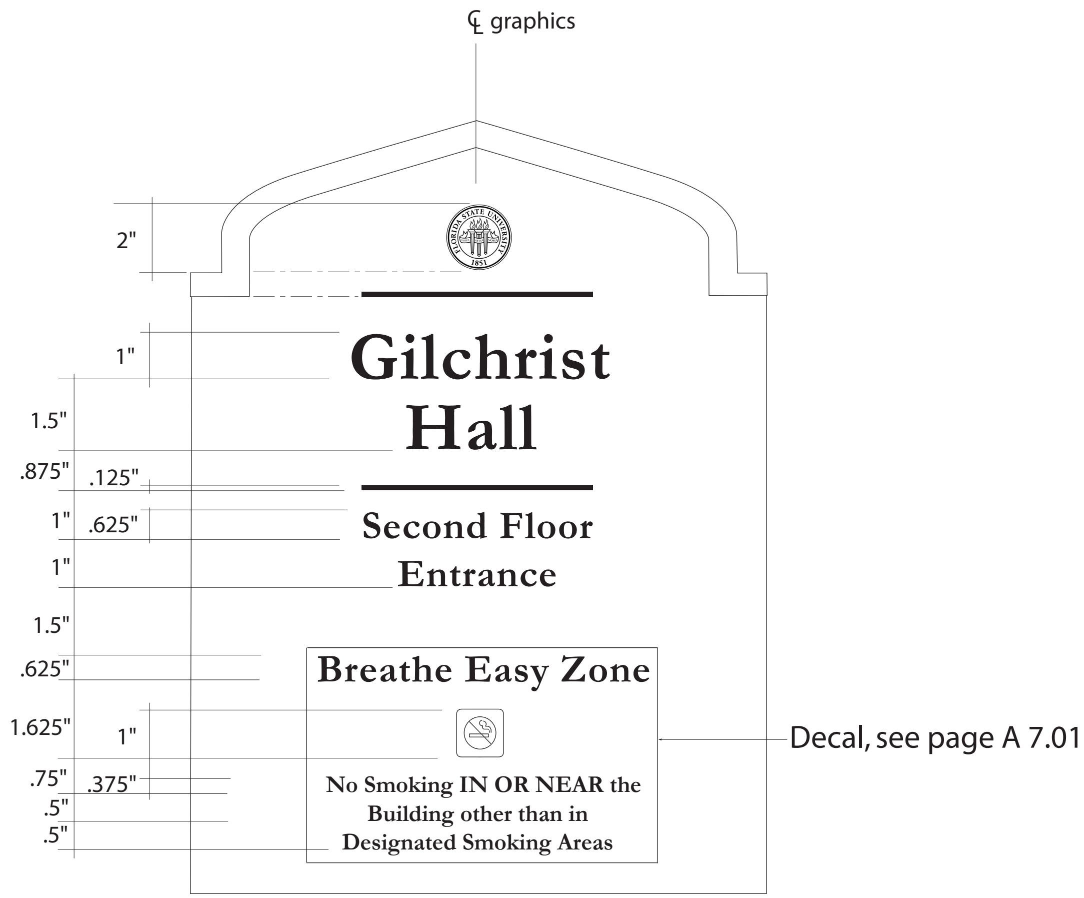
Current ADA Accessibility Guidelines (1990), do not require that building entrance signs be tactile. However, it is recommended that they meet ADAAG requirements for character proportion, sign finish, color contrast, and placement.

Fabrication Guidelines: Type 19 - Graphics Panel, solid plastic plaque- burgundy color ; Graphics, PSV, light gray cornice, gold university symbol and rules, white message. Type 19A - Graphics Panel, PSV decal applied to first glass surface; Graphics, photoscreened, colors same as Type 19 plaque.

Refer to manual pages B 19.01 for graphics measurements, B 19.02 for layout variations, B 19.10 for placement guide-lines, and B 19.20 for design intent drawings.

Elevation with Building Name, Entrance ID, and Regulatory Message

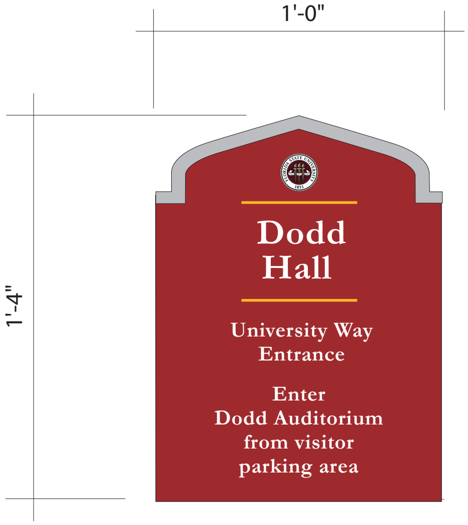
Scale: 1/4 Full



Elevation with Building Name,
Entrance ID, and Regulatory Message

Scale: 1/4 Full

The following layouts illustrate selected message options available. Other messages can be displayed, providing the building name, University Symbol, and horizontal rules are displayed as shown.

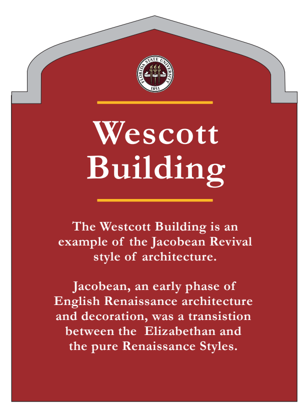


Elevation with Building Name and Information Message

Scale: 1/8 Full

Elevation with Building Name and Accessible Entrance ID

Elevation with Building Name and Regulatory Message



Elevation with Building Name and Historical Brief

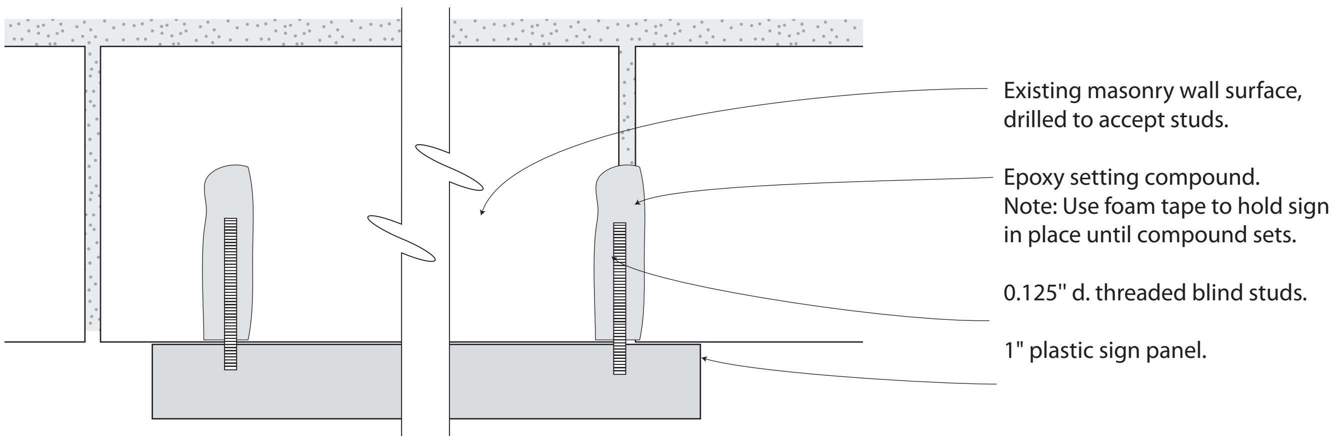
These signs should be located on the nearest wall surface adjacent to the latch side of the door, or in the case of double doors, on the nearest wall surface to the right side. Signs must be positioned to avoid door swing and protruding objects.

Placement Elevation for Single Door

Placement Elevation for Double Doors

Scale: 1/2"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A

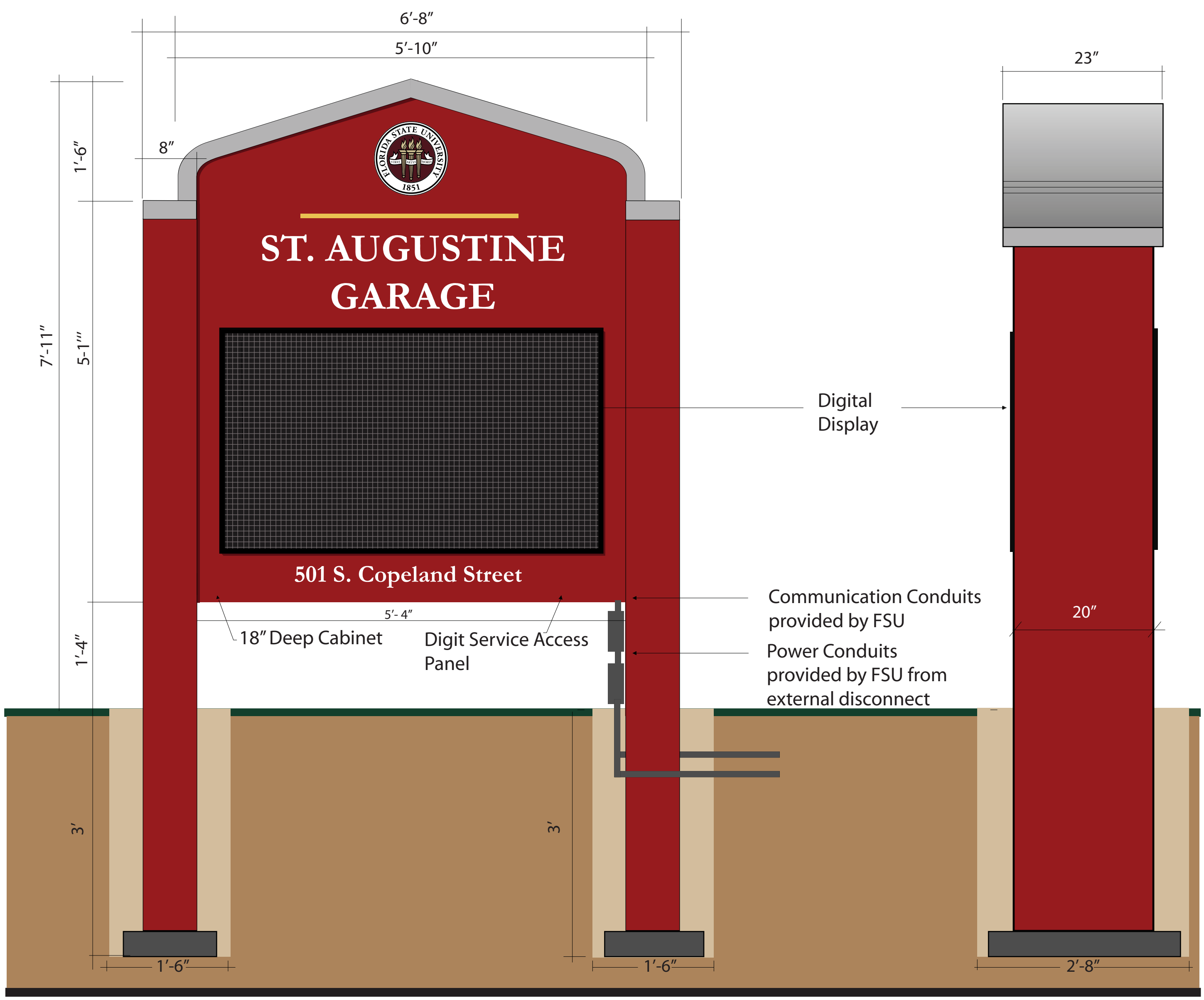
Scale: Half Size

Parking Garage Signs are intended to identify the building name, and to display the number of avaliable parking spaces for students, faculty, and staff. Sign may be two-sided or single-sided.

Electronic digital displays are provided in the sign and interfaced with vehicle monitor systems located in the garage structure.

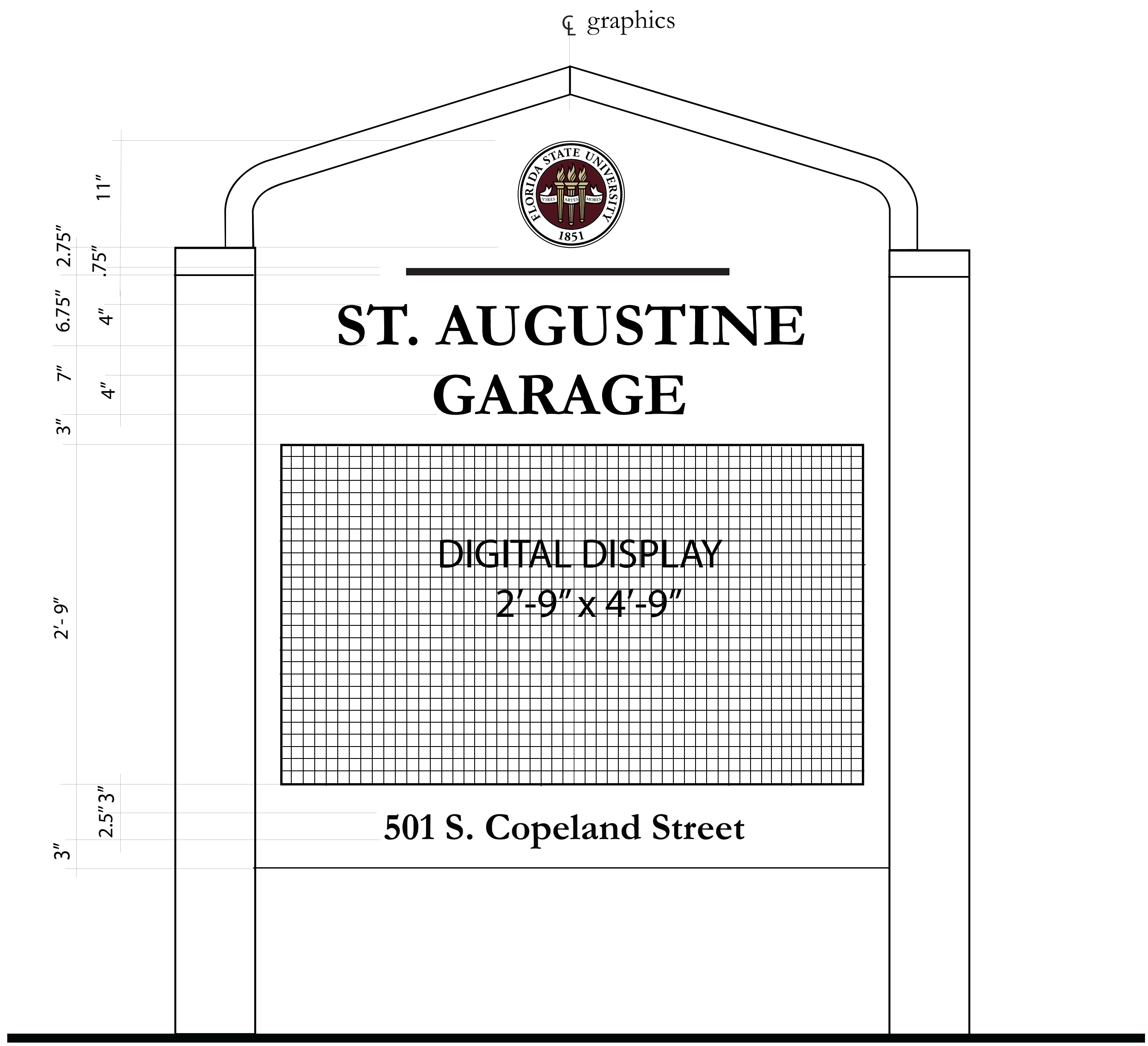
Fabrication Guidelines: Sign cabinet and posts, formed .125'' aluminum with garnet acrylic polyurethane finish set into packed sand footings; Cornice, formed aluminum with light gray textured coating. Graphics, reflective sheeting, white messages, gold rules,digital printed FSU Seal; Digital numbers display.

Refer to manual pages B 20.01 for graphics measurements, manual page B 7.22 Detail 2 for post footing construction.



Elevation
Opposite side similar
Scale: 1/2" = 1'-0"

Profile



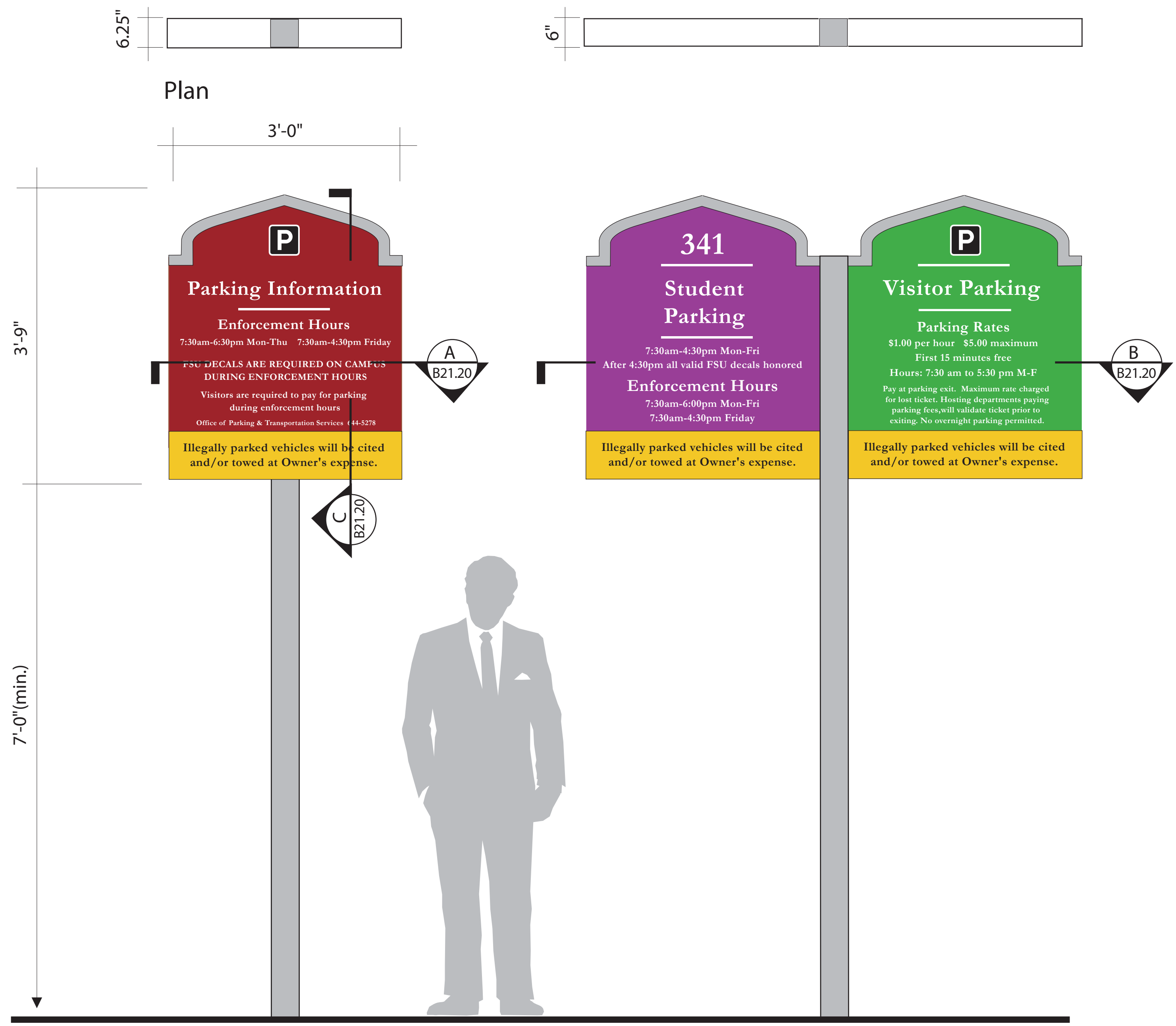
Elevation
Scale: 3/4"=1'-0"

These signs are used to identify contolled or designated parking areas throughout the campus. They may be single or double sided.

Sign fields are color coded to identify designated parking areas as follows: Green, visitors and metered spaces; Purple, student and freshman; Brown, faculty and staff; and Gray, motorcycles.

Fabrication Guidelines: Posts, formed from extruded aluminum sections with caps; Graphics Panel, solid plastic (various colors); Graphics, reflective sheeting, white messages on top panel section, PSV white and black pictograms and PSV black message on bottom panel section.

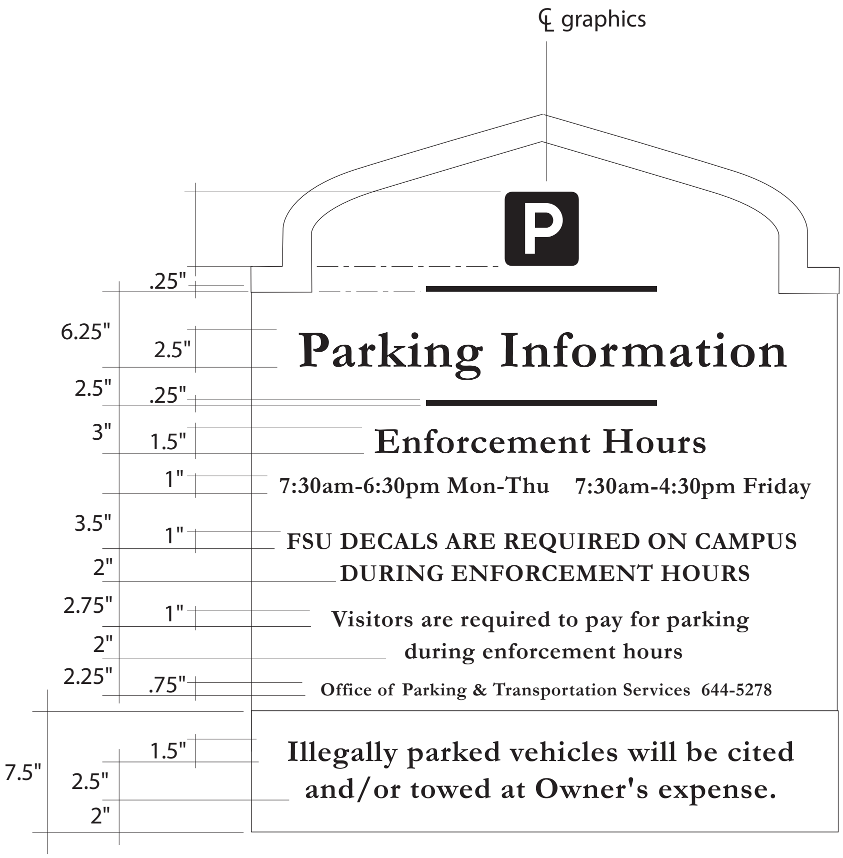
Refer to manual pages B 21.01 for graphics measurements, B 21.04 for layout variations, B 21.10 for placement guide-lines, and B 21.20 for design intent drawings.



Elevation of Reserved Parking Area
Single Sign Mount

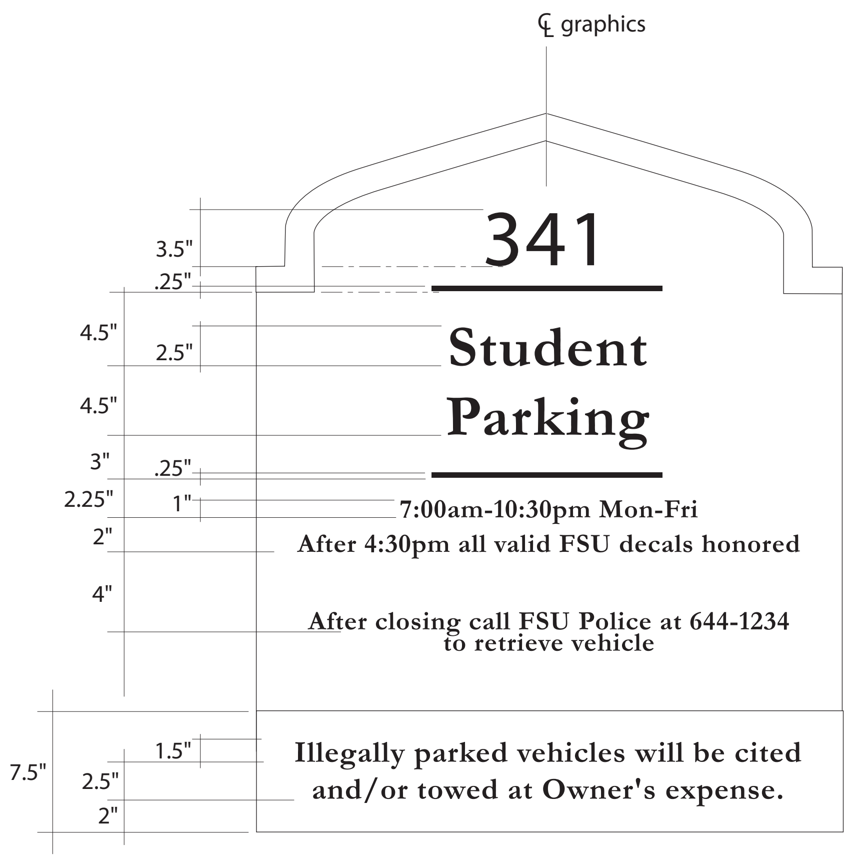
Double Sign Mount

Scale: 1/2"=1'-0"



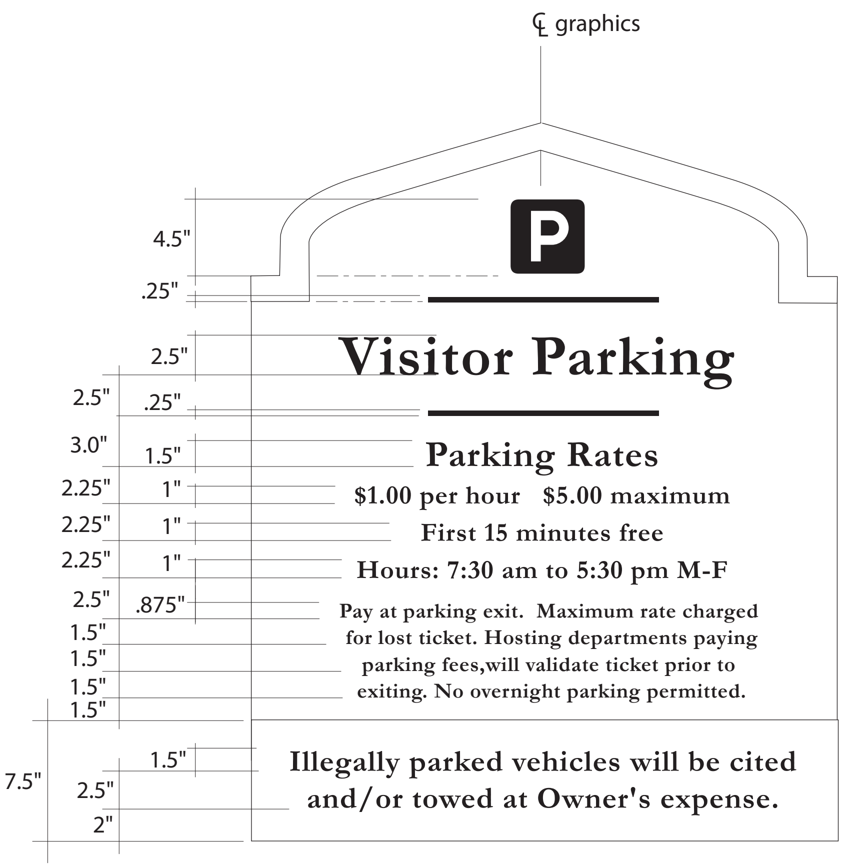
Reserved Parking Area Identification

Scale: 1"=1'-0"



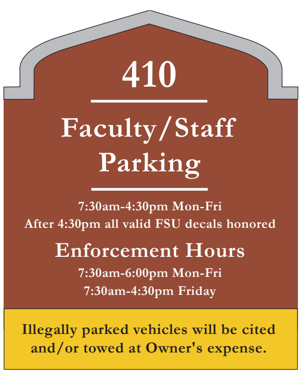
Reserved Parking Area Identification

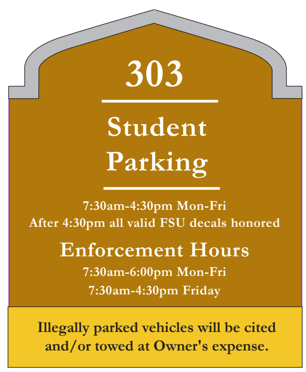
Scale: 1"=1'-0"

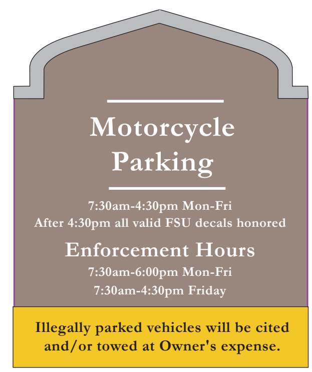


Reserved Parking Area Identification

Scale: 1"=1'-0"





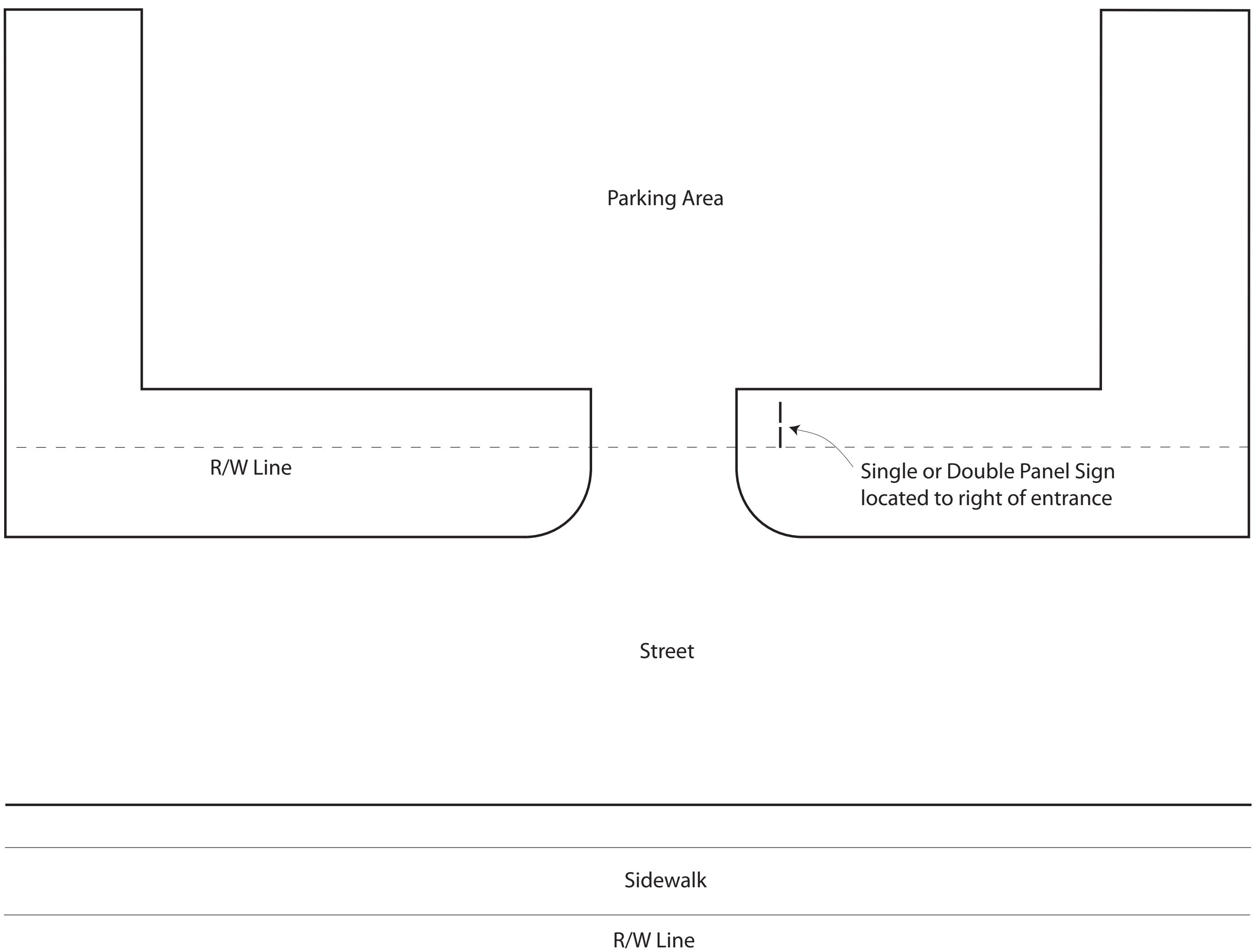


Typical Elevations

Scale: 1/2''=1'-0''

Signs are to be positioned perpendicular to street from which they are to be viewed and behind street right-of-way lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

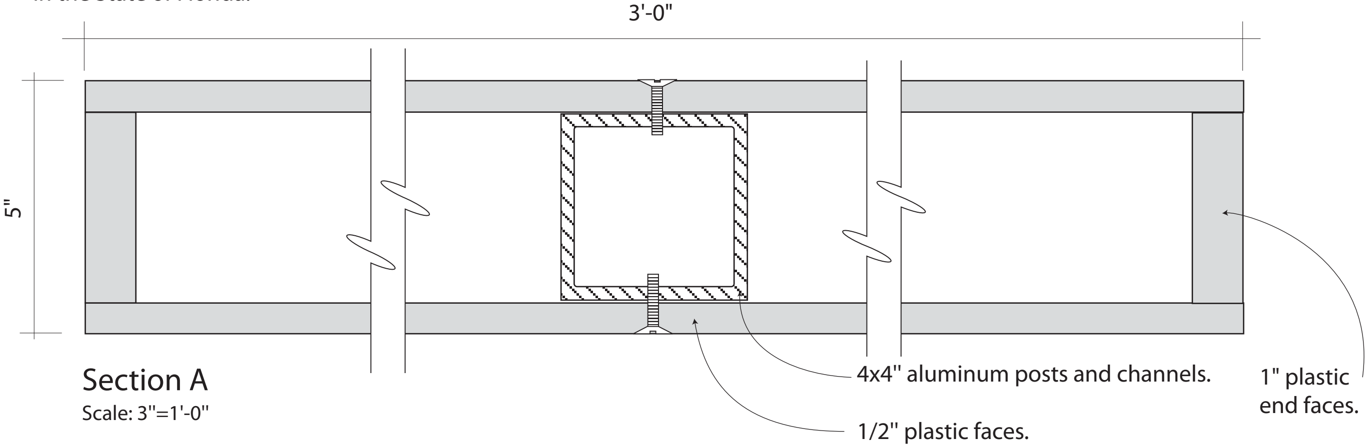
Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



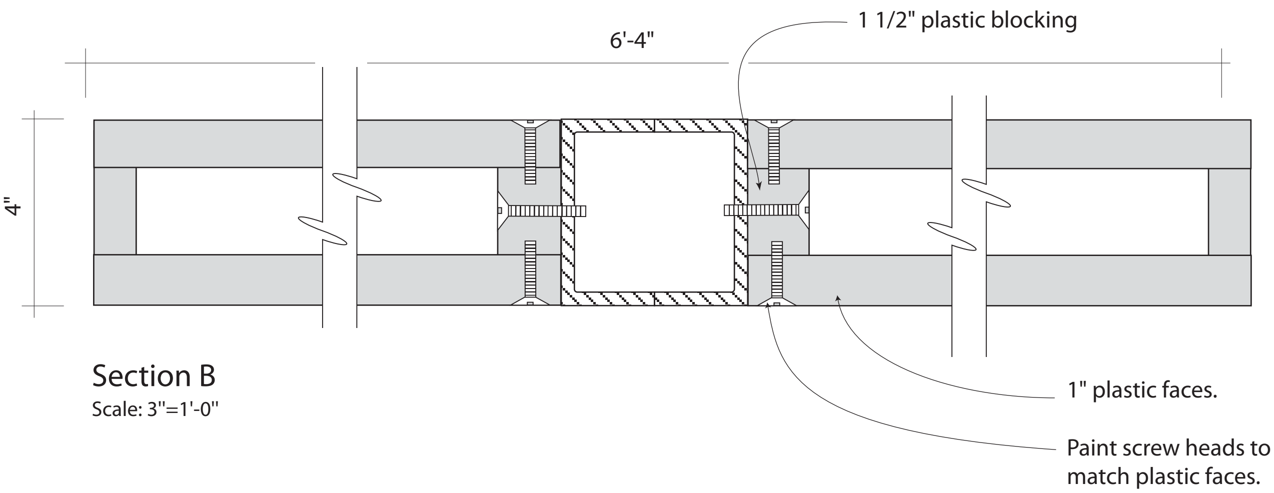
Typical Plan

Scale: NTS

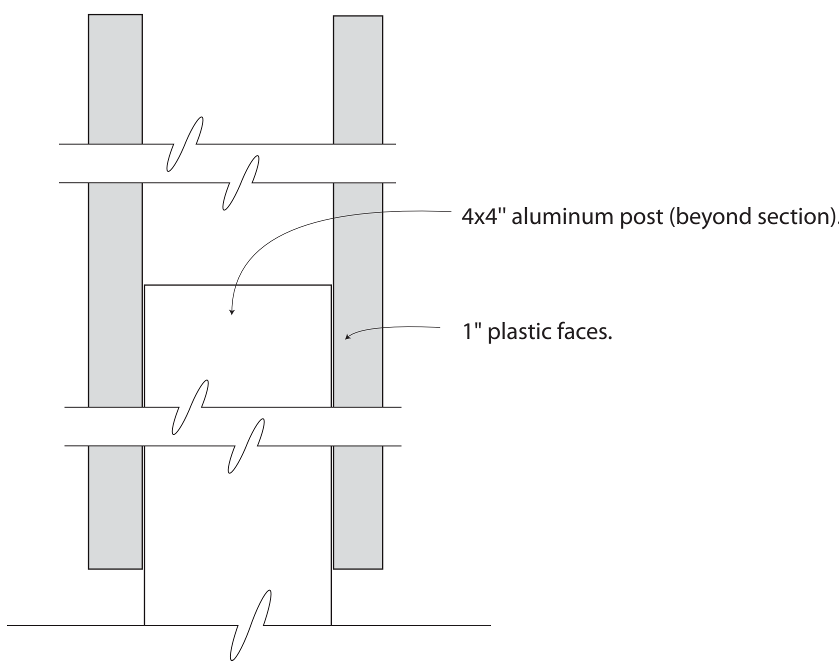
Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A
Scale: 3"=1'-0"



Section B
Scale: 3"=1'-0"



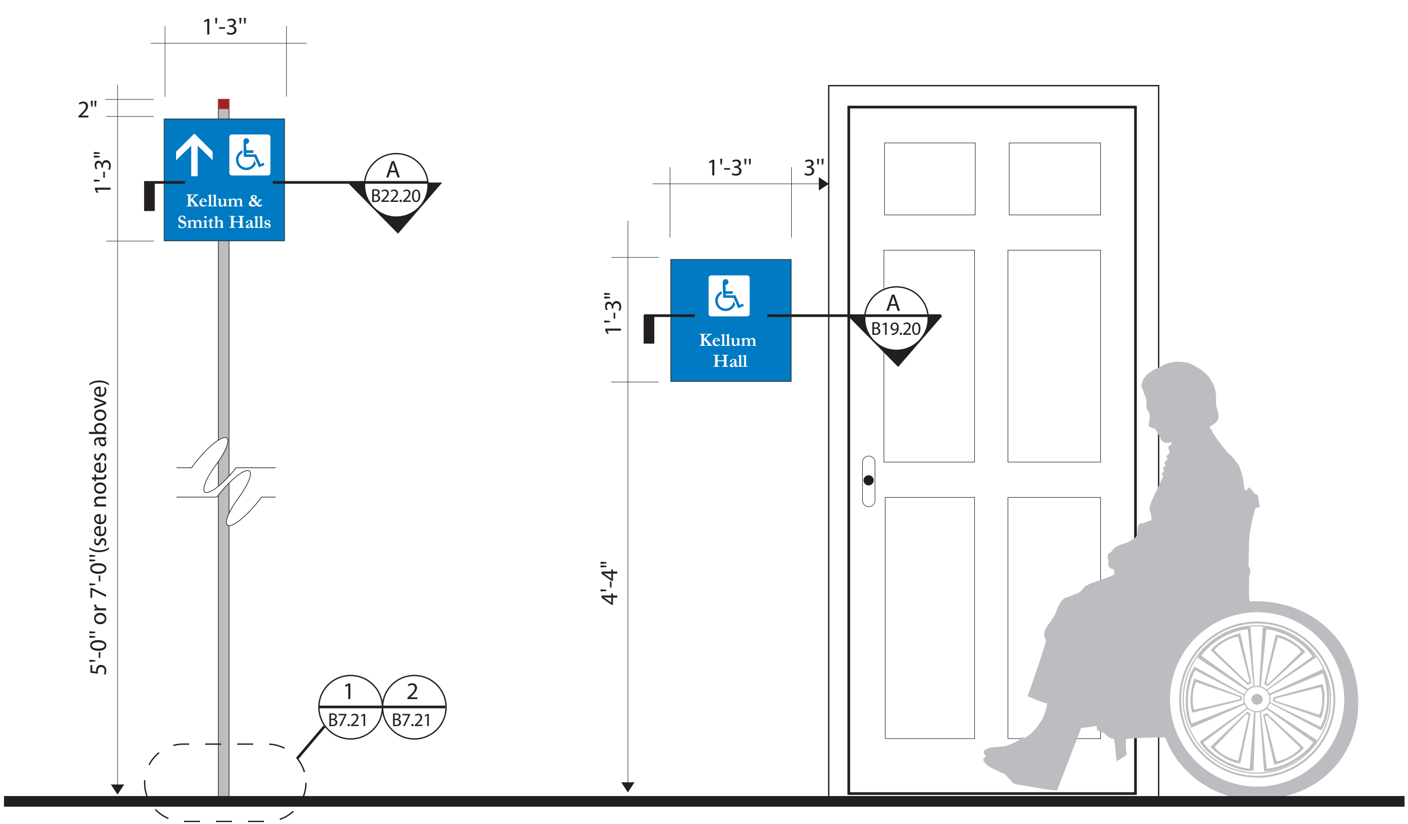
Section C
Scale: 3"=1'-0"

These signs can be used to identify and direct to handicapped accessible entrances, and provide other general information messages that may be required.

Sign clearances will vary for general information messages. Signs displaying general information that are located adjacent to pedestrian walkways are to be mounted with a clearance of 7'-0"; others may be located with a 5'-0" clearance.

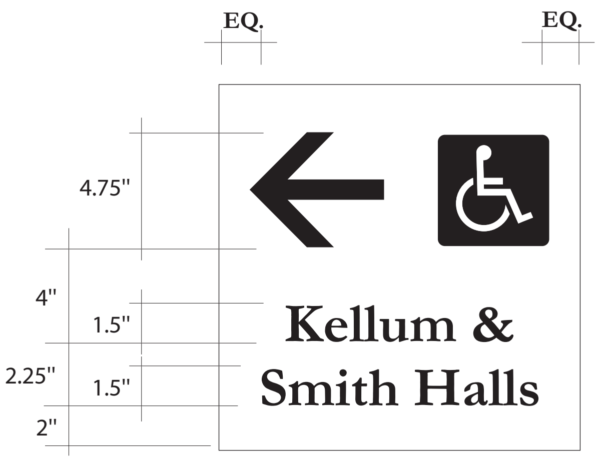
Fabrication Guidelines: Type 23 Posts, formed from extruded aluminum tubes with caps light gray polyurethane finish; Types 23 and 24 Graphics Panel, solid plastic- blue color ; Graphics, reflective sheeting, white message, pictogram field, and arrow.

Refer to manual pages B 23.01 for graphics measurements, B 23.10 for placement guidelines, and B 19.20 and B 22.20 for design intent drawings.



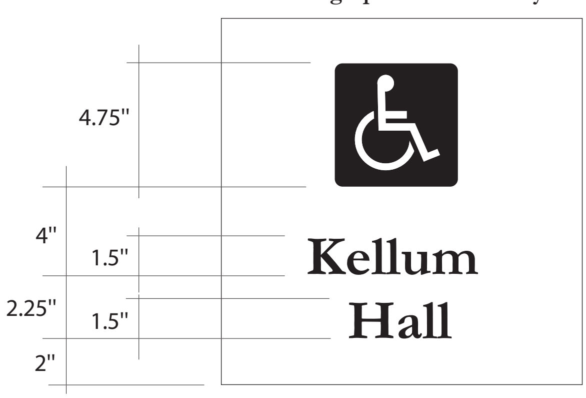
Elevation
Sign Type 23
Scale: 1/2"=1'-0"

Elevation
Sign Type 24
Scale: 1/2"=1'-0"



Elevation
Sign Type 23
Scale: 1 1/2"=1'-0"

Center all graphics horizontally.

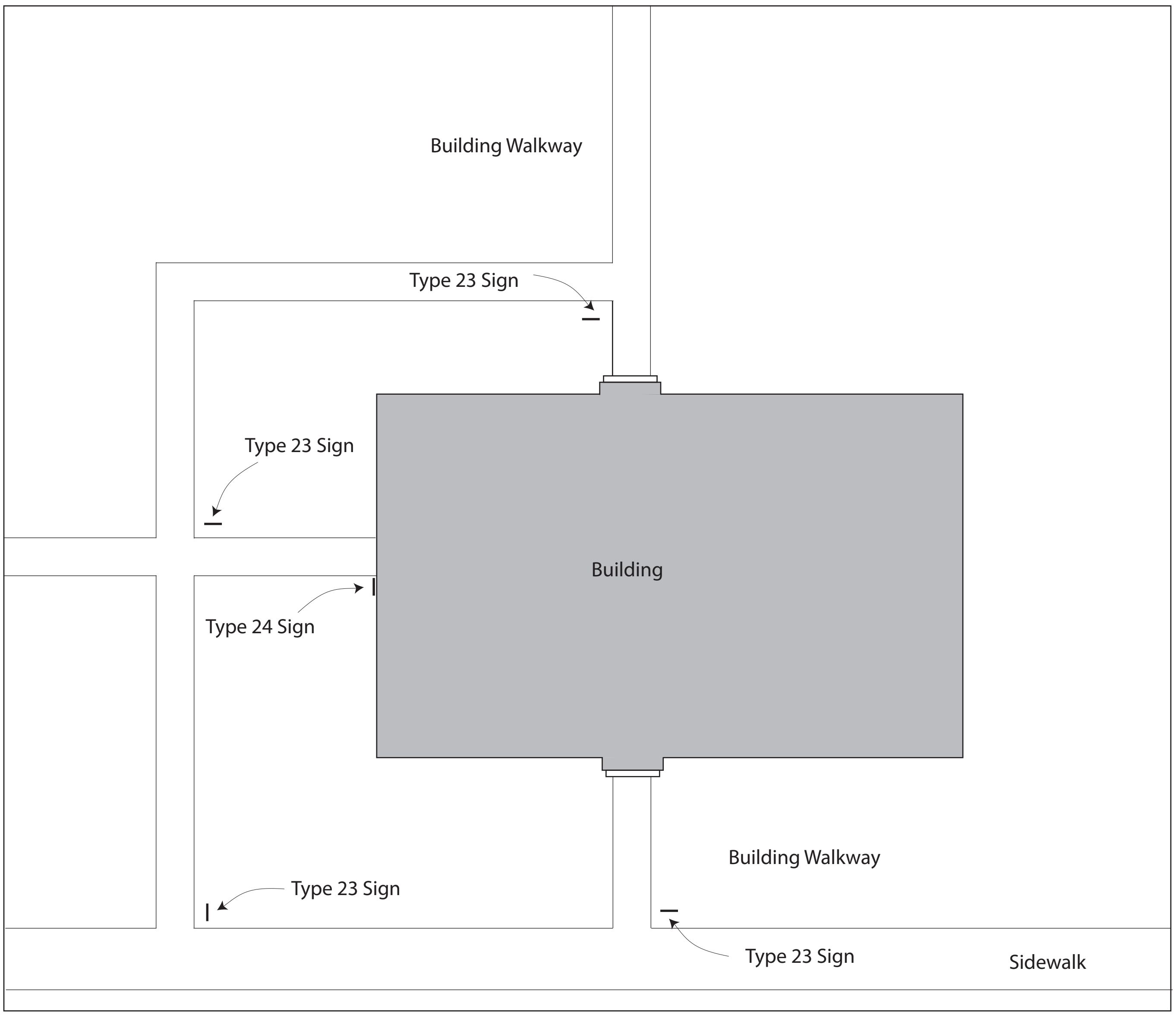


Elevation
Sign Type 24
Scale: 1 1/2"=1'-0"

Type 23 signs are to be positioned where they can be easily seen by a pedestrian from an unaccessible building entrance and along the accessible walkway. Type 24 signs are only to be used to identify accessible entrances, if all of that building's entrances are not accessible.

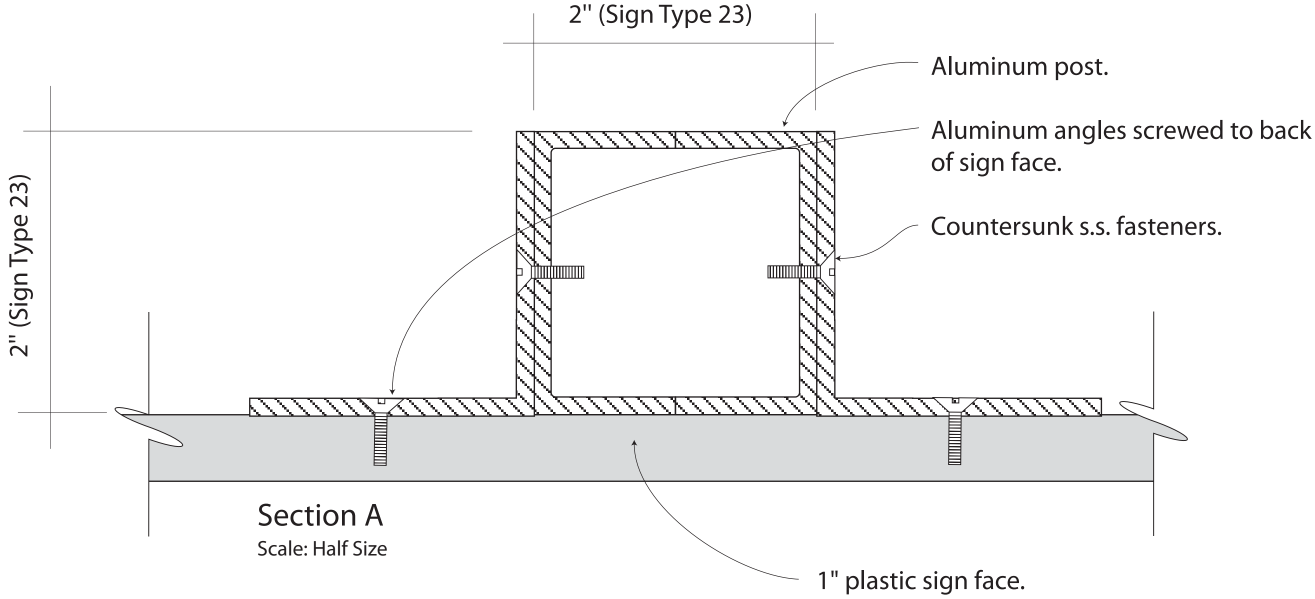
Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the signs from viewers.

It shall be the responsibility of the installer to obtain the locations of all underground utilities in the sign proximity prior to digging foundations.



Typical Plan

Scale: NTS



Section A
Scale: Half Size

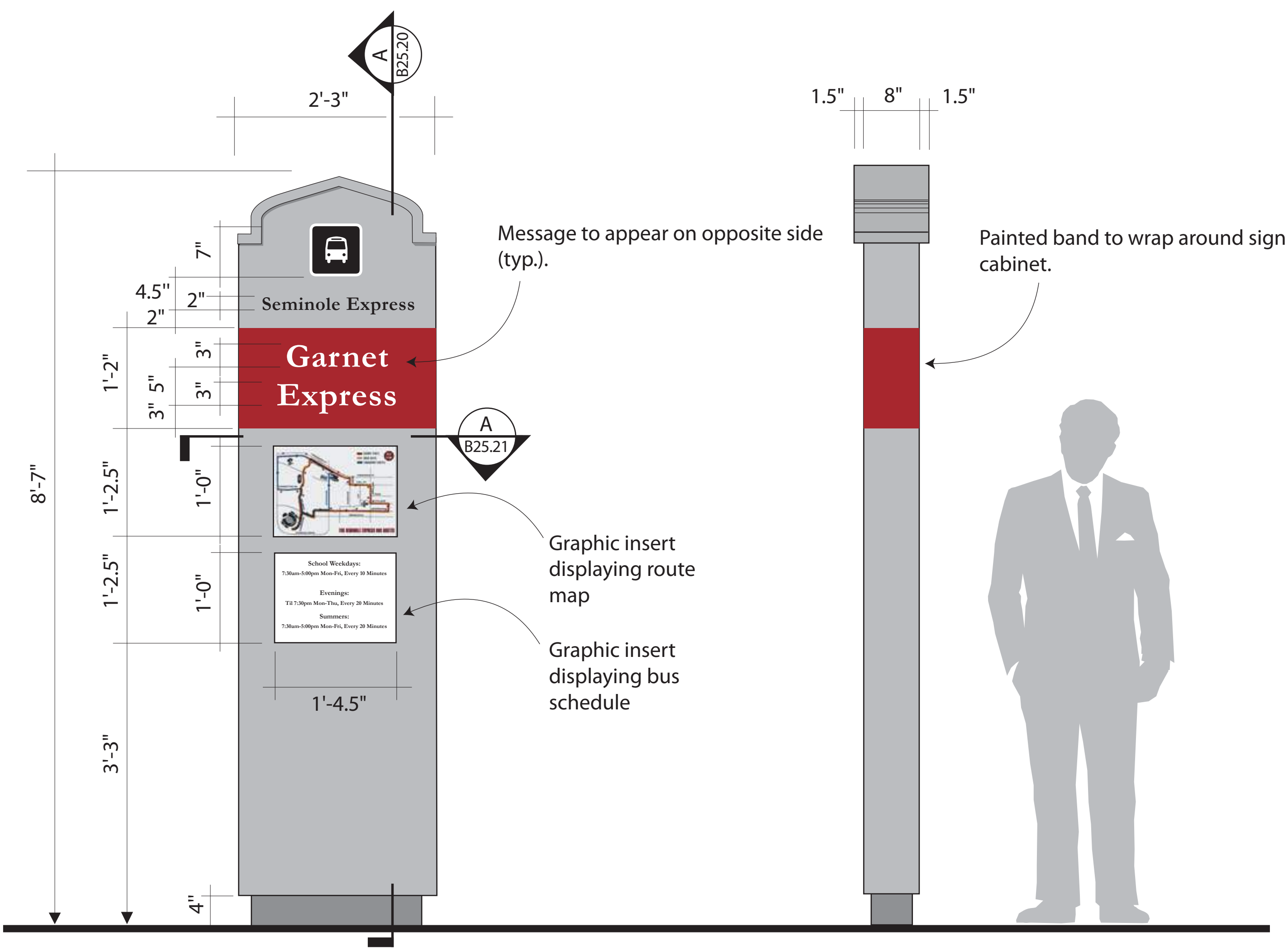
Section A
Scale: Half Size

These single sided signs are used to identify bus stops on campus. Route identification panels are color coded to identify Garnet, Gold, or Blue (Tomahawk Shuttle Routes).

Route name is to appear on both sides. Color band is to wrap around sign cabinet.

Fabrication Guidelines: Sign Cabinet, formed aluminum pylon, light gray polyurethane finish; Cornice, formed aluminum with light gray textured finish, Identification Band, polyurethane finish (various colors); Graphics, reflective sheeting, PSV black and white pictogram, PSV black message and white reflective sheeting message, Graphic Inserts; full color digital prints on PSV adhered to second surface of clear polycarbonate.

Refer to manual pages B 25.01 for layout variations, B 25.10 for placement guidelines, and B 25.20 for design intent drawings.

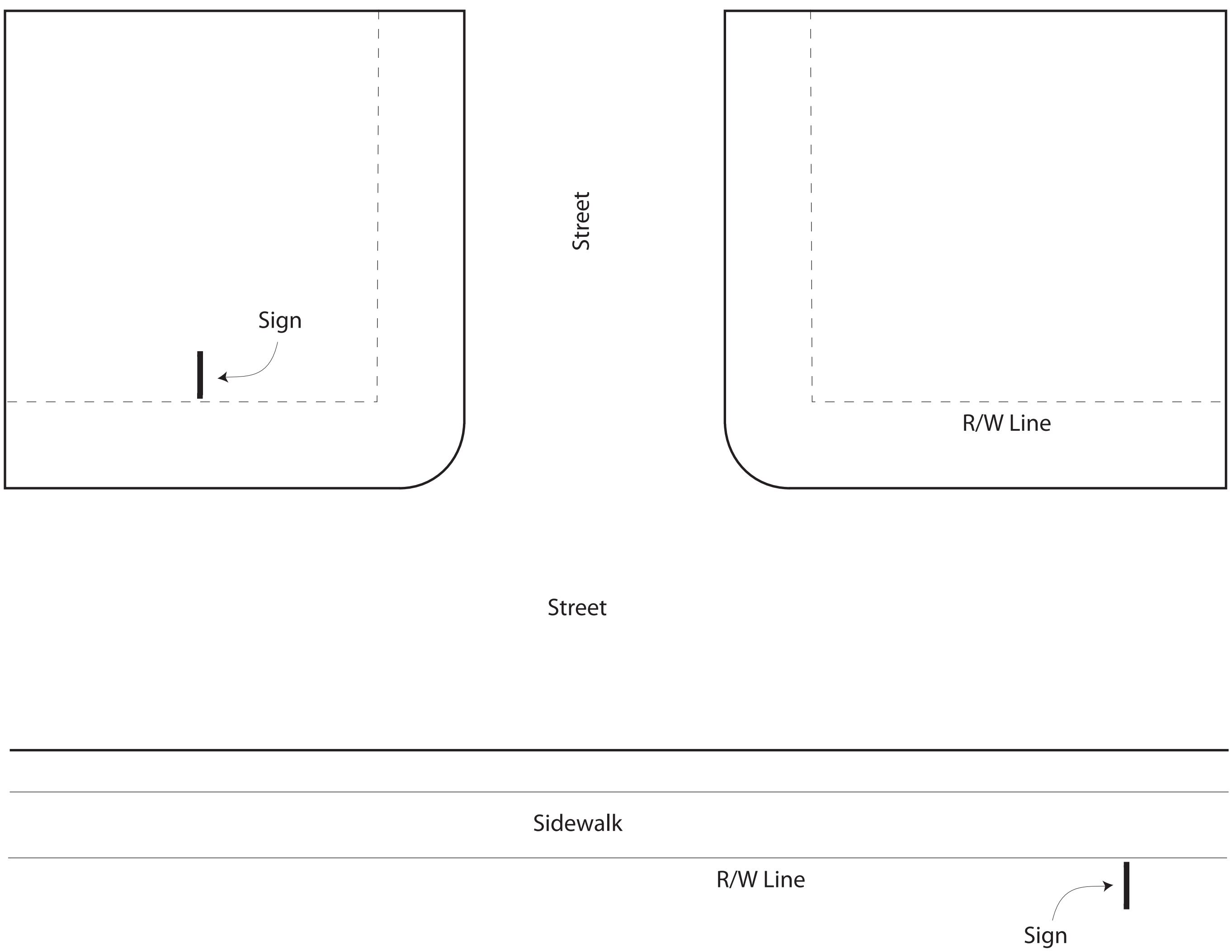


Elevation of Garnet Route Sign (Layout A)
Scale: 1/2"=1'-0"

End View

Signs are to be positioned perpendicular to street from which they are to be viewed and behind street right-of-way and setback lines. Sign locations are site specific; therefore, care must be taken to place the signs in locations free from obstructions that would block the them from viewers.

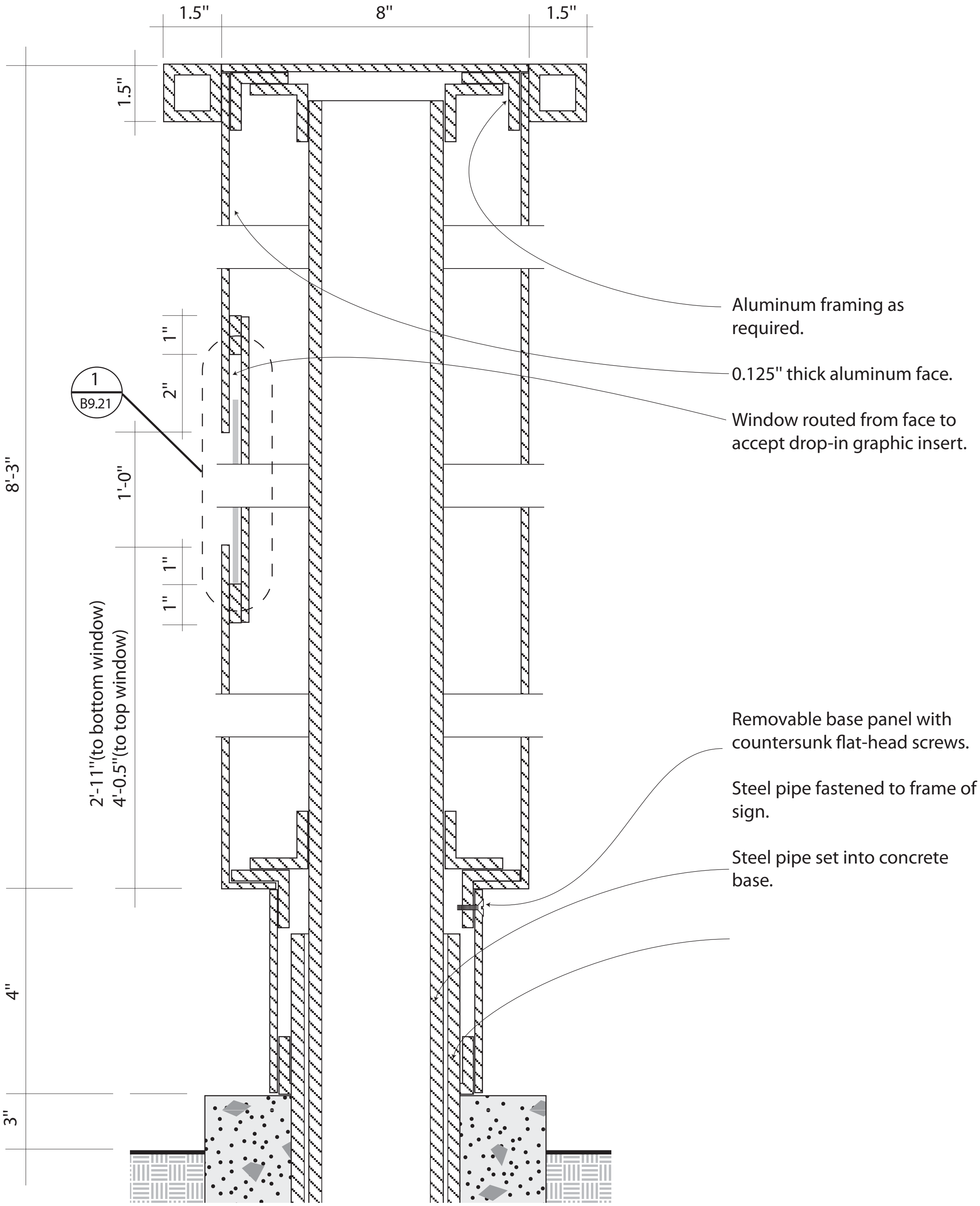
Since the location, quantity, and size of the signs may exceed the local zoning ordinance, approval from the appropriate regulatory agency is recommended prior to fabrication.



Typical Plan

Scale: NTS

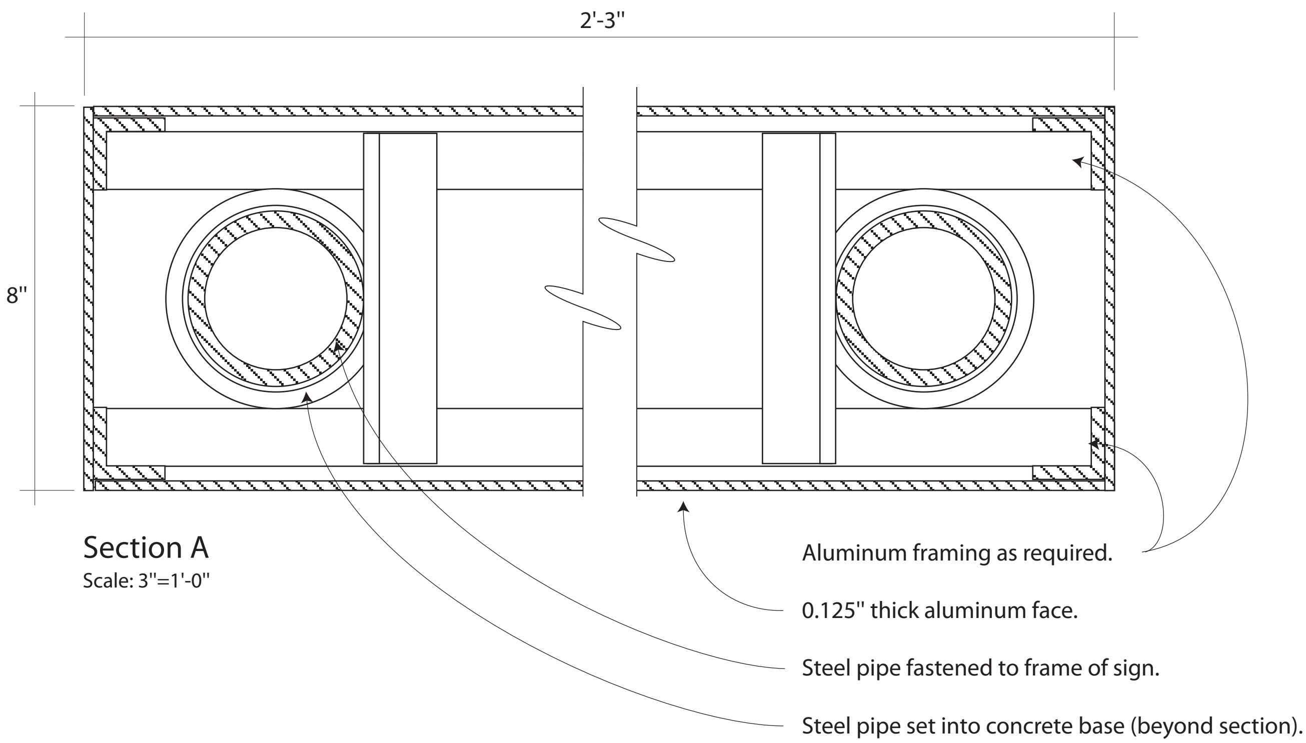
Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



Section A

Scale: 3"=1'-0"

Note: Material dimensions and configurations shown are for design intent only. All materials,dimensions, configurations and specifications must be signed and stamped by a registered structural engineer licensed in the State of Florida.



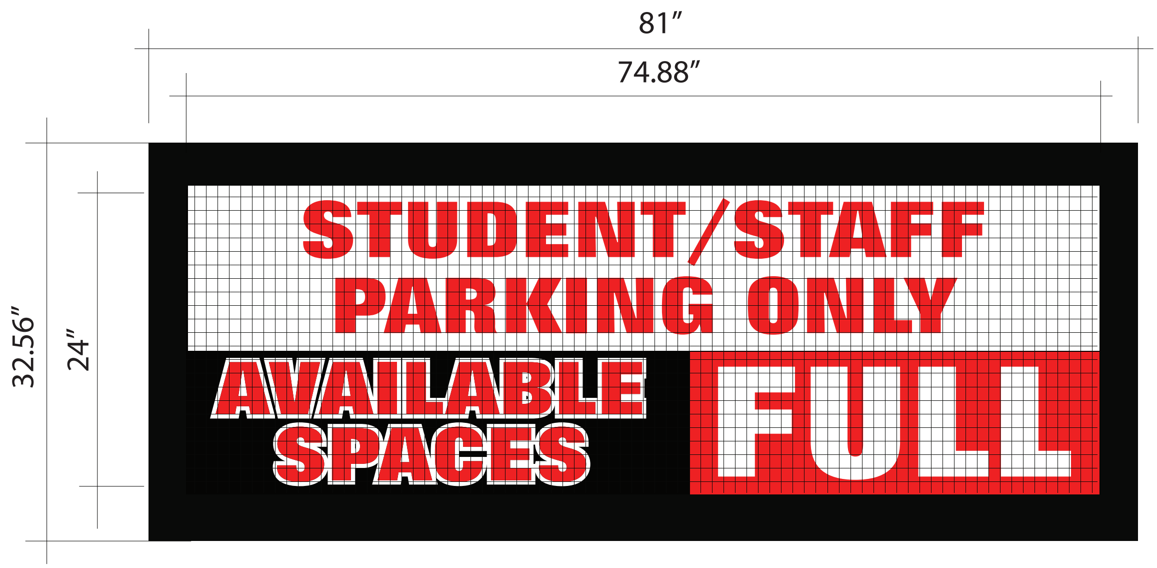
Section A
Scale: 3"=1'-0"

Parking Garage Digital signs are intended to inform students and staff about availiable parking spaces.

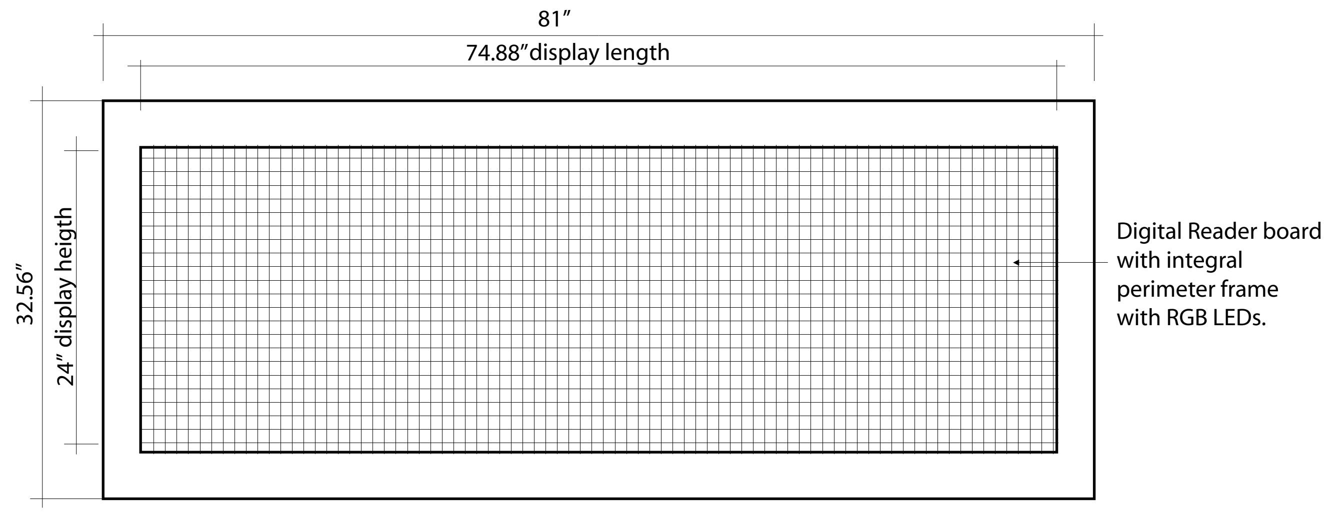
The display is interfaced with a vehicle monitor systems in the garage structure.

Fabrication Guidelines: All aluminum digital display with satin black polyurethane finish. All welded steel receiver frame wall mounted with expantion bolts to concrete substrate.

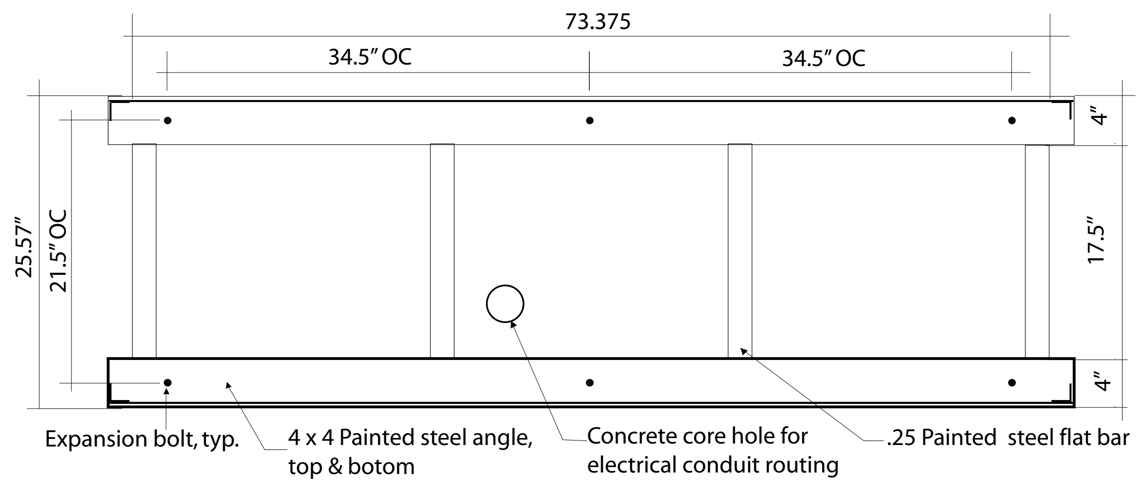
Refer to manual pages B 27.01 for graphics measurements, and fabrication details.



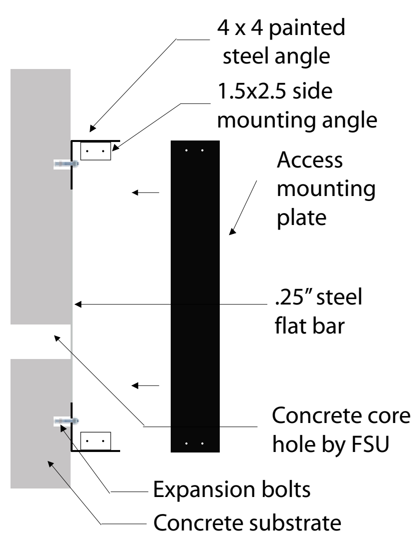
Elevation
Scale: 3/4″ = 1′-0″



Display Front View



Receiver Frame Elevation



End Frame Detail

Scale: 3/4"=1'-0"

Part 1 - General

1.0 Related Documents:

A. General provisions of the Contract, including General Conditions, applies to Work in this section.

B. FSU Signage Style Manual containing; Section A, Basic Design Components; Section B, Sign Type Drawings; Section C, Sign Location Drawings; Section D, Sign Message Schedules; and Section E, Specifications applies to Work in this section.

C. Architectural, civil, electrical, and landscape campus drawings filed with FSU Facilities Design and Construction Department, 109 Mendenhall, Building A, Tallahassee, FL 32306

1.1 Summary:

A. Section E includes the production and installation of new exterior signage.

B. Section E includes preparation of structural and electrical engineering drawings where required.

C. Section E includes the acquisition of permits and inspections.

D. Section E includes the removal of existing exterior signage, the repair of damaged substrates, and the cleanup of debris.

1.2 Description:

A. Provide the fabrication and installation of Exterior Signage identified in the Project Scope. The description of each Sign Type that composes this program is defined in the FSU Signage Style Manual.

B. By service contract agreement Florida State University (the Owner) will assume responsibility for providing electrical power leads, communication cables and related conduits to within ± 6 feet of proposed sign locations requiring such services; alternately, this work may be provided by a licensed electrical subcontractor. Under contract to the sign manufacturer the sign manufacture shall make all final connections.

1.3 Quality Assurance:

A. Sign Manufacturer must have been regularly engaged for the past two years in the fabrication and installation of exterior sign programs exceeding $150,000. in value.

B. Substitutions: all products specified may be substituted with an approved equal unless specifically noted otherwise. Approval must be in writing prior to bid submittal after review of submittal providing complete documentation of attesting to product equivalency.

C. Prequalified Manufacturers:

1. Cummings Inc.; Nashville, TN

2. Identities; Alpharetta, GA
3. Integrated Sign & Graphics, Louisville, KY
4. Apogee Signs, Tallahassee, FL
5. Advanced Signs, Panama City, FL

D. Prequalified Subcontractors for Digital Sign Components:

1. Daktronics, Inc.,Brookings, SD

2. Computerized Directory Systems; TTSS Interactive Products, Rockville, MD

1.4 Manufacturer Responsibilities:

A. The Manufacturer and his Subcontractor(s) shall hereby agree to read carefully all instructions to bidders, agreements, and specifications and any other attachments included in these contract documents and be bound by their conditions.

B. These contract documents are for design intent compliance and should only be used as a guide to produce the finished size, appearance, and function shown. Nothing contained in these contract documents shall be construed as a design for any engineered element. The Manufacturer and his Sub-contractor(s) shall be responsible for all structural and electrical engineering, and final electrical hookup.

C. All structural and electrical engineering drawings are to be stamped and signed by the respective engineers currently registered in the State of Florida.

D. In all cases, any and all national, state and local codes, ordinances and safety standards shall take precedence over these contract documents and it is the responsibility of the Manufacturer and his Subcontractor(s) to make certain that these codes, ordinances and safety standards are complied with.

E. Manufacturer agrees to apply for and secure all necessary permits at his cost. Manufacturer shall inform the Owner in writing prior to beginning any sign construction whether sign variance(s) or easements are required.

F. Before digging or coring sign foundations manufacturer shall be responsible for locating and identifying all underground utilities within the project area with the assistance of the FSU Central Utilities and Engineering stuff.

G. For all signs incorporating digital number displays or digital reader boards, the sign manufacturer shall provide all related hardware and software products required for proper operation by the Owner.

1.5 References:

A. Conform to latest edition of the following standards and specifications as adopted by the state of Florida:

1. ADA The American with Disabilities Act
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials
4. AWS American Welding Society

5. MAAMM National Association of Architectural Metal Manufacturers, Alum. Finish Manual
6. BOCA Building Officials and Code Administrators International, Inc.
7. NFPA National Fire Protection Association, National Electrical Code
8 . MUTCD Manual of Uniform Traffic Control Devices
9. FDOT Florida Department of Transportation, Roadway and Traffic Design Standards
10. UL Underwriters Laboratories
11. City of Tallahassee, Zoning Ordinance

1.6 Submittals:

A. Shop Drawings:

1. Submit to the Owner's Representative in PDF electronic format scaled reproducible shop drawings and sign face layouts for all sign types required.

2. All submittals requiring structural and/or engineering design shall be stamped and signed by a licensed professional engineer currently registered in the State of Florida.

3. All submittals from Subcontractors and suppliers must be reviewed by the Manufacturer before submittal to the Owner's Representative.

4. Approval of drawings, samples or data by the Owner's Representative shall not relieve the Manufacturer from responsibility for deviation from the design intent drawings or specifications unless the Manufacturer has in writing calling the attention to such deviation at the time of submission.

B. Materials and Colors, submit where applicable to the project scope:

1. Submit two 6" x 6" samples of each required material and paint color.

2. Submit two 1'-0" x 1'-0" samples of Scotchprint maps adhered to clear polycarbonate covers.

3. Submit 2" high project alphabet displays in PDF electronic format.

4. Submit applicable brochure data in PDF electronic format.

C. Field Samples:

1. Provide one full size operational field sample prototype of selected sign types to be determined by the Owner's Representative for review at the Owner's site prior to proceeding into production.

2. Upon acceptance, field samples may be incorporated within the Work.

1.7 Schedule:

Substantial Completion to be determined by the Owner's Representative.

1.8 Project/Site Conditions:

A. Field Conditions: Where the work of this Section interfaces with in-place construction, verify existing conditions. Obtain field dimension to ensure proper coordination. Notify the Owner's Representative in writing of conflicts before proceeding into production.

1.9 Artwork:

A. Artwork required by the Manufacturer to execute the sign work will be provided by the Owner in agreed-upon digital format.

Part 2 - Products

2.0 Concrete:

A. Scope:

1. Work included in this division includes manufacturing and materials for all cast-in place concrete, concrete sealing, and finishing for sign support foundations and platforms.

2. Configuration of foundation(s) to be determined by Manufacturer based on available space, location of underground utilities, wind loads, soil content, and related engineering design.

B. Materials:

1. Form materials shall conform to HC1 301.

2. Reinforcing steel shall conform to ASTM A-615, grade 60.

3. Steel wire shall confirm to ASTM A-82, plain, cold-drawn, steel.

4. Cement shall confirm to ASTM C-150, normal-type I, II or V, low alkali portland, gray color. Use type V when concrete is in contact with soil only.

5. Water shall be clean and not detrimental to concrete.

6. Admixtures shall be batch plant added with controlled metering devices to comply with ASTM C-94.

7. Grout, non-shrink type, shall not contain expansion cement or metallic particles.

8. Provide exposed surfaces for platforms to match adjacent surfaces in finish and color, or as directed by the Owner's Representative.

2.1 Unit Masonry:

A. Scope:

1. Work included in this division includes manufacturing and materials for all concrete masonry units (CMU) and brick veneer for sign support bases and their supporting structures.

B. Materials:

1. Lightweight hollow load-bearing concrete masonry units complying with ASTM C-90, grade N, type I, natural color.

2. Provide CMU units having nominal face dimensions of 16 inches long by 8 inches high by the depth shown or otherwise required.

3. Provide accessory shapes as indicated or otherwise required.

4. Face brick units having nominal dimensions of 8 inches long by 2-2/3 inches high by 4 inches deep, equal to Cherokee Red Flash

5. Mortar, type M or type S as directed by the Owner's Representative, to comply with ASTM C-207. Color TBD.

6. Reinforcing steel pipe shall conform to ASTM A-53.

2.2 Metals:

A. Scope:

1. Work included in this division includes manufacturing and materials for all steel and aluminum components of the specified signs and their supporting structures.

B. Materials:

1. Steel angles, flats, plate, channels, rounds and squares shall conform to ASTM A-36.

2. Steel pipe shall conform to ASTM A-53.

3. High strength steel bolts, nuts and washers for structural joints shall conform to ASTM designation A-325.

4. Other bolts shall conform to ASTM designation A-307.

5. Aluminum shall be 60637 T5 or 6061 T6 as recommended to comply with required service and finish

6. Sheet aluminum shall conform to ASTM B209-65.

7. Aluminum bolts and aluminum rivets shall conform to ASTM B316-64.

8. Recycled aluminum or steel shall not be used.

9. Manufacturer is responsible to specify all materials to meet or exceed all safety requirements and to uphold the Manufacturer's Warranty as indicated in the Agreement. If the Manufacturer requires deviation from the materials to meet these requirements, then he should submit a request in writing to the Owner's Representative prior to proceeding into production.

C. Welding:

1. Certification: Shop and field welders must be certified by a qualified testing laboratory and meet all national and local requirements. Certification must be current for all work performed on the project.

2. All welds to meet or exceed the structural requirements of the signs as set forth in the shop drawings prepared and engineered by the Manufacturer.

3. All welds to be continuous, ground smooth and finished to match.

D. Dissimilar Metals:

1. Aluminum shall be isolated from steel by means of a shop applied minimum 10 mil vinyl with electrolytic corrosion factor of 1.0 and temperature resistance range of -20 degrees F to +200 degrees F.

E. Routed Face Graphics:

1. The Manufacturer shall utilize digitally controlled machinery to cut the openings required in the aluminum faces as shown on the drawings.

2. All cutting must be within a tolerance of plus or minus 0.1 inches of the reproducible artwork.

F. Preparation and Painting: see Painting Section 2.5

G. Formed Aluminum Cabinets and Retainers:

1. The maximum allowable inside radius of any (90) ninety degree break formed edge shall be no greater than the thickness of the metal sheet.

2. All breakformed edges must be smooth, straight and free of any malformations.

3. All sign faces are to be fabricated flat without seams, except as noted on Design Intent Drawings.

2.3 Vinyl Applications:

A. Scope:

1. Work specified under this division includes the manufacturing and materials for acrylic, and all vinyl applications for signs and sign faces.

B. Vinyls and Reflective Sheeting:

1. All pressure sensitive vinyl (PSV) as manufactured by 3M® Company Scotchal. Colors to be as noted in Manual Sections A and B.

2. All reflective sheeting products as manufactured by 3M® Company Scotchlite. Colors to be as noted in Manual Sections A and B.

3. Digital map prints to utilize 600x600 dpi heat-transfer foil process on clear 3M Scotchcal self-adhering vinyl applied to second surface of 1/8" clear polycarbonate with UV-resistant Marguard coating. Other equivalent methods and materials may be approved upon submittal. Provide 3-year minimum warranty against fading for printed products.

4. Directory prints shall consist of Scotchcal reverse printed text applied to second surface of 1/8" clear polycarbonate with UV-resistant Marguard coating followed by a full sheet of Scotchcal premium grade PSV matching the existing "garnet" backgrounf color.

5. All project symbols and graphics produced in vinyl and/or reflective sheeting must match digital art provided by the Owner, within a tolerance of plus or minus 0.1%.

6. Manufacturer to produce all vinyl/reflective sheeting graphics on digitally controlled cutting equipment.

2.4 Hardware and Compounds:

A. Scope:

1. Manufacturer is responsible for providing all necessary hardware, compounds and fastening devices, whether or not they are specifically shown in the Design Intent Drawings, to provide a first class sign product.

B. Fasteners:

1. Generic types and locations of fasteners have been indicated on the drawings. Manufacturer is responsible for the final engineering design of all attachments. All fasteners to be non-corrosive and all exposed fasteners shall be finished to match adjacent surfaces.

C. Water Seal:

1. Manufacturer to provide silicone or other approved equal weather sealing as required for all internally illuminated signs or components, which are part of this sign work.

D. Structural Adhesives:

1. Structural adhesives shall not be used in the manufacture of signs.

E. Studs for Acrylic Mounting:

1. Three-sixteenth (.187") inch diameter threaded aluminum studs shall be welded to the reverse side of the aluminum face as shown on the drawings for mounting of the acrylic "back-up" panels. A flat washer, lock washer and nut shall be used on each stud as shown on the drawings.

2. Where aluminum islands are created due to face cutting, a minimum of one stud shall be used on islands having a greatest dimension less than two inches and a minimum of two studs shall be used for larger islands.

2.5 Painting:

A. Scope:

1. Work under this division includes the painting of all steel, aluminum, plastic and other surfaces.

B. Finish and Colors:

1. Single Source Responsibility: Provide primer, sealer, and finished coat material from same manufacturer.

2. Paint system shall be provided by PPG Industries, Matthews Ultra Low VOC with separate gloss clear coat applied before vinyl graphics are applied.

3. Preparation: Clean surfaces from oil, dirt and foreign matter.

4. Drying time to be as per the paint manufacturer's specifications.

5. Quality Controls:

   a. Drips, runs, orange peeling, streaks, etc., will not be acceptable in any finish coats.

   b. Manufacturer shall make efforts to prevent the painted surface from being scratched or marred in the shipping and installation process.

   c. Field Touch-Up: Scratched paint surfaced may be touched up in the field provided that the scratch is no wider than 1/8" and no longer than 1 1/2". Any damage that extends under the paint such as dents must be replaced with a new part that is factory finished.

6. Painted colors shall match color matching codes indicated in Manual Section A. Where work scope involves existing signs, field verify and match existing colors or as directed by the Owner’s representative.

C. Textured Finish:

1. Dryvit, acrylic coating, fine texture, to match light gray color indicated in Manual Section A.

D. Sign Faces:

1. Finish to be applied to faces, returns and backs as per the Paint/Polyurethane Coat Manufacturers specifications.

2. One-part touch-up paint for each color shall be shipped with each sign for touch-up during installation.

E. Formed Sign Cabinets:

1. Paint preparation shall be as specified in Paragraph 2.5 B above.

2. The interior of illuminated sign cabinets to be sprayed white gloss enamel or white gloss polyurethane for maximum light transmission.

3. Non-illuminated sign cabinets do not require that interior surfaces be painted.

F. Cast aluminum letters:

1. Returns for each letter to receive 2 coats black polyurethane , clear finish to be applied to faces and returns as per the Paint/Polyurethane Coat Manufacturers specifications.

G. Steel:

1. All steel components of the sign structure shall be clean, free of oil, grease, mill scale, dust, shop debris, etc., then primed with one coat of iron oxide primer.

H. Hardware:

1. All exposed fasteners to be painted to match adjacent surfaces.

2.6 Electrical Components:

A. Owner's Representative will provide required electrical leads to ± 6 feet of electrical sign locations.

B. Manufacturer to provide final hookup and testing.

C. All electrical components; lamps, ballasts, wiring etc., shall be masked from painting.

D. Components shall be compatible with available circuitry, comply with UL standards, and be easily accessible for servicing and maintenance.

E. T-8 daylight rapid start fluorescent lamps or equivalent LEDs as required to provide an even illumination across sign face without hot spots or shadows. Provide 1000 lumens per square foot behind copy areas.

F. Manufacturer shall provide exterior service disconnects for illuminated components for use by the Owners' maintenance personnel. The switches must meet or exceed all N.E.C., U.L. and all local safety ordinances and laws.

G. Workmanship, Materials, UL Label:

1. All work shall be performed in a good workmanlike manner and shall present a neat mechanical appearance. All work and materials must comply with United Laboratories (UL) standards for safety for electrical signs. All electrical sign cabinets shall bear the "UL Label".

H. Ballast Mount and Raceway Access:

1. All ballasts and raceways to be mounted to comply with UL standards and must be
easily accessible for servicing and maintenance.

I. Testing:

1. All illuminated signs and components shall be tested upon installation and must be fully functioning.

J. Light Leaks:

1. Weep holes and sign cabinet seams shall have internal baffles to prohibit light leaks.

2.7 Plastics:

1. Cast acrylic sheet, white 7328 Plexiglas® by Rohm & Haas, in thickness specified.

2. Polycarbonate sheet, clear Lexan® by General Electric in thickness specified.

3. Solid plastic panels, UV stabilized polymer sheets as manufactured by Laminations, Inc. Manufacturer's rep: Carmen Stambone, Stambone & Assocs. (863) 646-6445.
4. Solid plastic posts, UV stabilized reinforced extruded shapes as manufactured by MAX-R. Manufacturer's rep: Kari Lyles, regional sales manager.(888)868-6297 Ext.1232

2.8 Special Sign Components:

A. Digital Reader Boards:

1. Daktronics Datamaster DF- 2053 Drop-In.

2. Pixel: non-reflective white and red on black base.

3. Communication; Transition Networks SBFTF Series Bridging Media Converter.

4. Software: Easy Writer 2/0 for Windows.

5. Electrical Requirement ; 277 v. lead.

B. Computerized Directory System:

1. Touchscreen; FTP 15-2 flat panel LCD monitor with .250’’ thick clear tempered glass cover.

2. CPU; SB 500XX controller, internally mounted.

3. Temperature control: internal exhaust fan by supplier.

4. Software; Selfinform® by TTSS, customized application for Windows.

5. Speakers and microphones; by supplier.

6. Electrical requirement; 110v. lead.

C. Graphics Inserts:

1. Opaque ScotchPrint® applied to second surface of clear polycarbonate, trimmed to sizes specified.

2. CMYK images produced at 200ppi.

Part 3 - Execution

3.0 Examination:

A. Verification of Conditions: Examine conditions and substrates where products specified in this section are installed; notify the Owner's Representative within three (3) business days of any unacceptable condition(s) encountered.

3.1 Delivery, Handling, and Warranty:

A. Delivery: Deliver materials to job in protective wrapping, labeled for identification as needed for daily installation.

B. Handling: Protect all sign components; if components are damaged during handling- restore affected components to the original condition.

C. Warrant shop applied finishes to withstand effects of weather, heat, tarnishing and aging for five (5) years.

3.2 Installation:

A. Coordinate times for sign installation with Owner's Representative to minimize disruption to the activities of other trades.

B. If required, provide safety barricades and signed notification to protect the public during installation.

C. If required, repair and refinish surfaces damaged during sign installation.

D. Whenever possible, provide concealed fasteners. Flush exposed fasteners with surrounding surface. Match color and finish of exposed fasteners with adjacent surfaces.

E. On exposed surfaces, provide continuous welds, grind smooth, and finish to match.

F. Provide an adequate number and size of anchorage devices and fasteners for securing sign faces to in-place construction.

G. Perform cutting, drilling and fitting for installation of signs. Set work in location, in alignment and in elevation, plumb, level, true and free of rack, measured from established lines and levels.

3.3 Adjusting:

A. Touch-up: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same paint used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.4 Cleaning:

A. Clean sign faces and supports as recommended by manufacturers of proprietary materials. Clean installation area of dirt and debris.

B. All sign installation sites, shall be cleaned of debris and restored to their pre-existing condition at no cost to the Owner.

C. Old signs shall be removed from the site by the Manufacturer. Scrap aluminum and plastics are to be recycled.

3.5 Protection:

A. Protect installed work during construction period to prevent damage to finish surfaces.

FSU Specifications for Systems and Safety Equipment associated with Laboratories and Hazardous Materials Storage or Usage Areas

The Florida State University (FSU) requires construction or renovation projects to meet all applicable code and regulatory compliance requirements. Incorporation of consensus standard recommendations and commonly recognized best practices is also expected. This guide is intended to supplement those requirements and other items specifically listed in the "FSU Design Guidelines and Specifications" in order to assist with compliance and address common problems and questions that have arisen related to safety equipment and systems during past projects. It is not intended to be all inclusive but should provide sufficient scope to design professionals for most FSU projects. The Environmental Health & Safety (EH&S) Department may always be consulted for amplification or clarification related to these topics, especially for large, complex or unique projects at (850) 644-6895.

The primary references containing legal compliance requirements specific to these types of applications are:

NFPA30, 2003 edition*, *Flammable and Combustible Liquids Code*
NFPA45, 2004 edition*, *Standard on Fire Protection for Laboratories Using Chemicals*
NFPA55, 2005 edition*, *Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*
29CFR1910 current edition, Occupational *Safety and Health Standards*
Chapter 64E-5 F.A.C., *Control of Ionizing Radiation Hazards* (applicable for radiation producing machines or radioactive materials storage or use areas)
**These standards are adopted and required by the Florida Fire Prevention Code, Chapter 69A-60 F.A.C.*

The specifications and guidance contained in the following publications represent the primary non-mandatory references that shall also be followed to the greatest practical extent:

ANSI/AIHA Z9.5-2003, Laboratory *Ventilation*
ANSI/ASHRAE 110-1995, *Method of Testing Performance of Laboratory Fume Hoods*
ANSI Z358.1-1998, *Emergency Eyewash and Shower Equipment*
29CFR1910.1450, App A, *National Research Council Recommendations Concerning Chemical Hygiene in Laboratories*
HHS Publication No. (CDC) 21-1112, rev 2009, *Biosafety in Microbiological and Biomedical Laboratories, 5th Edition* (applicable for potentially infectious organism storage or areas that require biological containment)

The FSU EH&S specific requirements and interpretations listed below are intended to provide consistency across all University properties and must be followed to most effectively utilize our resources while ensuring the protection of personnel and the environment. Design professionals should not deviate from this guidance without consulting with appropriate EH&S Industrial Safety and Health Engineers (i.e. – the University Biological, Chemical, Laboratory or Radiation Safety Officer; their assistants; or supervisors).

Ventilation

Design professionals are encouraged to explore the latest technologies and approaches for optimizing system performance and providing safe and reliable systems that also conserve energy. However, priority for selection should always be given to tried and true system designs that have been proven by actual operation in similar environments. There is much room for improvement in reducing energy usage without sacrificing safety by properly utilizing currently available technologies. Design professionals need to always consider the actual needs of our researchers and review the "Building Automation Design Requirements" appendix in this manual, while planning these systems. Experience demonstrates that the needs of our researchers are not always sufficiently delineated at the onset of new construction projects and future potential laboratory use is often unknown. This tends to drive designs in a direction that is far too conservative from a safety standpoint, utilizing too much energy without any real benefit. EH&S personnel will gladly consult with the research group(s) and assist design professionals with this analysis.

Research laboratories have traditionally been designed to operate near 12 air changes per hour (ACH) throughout the entire facility when most areas do not require this high of an air exchange rate. EH&S recommends laboratories using chemicals be set to initially operate at 8 - 10 ACH, with sufficient capacity reserved to supply up to 12 ACH. 12 ACH should only be required as an initial rate for animal use areas, organic chemistry or other high activity laboratories that frequently use high volumes of volatile solvents.

All laboratories should be adequately designed with supply and exhaust diffusers situated to ensure that air is well mixed in the entire ventilated space, turbulence is not created near fume hoods or other direct ventilation equipment and proper differential pressures are maintained between spaces and within the building envelope. Ventilation systems shall also be designed with sufficient capacity to provide maximum rates to all spaces, with reasonable room for future equipment installation and system expansion, while still being able to operate under loads that will not cause excessive noise or wear and tear on system components. Ventilation ducts should be run in a manner that will reduce turbulence, shall never be internally insulated, and internal obstructions shall be avoided to the greatest extent practical.

Nighttime setbacks can often be utilized. 6 ACH should be the lowest setback rate programmed for any space containing volatile or flammable chemicals. Other spaces can be set lower with EH&S and Utilities approval. These setback systems must be fail-safe such that the system reliably operates at normal ventilation rates when conditions warrant, such as when sensors indicate that the space is occupied; when indoor air quality parameters in the general exhaust are detected outside of prescribed bands; or some similar mechanism approved by FSU Utilities and EH&S is implemented.

Fume Hoods

- Fume hoods should be installed so that they will operate at an average face velocity between 90 and 100 fpm, single point readings between 80-120 fpm are acceptable. Variable Air Volume (VAV) hoods are preferred, Constant Air Volume (CAV) hoods may also be considered.
- Ductless fume hoods shall not be specified in lieu of a ducted fume hood and shall never be used for anything other than nuisance dust or odors.
- “High efficiency” type hoods that reportedly provide adequate containment at lower air flows or face velocities have not proven to provide adequate containment within our typical campus environment at the lower ventilation rates prescribed by manufacturers. They have increased complexity and are more expensive, therefore EH&S recommends that these not be specified. If these are desired to be utilized, guarantees must be obtained to ensure future performance will remain adequate and future cost savings will be realized as an overall net benefit to FSU.
- After any new installation or major ventilation system repair work, the affected system fume hoods shall be tested at the horizontal sliding sash stop height, or 18 inches if no stops are installed, in accordance with ASHRAE-110 (1995 or more current version). This testing shall be scheduled after facility testing and balancing has been completed. This testing shall be performed by a qualified third-party testing agent or company. Copies of all performed testing results (whether passed or failed) must be forwarded to EH&S along with the manufacturer’s “As Manufactured” (AM) testing results. If changes are made to the ventilation system after this testing is done, which could be expected to affect fume hood performance, the ASHRAE-110 tests must be repeated. These hoods must pass the As-Installed (AI) testing criteria with tracer gas flow rates increased from 4.0 to 8.0 lpm and they shall not exceed an average release concentration of 0.05 ppm or exceed a peak concentration of 0.5 ppm. If a hood cannot pass ASHRAE testing with these enhanced specifications EH&S personnel must be contacted to determine if the original ASHRAE specifications can be utilized for that particular space.
- Fume hoods shall be designed and manufactured in accordance with industry standards with chemically resistant materials. They should be able to contain small spills with assurance that these will not cause degradation of the fume hood and shall be easy to decontaminate. Standard resins and composites that are currently utilized for construction of these units should be adequate. Stainless steel interiors are not necessary for the typical radioisotope work that is performed at FSU and shall not automatically be specified for this purpose. Likewise, HEPA filtration, scrubbers or other special exhaust components should not be necessary for anything other than dedicated radiochemistry or perchloric acid hoods. Please

consult with EH&S staff, if researchers report or design professionals feel that these types of additional criteria will be needed.

- Visual and audible low flow alarms shall be provided for each fume hood. These shall be calibrated when installed, visible to users at the hood, and have a means for the users to temporarily silence the alarm. They shall also be capable of set point adjustments by trained FSU Utilities personnel that have been provided any necessary equipment.

Other Local Exhaust Devices

- Gloveboxes, downdraft tables and other such equipment can be used effectively as adjuncts or replacements for chemical fume hoods. These shall be ducted to appropriate exhaust systems whenever ventilation is required to control hazardous emissions. Recirculation or filtration type devices shall not be specified unless they will only be utilized to control non-hazardous emissions. Any installed gloveboxes shall meet the specifications outlined in "Gulidelines for Gloveboxes" Third edition, AGS-G001-2007.
- Snorkels, canopy hoods and other such ducted devices that cannot be sufficiently tested for containment performance shall not be installed with the intention of controlling hazardous exposures. These devices may be utilized for heat removal or the control of non-hazardous emissions.

<u>Safety Showers and Eyewashes</u>

- Install plumbed devices in sufficient locations for the anticipated use of the facility in accordance with ANSI Z358.1. Self-contained safety shower or eyewash stations shall never be used in lieu of plumbed devices.
- These units are to be connected to cold potable water supply lines only. For typical indoor installations, hot water supplies and thermal mixing valves are not required and should not be installed. The added complexity can negatively impact reliability without much benefit in our Florida climate.
- Plumb these devices such that they are not on the ends of long dead end branch lines or otherwise situated within the plumbing system to allow for stagnation of supplied potable water. This will aid in maintaining chlorination levels sufficiently high to inhibit growth of microorganisms that may be hazardous to users.
- Eyewash units shall have two nozzles, one for each eye. Do not install single nozzle drench hoses or other multiple nozzle devices.
- Safety shower and eyewash stations should be rugged in construction and simple in their operation in order to promote ease of use and long-term reliability. Extra accessories such as alarms, floor mounted activator pedals attached with chains, eyewash bowl covers, etc. that do not enhance these properties should be avoided.
- The safety shower activator shall be installed so that it can be activated by a person standing directly under the spray from the shower head.
- When safety shower actuator handles are wall mounted versus suspended directly from near the shower spray head, they need to be placed in an obvious location which is close enough that an individual can activate the shower while standing in the area of the spray pattern.
- Consideration should be given to flooring installed below this type of equipment to ensure that it will not pose an atypical slip hazard when wet.
- Do not install any signage that comes with this equipment, forward it to FSU EH&S personnel and they will ensure that appropriate signs are installed per current regulations.
- Drains do not need to be installed below these devices but may be in order to assist with routine testing and cleanup after emergency activation. When floor drains are installed, they should be provided with self-priming traps. Do not install floor drains in chemical or hazardous waste storage rooms.

<u>Other Plumbing Considerations</u>

- No drains should be directed to the stormwater system except for stormwater runoff and condensate drains.
- All floor drains, except those specifically approved, shall be directed to the sanitary sewage system.
- Sanitary sewage system drains installed in areas expected to be infrequently utilized shall have self priming traps to prevent loss of the water seal due to evaporation.

- No holdup tanks are to be installed for any type of drainage collection.
- Acid neutralization tanks are neither warranted nor required by federal or state laws and shall not be installed unless municipal Authorities Having Jurisdiction mandate such installations in areas that are not covered under an existing Campus Master Plan or similar development agreement. EH&S shall be notified at the project onset if these tanks are intended to be installed.
- Access ports should be provided for obtaining liquid samples of building effluents for each laboratory drain system installed in any new facility and when feasible for major renovations of existing facilities.
- At least one floor level sink or drain, plumbed to sanitary sewage, and capable of receiving fluids from floor cleaning machines or similar equipment, shall be installed in each facility within appropriate service areas such as the janitorial closets.
- Corrosion resistant piping shall be installed on drains originating from laboratory sinks or equipment in order to protect the initial portions of the waste system from degradation due to trace chemicals that may be found during operations such as the routine washing of empty laboratory glassware. Minimize horizontal runs of downstream laboratory drains to prevent chemicals from pooling and/or upgrade the piping to protect them in a similar manner.
- Plumbing vents from laboratory drains should be directed to building roofs whenever possible. When installing alternative systems, ensure that all special adapters, such as air admittance valves, are rated appropriately for chemical and industrial use for the types of chemicals used within that laboratory or facility.

Biological Hazards

Any facility design involving the use of biological materials requiring BSL3 or BSL4 controls shall be submitted for approval to the FSU Biological Safety Officer (BSO). The BSO will identify the minimum controls necessary and will assist in obtaining any approval required from regulatory agencies. Specialty signage required will also be provided and installed by the BSO after use of the materials or machines have been authorized.

Biological Safety Laboratories, Levels 2 through 4 (BSL-2, 3 or 4)

- Eyewash stations shall be accessible to users within any BSL-2, 3 or 4 facility, such that they do not have to leave the containment area in order to access them.
- Viewing windows shall be installed so that personnel working within BSL-2, 3 or 4 containment areas can be observed by personnel outside of the containment area.
- Separate HEPA filtered exhaust shall be used in all BSL-3 or 4 facilities to provide the negative pressure differentials required by the BMBL.
- BSL-3 or 4 areas must have visual indication that a sufficiently negative relative pressure is being maintained. These indicators must be able to function without power.
- BSL-3 or 4 facilities must be commissioned by a qualified and independent testing company or agent before use.

Biological Safety Cabinets (BSC)

- Biological safety cabinets should be Class II Type A1 recirculating cabinets. They shall not be ducted or thimble connected to the building ventilation system and shall never be used to provide the negative pressure differential required within the containment area.
- If volatile or toxic chemicals will be used and a chemical BSC may be necessary for the project, please consult with the University Biological Safety Officer.
- These devices must be certified as part of the project and before use. Whoever purchased them is responsible for the cost of initial certification and any repairs or modifications that are required.
- Gas lines shall not be plumbed into any BSC.

Autoclaves

- Sufficient space should be provided around autoclaves to allow for easy service access to filters, drains, and exhausts.
- Safety valve discharge outlets must also be located so that they will drain and exhaust safely.
- Drain lines and joints shall be capable of withstanding temperatures and pressures that may be expected during operation of the autoclave.
- The autoclave room shall be of adequate size for the device and the resultant heat generated during its operation.
- Autoclaves should be tested after installation to ensure that they are working properly. The University Biological Safety Officer can assist by performing these tests or recommending a qualified and independent inspection agent or company.

Radiation Hazards

Any facility design involving the use of regulated ionizing (radioactive materials, x-ray machines or accelerators) or non-ionizing (LASERS, high magnetic fields, radio-frequency transmitters, etc.) radiation hazards shall be submitted for approval to the FSU Radiation Safety Officer (RSO). The types, quantities, strengths and any other relevant data for the hazard(s) involved shall also be furnished. The RSO will specify the minimum controls necessary and will assist in obtaining any approval required from regulatory agencies. Specialty signage required will also be provided and installed by the RSO after use of the materials or machines have been authorized.

Flammable Liquids Storage

- Cabinets that are not permanently installed shall not be ventilated unless other options to control fugitive emissions are not feasible. If it is determined that ventilation will be necessary, the University Chemical or Laboratory Safety Officer should be consulted and all of the requirements of NFPA-30 and 45 shall be met.
- Bulk containers (larger than 10 gallons size) shall be kept out of laboratory areas. Large total quantities of chemicals should also be kept out of these areas. Where this type and quantity of chemical use is expected, provisions should be made to provide suitably designed storage areas near laboratory or use areas.
- Chemical storage rooms shall also meet the safety and environmental compliance requirements outlined for chemical waste storage areas as described in 40CFR (specifically 262.34 or 265.31,265.32a-c, and 265.176)

Corrosive Liquids Storage

- Provide sufficient space for the segregated storage of acid and base liquids with provisions made to allow separation of organic acids from mineral acids, as warranted based on quantities. As a general rule, if the chemical usage expectations are not identified, provide at least 2 cabinets (with 6 sq. ft. each of shelf space and capable of storing up to (4) one liter size bottles or an amount equivalent to one-third that which is provided for flammable storage, whichever is greater.
- Chemical storage cabinets for corrosives must be lined or constructed with chemically resistant materials.

Compressed Gases and Cryogenic Fluids

The specifications required by NFPA-55 shall be complied with and incorporated into all new designs and renovations. Particular attention should be given to the following historical problem areas to assist with code compliance by the ultimate users of the facility.

- Permanently installed gas cylinder storage locations or spaces are preferred and should be allocated such that they allow securing cylinders or dewars out of high traffic areas and located such that they will not interfere with egress. Sufficient distance or fire-rated walls shall be provided to allow for segregation of non-compatible gases
- Storage should be provided for one in-use and one spare cylinder of each type of gas that will be needed within individual laboratory units when external storage locations are not provided.

- Special ventilated gas cabinets must be installed gases possessing the fire and health hazard ratings specified in NFPA-45 are expected to be utilized.
- When constructing piping systems from remote compressed gas or cryogen storage locations that are not entirely visible to users, ensure that piping is compatible with the gas that will be carried, is labeled at the ends and along the path identifying the gas or gas type being utilized, and is adequately protected.
- Most compressed gas cylinders are not owned by FSU. Vendors frequently deliver large shipments of these products to University exchange locations typically found by facility loading docks. Design professionals can help foster user safety by providing sufficient cylinder storage rack or cage capacity in these locations such that the cylinders:
  - Can be secured vertically
  - Are prevented from tipping or theft
  - Will not require more than four cylinders to be ganged together at one time
  - Are protected from direct sunlight, rain, pools or water, extreme temperatures or other such hazards
  - Are able to have non-compatible classes segregated by distance and/or fire rated walls
  - Are not stored near elevated surfaces greater than half of the shortest cylinder height or in any location that interferes with building egress or presents any unsafe condition

Noise Levels

Ensure that ambient laboratory noise levels emanating from installed systems and associated equipment will not preclude effective communication at normal voice levels. Generally, this means that 55 dBA throughout the area, or 60 dBA immediately adjacent to noisy equipment such as fume hoods, should not be exceeded. Simple measures such as the installation of flexible ducting to fans, sound isolation of ducts and motor mount attachments, proper location of HVAC equipment and the operation of systems within efficient load ranges should alleviate this potential concern.

Laboratory Associated Personal and Office Spaces

Space should be provided which is separate from laboratory work areas for students, staff and faculty to perform their non-laboratory duties. Break areas for eating and drinking shall be provided in each facility and shall always be located outside of laboratories or other chemical storage areas.

Laboratory Furnishing and Flooring

All laboratory work surfaces, including stools and chairs, must be non-porous, easily cleaned and decontaminated. Permanent casework, countertops, and flooring must be rugged and chemically resistant. The floor must be non-pervious, one piece, and with covings up the wall at least 4 inches. This can be achieved by use of glue, heat welded vinyl flooring, epoxy coated concrete slab, etc. Temporary flooring such as anti-fatigue mats should also be non-porous, easily cleaned and decontaminated, and with an emphasis placed on non-slip characteristics.

Ergonomics must be taken into consideration for all laboratory work stations. Countertop depths should be limited and/or equipment positioned such that personnel do not have to reach across and contact potentially contaminated surfaces to reach switches, fixtures or sinks. Knee space must be provided under bench top work area counters so that chairs and stools can be used comfortably. Seated bench top work areas, ADA compliant countertops, ADA fume hoods and other such areas should have marine edges (raised edges) or similar features on the countertops to minimize the likelihood of spills pouring onto laboratory personnel.

DIVISION 14 – ELEVATORS, CHAIR LIFTS AND DUMBWAITERS
IT IS RECOMMENDED THAT THE ELEVATOR SHOP OR CONSULTANT BE RETAINED TO ASSIST WITH ALL ELEVATOR, DUMBWAITER AND CHAIRLIFT SPECIFICATIONS AND DESIGNS.

HANDICAP REQUIREMENTS:

Elevators and Chairlifts shall be handicapped barrier free in accordance with design standards of the National Elevator Industry, Inc. ANSI A- 117.1 and ADA Standards.

ELEVATOR MANUFACTURER AND CONTRACTOR REQUIREMENTS AND QUALIFICATIONS:

<u>ONLY NON-PROPRIEARY EQUIPMENT ALLOWED</u>

An approved manufacturer regularly engaged in manufacturing elevator equipment of the type required for this project.
The manufacturer or authorized agent of an elevator equipment manufacturer with not less than ten (10) years of satisfactory experience installing and servicing elevator equipment equal in character and performance to the project elevator. Any welding on the site must be performed by personnel who have successfully passed an American Welding Society authorized test and whose welding work has been judged by a natural person who is fully authorized to do so by the American Welding Society. The authorized person who evaluates the welding must sign the certificate signifying applicant has passed required tests. No substitutions will be permitted.

The Installation Contractor must submit catalogs and show evidence that all required parts are kept in inventory within ten (10) miles of the elevator installation. The Installation Contractor must certify that he/she has a Service Office with full time employees within ten (10) miles of the project site.

The Elevator Contractor must pay the expenses of a QEI Certified Elevator Inspector not employed by the installing Contractor to witness all testing of the equipment. A Copy of the testing report must be turned over to the Owner and to the Elevator Contract Administrator for the University. The cost of all elevator inspections and certificates are to be paid for by the Contractor.

ELEVATOR MAINTENANCE:

Elevator maintenance and warranty on new and/or up-graded elevators shall be for a period of 24 months after acceptance. The Certified Mechanic must spend a minimum of Three (3) hours per month per traction, one and half (1.5) hour per month per hydraulic, one (1) hour per month per dumbwaiter and/or one (1) hour per month per chairlift regularly and systematically cleaning, examining, adjusting lubricating per Manufactures Recommendations. The approved elevator maintenance Technicians must be certified with a Certificate of Competency from the State of Florida. The Contractor shall be responsible for providing additional maintenance, repairs, service, call-backs and other work on a 24 hour, 7 days per week basis as part of the installation or modernization contract. Response time for any problem calls must be within one (1) hour after notification of the problem.

ELEVATOR PIT AND HOISTWAYS:

The elevator pit area, which includes the floor and walls up to the lowest landing threshold area must be water sealed and painted with two (2) coats of high gloss acrylic latex floor enamel.

Pit ladders are to be installed according to all codes enforced at time of installation. Location of ladder is to be determined by the Elevator Contractor and Designing Firm.

Sump holes to be installed in Pit, covered by grate. If Sump is to be used, installation of Sump Pump must be installed according to all codes enforced at time of installation.

Conduit and Lighting Fixtures in Pit are to be installed for WET conditions. All codes governing this type of lighting system at the time of installation must be followed.

All voids, holes, slots, etc., in the hoistway shall be grouted or pointed up to obtain fire rating. All nails, snap-ties, form straps and wood shall be removed from hoistway.

Where needed, grating shall be provided in shafts to permit safe lubrication of sheaves and equipment.

ELEVATOR MECHANICAL ROOM:

The elevator machine room shall be sized for the equipment to be used. The room shall be heated and cooled with a thermostat located in the machine room. Machine room shall meet all applicable code requirements. The elevator machine room walls and ceiling must be primed and completely painted with two (2) coats of semi-gloss acrylic latex paint. The machine room floors shall be smooth and level. The elevator machine room floors must be painted with two (2) coats of highest quality oil based light gray color gloss floor and deck enamel.

The elevator machine room shall not to be used for storage of any kind. No foreign piping, ductwork or conduit shall pass through hoistway and/or machine room.

All elevator machine room doors must be self-closing, self-locking, requiring a key to open. Door must also have a sign stating Danger Elevator Equipment. Machine Room Doors shall be not less than one and one-half hour fire rating B label, not less the 3‘ 4” in width and not less than 6‘ in height. Doors shall be provided with a spring type lock arranged for opening from the inside without a key. A key is required to open the door from the outside.

Elevator machinery rooms must be well lighted in order to provide a safe environment for the elevator technicians to work. Lighting must be at least 19 foot candles, measured at the floor, in all portions of the room. Lighting must have guards to protect lamps. Light switch shall be located on the lock-jamb side of the access door. Elevator machine rooms shall have a head room of not less than 7‘0, (Head room is determined by measuring from the floor to overhead items such as wire duct, beams, lights, etc. Stairways for access to elevator machine rooms shall be of metal and shall Conform to the following: Maximum angle of sixty (60) degrees from the horizontal. Stair treads shall not be less the 28 inches in height.

Stair treads shall be level and not less the 6 inches in width with slip-resistive surface. The rise shall not be less than 8 inches or more the 10 inches. The headroom from the top any tread shall be not less than 7 foot vertical clearance, measured in line with the face of the riser.
There shall be no more than 14 feet in an unbroken vertical rise.

Stairway floor opening shall be guarded by a metal railing 42 inches in height with intermediate rail and toe board.

Open side of stairs shall be protected with a metal handrail not more the 34 inches in height from the upper surface of top rail to surface of tread in line with face of riser at forward edge of tread, and with intermediate rail. Access to elevator mechanical rooms across roof shall have steps or ramps with metal railing built over pipes or other obstructions.

All Electrical disconnects, fusing and receptacles shall be installed following all Codes enforced at time of installation.

All hoist way vents shall be installed following all Codes enforced at time of installation.

Elevator machine rooms shall not be located adjacent to classrooms and other noise sensitive spaces without thorough consideration to noise transmission to these spaces.

PAINTING OF EQUIPMENT:

Elevator equipment must be completely painted in the field, except for the stainless steel and for the polished machined surfaces of the hydraulic buffers, guide rails and/or hydraulic plungers.

ELEVATOR SERIAL NUMBER SPECIFIC OPERATION, ADJUSTMENT & MAINTENANCE DATA; TOOLS OR COMPUTER DEVICES, FOR EACH ELEVATOR (OR FOR EACH MULTI-CAR GROUP ELEVATOR SYSTEM) ELEVATOR ELECTRICAL CONTROLLER AND DOOR OPERATOR CONTROL, IS TO BE PROVIDED TO OWNER:

Elevator Contractor shall provide four (4) copies of typewritten or professionally printed, elevator serial number specific installation, adjustment and troubleshooting instructions, to be used in maintaining and repairing all new, up-graded or renovated elevators or group elevator systems. Elevator Contractor shall provide four (4) copies of the elevator serial number specific, as built, electrical wiring diagrams, designed with point to point wiring or circuit connections. Further, furnish a complete set black on white drawings, printed on high rag content paper for long life, to be used for reproduction of wiring diagrams, if needed in the future. Additionally, provide one (1) complete set of the same high quality wiring diagrams, laminated with heavy gauge clear plastic, and designed to be hung on sturdy wall bracket(s) in the elevator machine room(s). Drawings shall be designed to be easily removed from the rack for use by the elevator technicians. Elevator Contractor shall provide four (4) copies of all elevator serial number specific computer or handheld adjustment device passwords, legends, reference codes, key words, operational descriptions and related information so that a competent elevator technician can access the elevator electrical controller system(s), make adjustments to the equipment settings, determine the malfunction codes, troubleshoot the electrical system or verify correct operation of the elevator electrical controller or door operator equipment.

Elevator Contractor shall provide four (4) copies of an elevator serial number specific replacement parts list for each elevator or group of elevators, located in a new building, or that which is renovated or up-graded in an existing building.
Elevator Contractor shall have the right to furnish either ―on board‖ mounted computers or hand held diagnostic devices, or similar portable computer or hand held devices that can be disconnected from the elevator electrical controller and door operator controller systems. Either design is acceptable so long as the required maintenance and adjustment information, diagnostic functions, equipment operation, equipment performance and troubleshooting activities can be performed without unnecessary delays, and the same performance results can be anticipated. Regardless of the type of computer or diagnostic equipment provided under the contract, the Elevator Contractor must provide the Owner with one (1) complete set of computer or handheld technical equipment devices that will operate each and every elevator covered by the new elevator or elevator up-grade contract. Provide a complete set of current, as built and installed, microprocessor software for each and every elevator covered by the contract.
The Elevator Contractor must provide a notarized letter with his bid that states that, if he receives the contract to perform the elevator work, the Elevator Contractor shall provide all of the required installation and adjustment information, computer devices or service tools, data, instructions, diagrams, parts lists and related information at the time the project is completed.
All required information, data, diagrams, instructions and related materials shall be provided in heavy duty, oversize type, three (3) ring binders, properly identified with the project name, locations, elevator serial numbers, building elevator numbers and related information.

REPLACEMENT PARTS:

All of the major parts utilized in new or up-graded elevators must be manufactured in North America, and the elevator manufacturer must have a documented quality assurance program.
Only new parts or components shall be accepted. The installer shall not use rebuilt, used or reconditioned equipment or parts on any new elevators or up-graded elevators. The only used equipment allowed are existing components that are specified to be reused during an elevator up-grade contract. None of the parts or equipment removed from the project can be used elsewhere on the Florida State University Campus.

The Elevator Contractor, and Elevator Manufacturer, if not the same company, must provide a notarized letter at the time the elevator work project is bid stating that all necessary replacement parts, supplies and related equipment, necessary to maintain, repair and service the elevator equipment will be promptly sold, without delays, directly to the Owner, or to the Elevator Contractor who maintains the elevator equipment on behalf of the Owner without the necessity of the replacement parts being initially purchased by the Owner. The letter must be signed by an executive officer of the Elevator Contractor.

FASTENERS:

All exposed screw is to be of the vandal (tamper-proof) type. Include countersunk, vandal resistant, 316 stainless steel screws for cover plates. Drive pins to attach any surface mounted Braille plates.

THRESHOLDS/SILLS:
Car and hoistway sills shall be Nickel Silver.

DOOR OPERATORS:

Elevator Door Operators must be highest quality, heavy duty type, with―closed-loop,‖ type microprocessor digital control system. Door operator must have digital encoder.
Include the following features in door operator control system: Door position monitoring, door velocity monitoring, Door motor current monitoring, Door closing pressure monitoring. Doors must reopen when door pressure setting is reached in closing direction.

LANDING STATIONS:

Push button stations located at each landing that includes mirror finished vandal resistant, stainless steel buttons with flush jewels in the center that indicates that the call has been registered. The call registered jewels shall light up brilliant red with the use of ultra-bright light emitting diodes. The cover plate shall be made of no. 4 satin finished no. 316 stainless steel, minimum of 1/8 inch thickness, approximately 7 inches wide and shall be of an overall size that will contain the following: a. Either single (terminal floors) or double buttons (intermediate floors) of the appropriate diameter to meet code for handicapped. b. Engraving and red epoxy filling of a sign to indicate **― IN FIRE EMERGENCY, DO NOT USE ELEVATOR – USE EXIT STAIRS."** Use ½ inch high letters. Also, provide a flame Pictograph symbol of the appropriate size, utilizing a durable plastic insert mounted from the rear into a laser cut hole, or by engraving and filling the area with the required colors of epoxy material for long life service.

FIREMAN‘S PHONE AND RECALL:

Fireman‘s phone jack neatly incorporated. Do not provide an exposed nut on the front of the station. Shielded pair of wire to be run from each jack to junction box at a location outlined by the Owner. Verify location of Fireman‘s recall switch and instructions with Fire department and Architect. Instructions should be engraved into plate and filled with red epoxy. Provide for Phase I and Phase II operation. Include suitable fireman‘s insignia type jewel in station. The fireman‘s jewel the designated floor station will flash in the event the smoke detector activation was in the machine room or hoist way. Switch shall be keyed to match the fire service key currently being used on the FSU Campus, key number G-1617X. If local codes call for a different type of Fireman‘s Service Key, the G-1617X key must not be used. Engrave instructions in designated landing push button station and in cab front return panel.

HYDRAULIC ELEVATORS:

NOTE: ALL HYDRAULIC ELEVATORS MUST BE INSTALLED ACCORDING TO ALL CODES AT THE TIME OF INSTALLATION.

A Hydraulic Elevator can only be used when total travel is less than fifty (50) feet. The Motor Starter for new or up-graded hydraulic elevators must be soft start type, adjusted to a maximum of three (3) times the full load running current. Elevators not on Emergency Generator System must be place on a Battery Lowering System. Provide highly accurate electronic load weighting device, overload alarm and signal light. Alarm and signal light shall function if load exceeds design capacity. Elevator shall not function if overloaded conditions exist. All door frames, headers, etc., shall be grouted solid to maintain fire rating. The hydraulic cylinder assembly shall include the following:
The hydraulic jack assembly (cylinder) shall be a complete new assembly of the highest quality available, and manufactured in strict accordance with ASME A17.1-1996, Safety Code for Elevators

and Escalators, including the latest published addenda as of the date of the written specifications. The total length of the cylinder must include the required over – travel at top and bottom landings Multiple sections on the plunger and cylinder, if necessary, to permit ingress into the building and Hoistway without damage to the building or the equipment.

The hydraulic cylinder must have external, threaded type couplings for multi-section cylinders. There shall be no materials at the coupling(s) that reduce the interior clearance of the hydraulic cylinder. The jack packing seal around the plunger must be of the molded type that does not require adjustment. The packing gland must be designed to accept the molded packing or seal that is clamped in place without the use of unusually high pressure on the attachment bolts. The top of the cylinder shall have a ring for collecting the oil that seeps past the jack packing and/or wiper ring.

Provide a new drip tube from the top of the cylinder to new five (5) gallon collection container that has a small entry hole for the drip line. Leakage of more than one 1/2 gallon per month will not be accepted.

The jack assembly shall be supported on a pair of new steel channels of adequate strength that are approximately as long as the distance between the elevator guide rails. Reinforce mounting brackets shall support the weight of the fully loaded elevator and cylinder on the pit channels. The pit channels must be at least 6' in height, and weighing at least 16.3 pounds per foot. The pit channels shall be capable of supporting the vertical reaction on the hydraulic cylinder and the full loaded car without deflection. The pit channels must receive a rust inhibitive primer and two (2) finish coats of paint before installation.

Additional Protection against Electrolysis: The entire hydraulic jack assembly shall be completely electrically isolated from the entire building, elevator car/platform, pumping unit, pit mounting channels and all other components of the elevator by using the following insulating techniques:

The jack plunger shall be isolated from the elevator car/platform assembly through the use of specifically designed rubber isolated platen plate that will not allow metal to metal contact and absorb pulsations from the hydraulic pump. The minimum thickness of the rubber under compression from a fully loaded car shall be at least 3/4 inch.

The hydraulic cylinder assembly must be isolated from the jack support channels and the pit floor. The material to be used between the cylinder mounting brackets and the top of the support channels is Micarta or any high quality high pressure plastic laminate material of at least 3/8 ― thickness. The backs of the channels must be isolated from the top of the cylinder with a double wrapping of high quality rubber sheeting material, which is wrapped around the top area of the cylinder (behind the pit support channels) and secured with an oil resistant cement. The pit support channels must not make metal-to-metal contact with the cylinder. The bolts that attach the support brackets to the support channels must be positively insulated with high strength rubber. Micarta or schedule 40 PVC insulating material around the bolts, washers and nuts to prevent metal to metal contact between the cylinder and the cylinder support channels.

The oil pressure supply line must contain at least two (2) rubber isolated sound and vibration isolation couplings the effectively isolate the pumping unit from the cylinder. The blow- out proof isolation couplings must be installed in the machine room as required by ASME A17.1. The oil pressure supply line, from the point of the isolation couplings, must be completely isolated from the building structure, pit floor and any other material in a manner that is effectively isolated to prevent a grounding effect. The use of high quality rubber materials at least 3/8‖ thick when fully compressed will be acceptable as an isolation material for pipe supports or hangers.

Electrical isolation couplings without sound and vibration-absorbing properties are not acceptable.

The oil pressure supply line shall be insulated from the building structure, walls, supports and all other contact points. Where the piping penetrates a wall, the piping shall be insulated with rubber materials at least 3/8‖ thick when compression.
The complete isolation of the jack assembly must be checked during installation, and after the installation work has been completed to verify that there is no electrical path to ground. Elevator Contractor must use a meager and high quality ohmmeter to verify that his work complies with these work specifications, and the effectiveness of the isolation must be demonstrated in the presences of representatives of Florida State University. The Elevator Contractor will be required to remove or correct any work that does not fully comply with the isolation requirements.

Hydraulic Oil Line: The oil line shall include the following:
The oil line shall be schedule 80 thickness, with threaded forged steel fittings at all locations where the oil line must change directions or be coupled. Victaulic or similar brand clamp type fittings are not permitted except that one (1) Victaulic fitting may be utilized where the oil line connects to the hydraulic control valve at the pumping unit so long as it is correctly installed and not used to correct for alignment deficiencies in the oil line. All threaded fittings must be sealed with Expando brand thread sealer. Install a high quality ground joint union near the hydraulic cylinder. Flexible hoses shall not be used under pressure in this installation. Install the pipe rupture valve adjacent to the hydraulic cylinders. The valve must be adjusted to properly to stop the decent of the elevator car in the event of pipe or valve rupture; however, the passengers should not be burdened by unnecessary closure of the valve when no emergency exists.

Two (2) oil shut-off valves must be installed in the oil line. One (1) shut-off valve shall be installed adjacent to the pumping unit, and is to be provided for purpose of being used when the relief pressure is tested on an annual basis. One (1) line shut-off valve is to be installed near the hydraulic jack cylinder and is to be used only when the packing is replaced in the jack. Elevator Contractor shall attach a laminated plastic tag on the valve handle stating that the valve is to be used for packing replacement purposes only. The lettering on the tag shall be with 3/8 inch high letters stating the following: ―Caution!! This valve is to be used when serving the cylinder only. Do not use for hydraulic system pressure tests.‖ tag lettering must be a contrasting color to the surface.
The bursting strength of both valves shall comply with the requirements of ASME A17.1, Section 1302, Safety Code for Elevators.

Perform all the necessary cutting as may be required to run or install the oil supply line from the machine room to the hoist way, including the work necessary to completely isolate the oil line from the building or other building systems. Isolation of the oil supply line must be neatly installed, and be rubber at least 3/8 inch thick while under compression.
Hydraulic Muffler Device: The Oil line must be equipped with an effective muffler device that removes the hydraulic pump pulsations and noise before being transmitted to the hydraulic cylinder through the oil supply line. The muffler must have rubber absorbing materials that can be replaced on a regularly scheduled basis. The muffler device shall be held together with high strength bolts and designed to be serviceable without removal from the oil supply line. Connections must be threaded. Include a metal tag on the muffler to indicate the required service by replacing the rubber pads every two (2) years. Locate muffler device in the elevator machine room area in a manner that will not inhibit the service work.

7. Hydraulic Oil:
The hydraulic fluid for all new or up-graded hydraulic elevators must be grade VG-32, biodegradable type vegetable oil or approved equal.

Install a large data plate on the power unit identifying the oil that
has been installed in the system.

Hydraulic Cylinder Installation:

All hydraulic cylinder casing for new hydraulic elevators or replacement cylinders for existing elevators must be installed in a completely plumb condition with a variation of not more than 1/8-inch variation from absolute vertical plumb condition from bottom to top of the cylinder. The plumb condition must be demonstrated to representatives of Florida State University and/or his/hers designee prior to installation of the back fill sand, and prior to installation of the guide bearing and plunger assembly in the cylinder. A weighted "spider" shall be hung from a plumb line for checking the plumb condition at least every 12 inches from bottom to top of cylinder.

TRACTION ELEVATOR:

NOTE: ALL TRACTION ELEVATORS MUST BE INSTALLED ACCORDING ALL CODES AT THE TIME OF INSTALLATION.

All elevator driving machines and elevator controller equipment must be Installed in a machinery room separate from the hoist way area. **All Equipment shall be non-proprietary.**

All new or up-graded geared traction driving machines must have full synthetic gear oil of the proper viscosity according to the machine manufacturer's recommendation.

Traction elevators must have VVVF AC controllers with digitally controlled ―closed-loop‖ type vector controlled micro-processor systems such as Megnetek. The motor control system shall be quiet in operation with no objectionable air-borne or electrical noise. All traction elevators must be equipped with as ascending elevator-braking system. The system shall be or equal to a Hollister-Whitney rope gripper system, a counterweight safety device with over-speed governor or a bi-directional under-car safety device/over-speed governor. Provide access door leading to metal gratings that shall be provided in shafts, where required by code, to permit access for lubrication of sheaves and equipment. Provide highly accurate electronic load weighting device, overload alarm and signal light. Alarm and signal light shall function if load exceeds design capacity. Elevator shall not function if overloaded conditions exist. All door frames, headers, etc., shall be grouted solid to maintain fire rating.

HOLE LESS EQUIPMENT:

If Hole less type of equipment is to be installed, isolation from the building is a must. Place the piston that will be installed in the pit on Non-Conductive and Non-Compressive material. If guide shoes are used, the guide shoes must be of the Non-Metallic type. Isolation material must be used to ensure that all hydraulic piping does not come in contact with the building.

CABS:

High cabs shall be provided unless noted.

If applied Wall Panels are used, place the Wall Panels on the sides and/or rear of the Elevator Cab; the panels must be constructed of 3/4 thick quality A/B grade plywood. The panels shall be backed with plastic laminate material to reduce warping and moisture intrusion. The face of the new panels shall be stainless steel. No. 4 satin finished stainless steel angle edges on the panels with mitered and welded corners. The stainless steel panel binders shall be formed of 10 gauge angles with screw attachments on the rear of the panels. The distance between the panels shall be reduced to approximately 1" Attach the new panels in a manner that requires a workman on top of the car to remove fasteners to prevent easy removal by unauthorized personnel. Cover the area surrounding and between the panels, as well as the base area, with Type 316 L, 16 gauge satin finished stainless steel glued to the cab's backing panel.

Over-lap the spaces by a least 2” on each side to prevent the stainless steel from becoming dislodged once the panels are in place. Use the highest quality industrial contact cement for attaching the stainless steel to the reveal areas.
Provide a complete set of protection pads and stainless steel protection pad buttons on each panel and on front return panel. Install the pad buttons to prevent easy removal.
Elevator Cab‘s floor shall be of resilient floor tile or vinyl sheeting.

Carpeting shall not be used. Diamond plate of Stain-less steel material shall be used in special areas.

The Elevator Cab‘s for new or up-graded elevators must have hinged, swing type front return panels to contain all of the operating devices, stainless steel vandal resistant buttons, indicators, standard size certificate holder, emergency phone (furnished by OTC), handicapped markings and other devices. NO SEPARATE COVER PLATES FOR CAR OPERATING STATION WILL BE ALLOWED.

All mounting must be from the rear to provide neat and vandal resistant panel. All information is to be engraved into panel. No plates or covers shall be attached from the front of the panel.
Front return panels must have heavy hinges, and vandal resistant locking devices.
The car operating panel shall contain all buttons and operating devices require by A17.1. Any other switches such as car lights, exhaust blower, Independent service, etc. shall be located in a separate cabinet with a locked, hinged door.
All stainless steel in elevator cabs for dormitories shall be 14 gauge, Type 316L stainless steel, except when heavier gauges are required for the application.
Cab ceilings for passenger elevators must contain LED lighting with vandal resistant security rings and electronic dimmers. Finish shall be stainless steel.

All elevators must have cab emergency lights and alarm System that is at least equal to Elevator Product Corporation ―Flexilite‖- EFP1 system that will illuminate a portion of the normal cab lighting fixtures for at least four (4) hours. System must have four (4) gel cell six (6) volt batteries and a charger-inverter unit, all for mounting on the car top.
7. The passenger or service elevator door protection must be Janus Pana 40 Plus, with 3-Dimenisional-protection feature.
1. Install a top emergency exit as required by ASME A17.1 Safety Code for all Elevators. Include electrical contact arrangement to prevent the elevator for being operated unless the top emergency exit is in the closed and locked position.

ELEVATOR PHONE:
A one (1) inch home-run conduit shall be provided from the elevator phone to the telephone equipment room.

Elevator Contractor shall provide and install phone that meets the requirements of the FSU Office of Telecommunications (OTC). The phone shall be rear mount in a swing type return panel; provide a punched or drilled grille work for the speaker and microphone. Each elevator shall have an emergency telephone. **Programming and Wiring connections shall be accomplished by OTC.**

CAB DOORS:
In Dorms, all Hoistway Door emergency release escutcheons shall be equipped with Barrel Key locks as manufactured by Tri-lock Mfg. And Maint. Corp. using Barrel Key #6950.

FREIGHT ELEVATORS:
NOTE: ALL FREIGHT ELEVATORS MUST BE INSTALLED ACCORDING ALL CODES AT THE TIME OF INSTALLATION.
Freight elevators shall be located in close proximity to docks and service area. They shall go to each floor and be of sufficient size to accommodate large equipment.

In the event a freight elevator is installed in a corrosive environment or installed in conditions that require sanitary environment, the equipment shall be fabricated from extremely corrosion resistant and/or materials that are easily sanitized.
If power assisted car gate(s) is used, provide electronic screen across gate opening.
Provide highly accurate electronic load weighting device, overload alarm and signal light. Alarm and signal light shall function if load exceeds design capacity. Elevator shall not function if overloaded conditions exist.

All door frames, headers, etc., shall be grouted solid to maintain fire rating.

CHAIRLIFTS:
NOTE: ALL CHAIRLIFTS INSTALLED ACCORDING ALL CODES AT THE TIME OF INSTALLATION.
Any chairlift being placed outside of building must be manufactured to withstand WET conditions and be placed in surroundings to protect from ALL weather conditions.

DUMBWAITER:
NOTE: ALL DUMBWAITERS MUST BE INSTALLED ACCORDING ALL CODES AT THE TIME OF INSTALLATION. The Dumbwaiter Car shall be constructed in Stainless Steel, including the Bi-parting car gate. Car shall have a least one (1) Stainless Steel Shelf. Hoistway Doors, Hoistway Frames and Door Seals shall be Stainless Steel.

XXIII. APPROVED MANUFACTURERS
1. Approved Elevator Manufacturers:
a. ThyssenKrupp Elevator Corporation
b. Otis Elevator Company
c. Schindler Elevator Company
2. Closed-Loop Door Operator Equipment
a. MAC
b. ECI
c. Motion Control Engineering
d. Smartraq
3. Micro-Processor and Car/Group Control Equipment
a. Motion Control Engineering and Elevator Controls Corp.
b. Approved elevator manufacturers‘non proprietary equipment
4. Motor Drive Systems for Elevator Machine Motors
a. Megnetek
b. Approved Equal
5. Hoisting Machine Motors Only
a. General Electric
b. Imperial Electric
c. Magnetek
d. Rueland Electric
e. Approved Equal
6. Elevator Hoisting Machines and Deflector Sheaves
a. Hollister – Whitney Elevator Corp.
b. Titan Machine Corp.
c. Approved Equal
7. Rope Gripper for Traction Machines
a. Hollister – Whitney Elevator Corp.
b. Approved Equal
8. Hydraulic Fluid

a. Hydro Safe Oil Division, Inc., Grade ISO VG-32
b. Approved Equal
9. Pump Motor
a. General Electric
b. Imperial Electric
c. Magnetek
d. Ziehl-Abegg
e. Thyssen/Krupp
f. Approved Equal
10. Hydraulic Pump
a. IMO
b. Allweiler AG
c. Approved Equal
11. Oil Control Valves
a. Beringer
b. Maxton
c. EECO
d. Thyssen/Krupp
e. Approved Equal
12. Hydraulic Cylinders
a. EECO
b. United
c. CEMCO
d. Approved Equal
13. Pipe Rupture Valves
a. EECO
b. Thyssen/Krupp
c. Approved Equal
14. 3D Door Detector Devices
a. Janus Elevator Products
b. Approved Equal
15. Car Emergency Lighting System
a. Elevator Products Corp.
b. Approved Equal
16. Vandal Resistant Signal Fixtures

a. Innovation Industries
b. GAL
c. EPCO
d. Thyssen/Krupp
e. Schindler
f. Otis
g. Approved Equal
17. Battery Powered Automatic Lowering System
a. Reynolds and Reynolds Electronic
b. GAL
c. Schindler
d. Otis
e. Approved Equal
18. Elevator Cab Materials
a. Gunderlin, Ltd.
b. Tyler Elevator Products, Inc.
c. H&B Elevators
d. Elevator Cabs, Inc.
e. Approved Equal
19. Elevator Hoistway Entrances and/or Hoistway Door Panels
a. Gunderlin, Ltd.
b. Tyler Elevator Products, Inc.
c. H&B Elevators
d. Elevator Doors Inc.
e. Approved Equal
20. Guide Shoes and Roller Guides
a. Elsco
b. Thyssen/Krupp
c. Otis
d. Approved Equal
21. Paint & Coatings
a. Pratt & Lambert
b. Sherwin-Williams
c. Martin Senour
d. Approved Equal
22. Chairlift Manufacturers
a. National – Wheel – O – Vator Inc.
b. Porch Lift
c. Approved Equal

23. Dumbwaiter Manufacturers
a. Atlas Elevator Company
b. Matot Corp.
c. Approved Equal
24. Door Hanger and Interlock Equipment
a. GAL Manufacturing
b. Approved Equal
25. Mobil Computer Security Cabinet
a. EDSAL #CSC6726
b. Approved Equal

APPROVED SUBSTITUTIONS:

Substitutions must, in the opinion of the Owner, Architect and Elevator Consultant, equal to, or exceed, the quality of the specified product.
Where noted above, products manufactured by the list of Approved Elevator Manufacturers will be acceptable subject to complete compliance with the technical specifications written based on these guidelines.

Elevator Contractor may only substitute other manufacturers of Elevators Cabs and Elevator Hoistway entrance materials, subject to the following:

The Elevator Contractor must agree to an inspection by the Owner‘s Representative(s), Architect and Elevator Consultant (if used on project) of the Elevator Cabs and/or Elevator Hoistway Entrance materials at the factory after shop assembly, but prior to shipment to the project site.
Any deficiencies found after assembly at the factory shop must be corrected prior to shipment to the installation site. The Elevator Contractor shall schedule the shop inspection at least 20 days in advance of the physical inspection date to allow suitable arrangements to be made for inspection of the materials.

The substitution(s) must fully comply with the specifications contained herein, including design, quality of fabrication and fit, quality of materials and every other aspect of the specified products.
The Elevator Contractor shall be responsible for all costs associated with correcting any deficiencies, or deviations from the specifications, caused by substitutions of material that is specified herein.
Further, the Elevator Contractor shall be responsible for arranging for all travel time and costs of Architect and Elevator Consultant (if used on project) associated with visiting, or revisiting, the manufactures facilities to examine the work of any firm not on the approved bidders list.
No extension of time in the completion schedule for the work will be granted as a result of the need to correct defects or deficiencies associated with the use of material substitutions.

THE FLORIDA STATE UNIVERSITY

DESIGN GUIDELINES AND SPECIFICATIONS

MECHANICAL

March 25, 2011

DIVISION 15000 - MECHANICAL UTILITIES AND EQUIPMENT

Part 1 – GENERAL

1.1 Overview

A. **Coordination of utility connections**: All utility work shall be coordinated with and approved by the Utilities Section through the Project Manager.

B. **Utility Connection Approval:** Utility work and connections to University utility systems must be properly planned to prevent disruption of classes, research efforts or life in the Residence Halls... All utility work shall be coordinated with the Utilities Section through the University Project Management Section. Each drawing that shows a connection to existing utilities must have a note that states that the Contractor shall request permission for all outages as far as possible in advance. This shall be a minimum of 14 days except in case of emergency. It shall be noted that even with the advance notice, it will not always be possible to grant the requested time and date, as classes and research must have precedence. Permission must be obtained, through the project manager, from the Utilities Section. Explicit details must be shown for all connections to existing utilities. The Utilities Section must approve both the location and method of the proposed connection, in advance... Note: this applies both to temporary construction utility connections as well as the permanent utility connections.

   1. It shall be the responsibility of the A/E to investigate and determine the actual location of all underground utilities or obstructions at the building site before beginning design work. The University will provide all available information as appropriate.
   2. The construction contract specifications shall provide for the orientation and training of University personnel on all installed equipment and systems.
   3. The contractor shall pay for utilities during construction. The contractor shall contract with the City of Tallahassee whenever possible. If it is necessary to have construction utilities supplied from the University, the contractor shall install temporary services in accordance with local codes. The University will bill the contractor monthly for utilities used. Shall the University wish to make an exception to this; the A/E will be so informed.
   4. Heat, air conditioning, humidity control and any other environmental factors shall be the responsibility of the contractor throughout the construction period.

C. **Life Cycle Cost Analysis:** The Architect/Engineer shall conduct a life-cycle cost analysis of alternative architectural and engineering designs to evaluate the efficiency of energy utilization for competing designs in the construction of new buildings. These requirements also apply to major building renovations including the replacement of major energy consuming equipment in existing buildings. The University Project Manager will advise the A/E as to the time during the Design that this life cycle analysis is due.

1. Such life-cycle costs shall be the sum of:

   (a) The reasonably expected fuel costs over the life of the building, that are required to maintain illumination, power, temperature, humidity, and ventilation and all other energy-consuming equipment in a facility, and

   (b) The reasonable costs of probable maintenance, including labor and materials, and operation of the building.

2. To determine the life-cycle costs the analysis shall include, but not be limited to:

   (a) The orientation and integration of the facility with respect to its physical site.

   (b) The amount and type of glass employed in the facility and the directions of exposure.

   (c) The effect of insulation incorporated into the facility design and the effect on solar utilization of the properties of external surfaces.

   (d) The variable occupancy and operating conditions of the facility.

   (e) An energy consumption analysis of the major equipment of the facility's heating, ventilating, and cooling system, lighting system, hot water system, and all other major energy-consuming equipment and systems as appropriate. This analysis shall include:

   (f). The comparison of alternative systems.

   (g). A projection of the annual energy consumption of major energy-consuming equipment and systems for a range of operation of the facility over a 25 year life of the facility. The analysis shall include the replacement costs of major equipment that has a life expectancy of less than 25 years.

   (h). The evaluation of the energy consumption of component equipment in each system, considering the operation of such components at other than full or rated outputs.

3. The Architect/Engineer shall prepare data, make the input and run the analysis on an appropriate Life-Cycle Cost Computer Program such as the Trane Trace Ultra 600, Carrier HAP 3.0, Elite Software’s Energy Program or other program based on DOE standards and approved by the University.

4. Before preparing the data, the Architect/Engineer shall discuss the energy-saving schemes proposed for the Project with the university Project Manager. The Architect/Engineer shall submit two sets of the following to the Owner: cover letter discussing the energy saving schemes considered, the computer results, the Architect/Engineer's recommendations and discussion of other energy-saving measures incorporated into the Project design, copy of the university Project Manager's written concurrence with the schemes and the complete computer run printout. The university Project Manager will notify the Architect/Engineer of the approved scheme to incorporate into the project.

D. Metering: All utilities are to be metered for each building, including water, steam, and chilled water. All utility metering must be coordinated with the University Project Manager prior to construction. All metering devices must have the capability to report to the Campus Energy Management System. If the building contains Auxiliary occupants in addition to E&G occupants, separate metering must be provided for each Auxiliary occupant. This shall be coordinated with the Utilities Section through the Project Management Section.

E. Separation for noise control: separate mechanical equipment and other noisy areas from academic and office areas.

F. Outdoor air inlet location: Care shall be taken in the placement of all outdoor air inlets to ensure that odors and other pollutants (automobile exhaust, generator exhaust, fume hood exhaust, etc.) do not enter the building.

G. Mechanical Room Access: Mechanical rooms must have adequate openings to facilitate the removal and replacement of major pieces of equipment. Provide double 3'-0" doors which swing outward, with active/inactive leafs.

H. Equipment Access: There must be adequate space in mechanical rooms to provide ample access space around all equipment for routine maintenance items and procedures, such as filter replacement, lubrication, and so on.

I. Pipe Insulation thickness: to be per latest energy efficiency standards.

J. Access to mechanical rooms: shall not be through other rooms. It is preferred that access to these spaces be achieved from a main corridor and/or exterior space. Access shall not be by ladders. Where possible, penthouse rooms shall have elevator access.

K. Storage in Mechanical Rooms: Mechanical rooms and similar spaces are not to contain storage areas. All power disconnects to equipment shall be so located as to be easily accessed.

L. Color Coding: All piping shall be color coded and labeled as to use.

M. Fan Labeling: All fans shall be labeled as to use, area served and power source.

N. All HVAC controls: shall be of the direct digital type and conform to the standard outlined in Building Automation and Central Monitoring Systems.

O. Air eliminators: All hydronic systems shall have adequate air eliminators installed.

P. Central-Station air filtration: Provide MERV 9 air filtration on all central-station air handling units.

Q. Manhole design: shall be carefully coordinated with the University Project Manager and the Utilities Section. Contact Director of Utilities for latest manhole standards.

R. Underground piping installation: All piping utilized for underground piping are required to have the ends sealed prior to storage or use on site. No end seals shall be removed until the end in question is actually ready for welding or otherwise connecting. In no event shall any piping be left in a trench with an open end at any time. This requirement shall be strictly enforced.

S. Systems Test & Balance: will be provided through the A/E as an additional service. The specifications will require the contractor to participate in the testing, make any changes necessary and pay for any re-testing that may be required to make the systems meet specifications.

T. Air Handling Unit Condensate Drains: All air handling unit condensate drain pans must drain to the storm sewer system, with a by-pass to the floor drains when using chemicals to clean coils. Contract Director of Utilities for standard detail for coil drains.

U. Return air plenums: Mechanical rooms shall not be utilized as return air plenums.

V. Ventilating and cooling of Mechanical rooms: Mechanical rooms that generate heat such as steam rooms and pump rooms shall be cooled using a thermostatically controlled forced air ventilation system utilizing outdoor air. Generally, pump rooms and similar spaces with electronic systems such as variable speed drives, shall be separated from rooms containing steam reducing stations and condensate pumps. Wherever possible, intake air shall be directed into the pump room and removed from the steam room. If cooling using outdoor air is considered not feasible, approval of an alternative cooling scheme shall be approved by the Director of Utilities.

W. Labeling of mechanical equipment: such as air handlers, pumps, exhaust fans, etc., shall be referred to and labeled by floor number, i.e., EF3-5 would be the fifth exhaust fan on the third floor.

X. Demarcation between new insulation and existing asbestos insulation: The A/E shall contact the University Department of Environmental Health and Safety Asbestos Coordinator prior to the commencement of a renovation project in order to determine the specifications for labeling and demarcation of the extent of new (non-asbestos) pipe insulation applied by the mechanical contractor following any abatement of asbestos pipe insulation for the project.

Y. Identification signage systems: and markings for all mechanical equipment and piping shall be required.

Part 2 - PLUMBING

2.1 Overview

A. Floor drains: are to be provided in all toilet rooms, custodial closets and mechanical rooms.

B. Strainers: All piping system strainers shall be equipped with valves for blowdown cleaning.

C. Hose bibs: shall be provided in toilet rooms located underneath the sink, machinery rooms and at 100-foot intervals in exterior areas for maintenance use.

D. Joint sealer: Teflon containing joint sealer shall be utilized in all screwed piping installations.

E. Color Coding: All piping shall be color coded and labeled as to use and flow direction.

F. Valve Boxes: All exterior valves shall be fitted with a complete one-piece valve box unit constructed of concrete, steel or plastic. The box shall have a hinged cover and be set in concrete. The installation shall be such to support small vehicle and lawn maintenance equipment.

G. Urinals: shall be of the flooded open throat type to avoid stoppages and odor problems. Urinals shall be provided with automatic flushing sensors. Urinals shall be designed for 0.13 gallons per flush.

H. Floor drains: where necessary, are to be placed at the lowest point in the area.

I. **Lavatory Faucets:** shall be the types that will not flow over 0.5 GPM and provided with automatic sensors. Where sensors are not considered cost effective, timed shut off valves shall be used.

J. **Washbasins:** Standard type washbasin shall have strainer type drain, lever handles equipped for handicapped use, cold water faucets, no hot water faucets (except in dormitories and service buildings) and soap dispensers. Use of hot water in any other locations is prohibited except when approved by the Director of Utilities

K. **Water Closets:** shall be wall mounted and designed for a maximum of 1.24 gallons per flush.

L. **Custodial closet faucets:** shall be single delivery mixing type with hot and cold water and have threaded spout equipped with a vacuum breaker and a three-foot hose. Place faucets 30" - 36" above sink rim.

M. **Bottle Refilling Stations:** In new facilities, provide at least one drinking fountain which includes a bottle refilling station. This unit should be located on the ground floor and be readily accessible from the main entry. Installation should be ADA compliant.

N. **Domestic Water Piping:** Below grade, all domestic cold water piping exterior to building shall be ductile iron or PVC. Underneath buildings, piping shall be type K copper or ductile iron. All domestic water piping inside the building and above grade shall be type L copper, except for high purity water. Materials for high purity water systems shall be coordinated with the University Project Manager.

O. **Domestic water pipe insulation:** all domestic hot water piping shall be insulated with foamglas pipe insulation and the domestic cold water piping that is exposed in unconditioned spaces shall be insulated to prevent sweating.

P. **Water Meters and Taps:**The City will furnish water meters and taps for domestic and fire water.

Q. **Tap fees and system charges:** shall be paid for by the Contractor. The City of Tallahassee has jurisdiction over the installation. Install water meters and domestic water backflow preventers above grade and provide insulated cover. Install backflow preventers in accordance with City Ordinance. Contact the City for their requirements and information. The City's approval for all proposed connections must be received prior to completion of the 100% documents. Written proof of the City's approval must be provided to the Utilities Section prior to bidding the project. Fire Flow backflow preventers shall be installed inside the building.

2.2 - <u>WATER BASED FIRE EXTINGUISHING SYSTEMS (Where required)</u>

A. **Water Based Extinguishing System:** The contractor shall furnish all labor and equipment for the complete installation of a water based fire-extinguishing system and shall be the installing contractor or site representative with the required license. No subcontracting will be allowed. The contractor must be NICET level III certified and must possess the appropriate class I or class II fire sprinkler license as required by the State of Florida.

B. **Codes**: Fire water based systems shall be installed, inspected, tested and certified per appropriate NFPA 13, 14, 20, 24, 25, including NFPA 101. Any applicable codes shall apply to meet State of Florida and Fire Marshal requirements, local and state jurisdiction.

C. **Warranty:** The fire system contractor shall be responsible for equipment, materials and workmanship of the system for one year. The warranty shall be enforced 24 hours a day, seven days a week including weekends and holidays during this period of time. The contractor will also respond after being advised of his responsibility and the nature and/or condition of the equipment that has failed by the FSU Fire Systems on-call technician. After notification has been made to the responsible equipment contractor, a maximum of one hour will be allowed to respond and arrive on site. When the problem has been secured or corrected to the satisfaction of the technician o the FSU Police Department will be notified.

D. **Backflow preventers:** The installation of fire water mains shall included backflow preventers in accordance with TREEO (Training Research & Education for Environmental Occupations) set forth by the University of Florida and NFPA requirements including City Ordinance. Contact them for their requirements and information. All fire mains and/or valves shall be painted and labeled to indicate the proper building name controls. The City must approve all connections to the City water mains. The City's approval must be received prior to completion of the 100% documents. Written proof of the City's approval must be provided to the Utilities Section prior to bidding the project.

E. **Connections and fittings:** Fire water system connections and fittings shall be compatible with the City of Tallahassee Fire Department fittings. Contact them for information.

F. **Spare escutcheon plates**: Provide six extra Escutcheon Plates of each type installed on any system, installer will provide manufacturer name and address, supplier name and address and parts number.

G. **Drains and inspectors test drains:** The main drains and inspectors test drains be piped to an adequate drain or outside the building. When piped outside the drain shall not affect the architectural design and landscaping of the building. When piped outside the building, the water flow shall not pose a threat to persons on sidewalks or streets adjacent to the building.

H. **Gauges:** Provide 3-1/2" gauges with a connection not smaller than 1/4", and each gauge connection equipped with a shutoff valve and provisions for draining.

I. **Valves:** All control, drain and test connection valves shall be provided with permanently marked weatherproof metal or rigid plastic identification signs. The sign shall be secured with corrosion-resistant wire, chain or other approved means.

J. **Valve signage:** All control valves will have proper signage to indicate the areas of coverage. This will start from the feed supply into the building through all branch lines.

K. **On systems with fire pumps:** the use of PVC and/or plastic pipe, fittings, or components will not be acceptable.

2.3- <u>HEATING AND STEAM</u>

A. **Steam Pressure:** Steam is supplied at pressures varying between 70 psig and 125 psig, depending on the season. The building steam systems shall have a maximum utilization pressure of 50 psig and shall be designed to operate with the inlet pressure to the building varying between 70 psig and 125 psig.

B. **Pipe Materials:** All high pressure and low pressure steam piping shall be Grade A ASTM A-106, schedule 40 seamless piping, and condensate return lines shall be schedule 80 seamless pipe. The use of pre-insulated steam and condensate return piping is permissible. Contact the Director of Utilities for currently approved types and manufacturers.

C. **Expansion loops:** All steam and steam condensate lines underground shall have properly sized expansion loops, which shall be properly anchored. If pre-insulated piping is used, the expansions loops shall be sized and located per manufacturer's instructions.

D. **Valves:** Valves installed above grade as part of the high-pressure steam system, and valves installed below grade, shall be 300 lb. valves. Valves that are 2-1/2" and larger shall be flanged, and all valves less than 2-1/2" shall be screwed. Valves installed in manholes shall be 300# butterfly valves. Contact Director of Utilities for latest approved types.

E. **Pipe connections:** All piping that is 2-1/2" and larger shall be welded, not screwed. A certified welder shall weld all underground fittings

F. **Steam pipe fittings:** High pressure steam fittings 2" and larger shall be butt-welded fittings with backing rings. Fittings that are 1-1/2" and smaller shall be forged steel screwed or socket weld fittings. Unions that are 2" in size shall be 300 lb. screwed cast iron or forged steel. All high-pressure steam nipples shall be schedule 80.9. Low pressure steam fittings that are 2" and larger shall be schedule 40 butt welded fittings with backing rings, and flanges shall be slip-on or weld neck flanges. Low pressure steam fittings that are 1-1/2" and smaller shall be 150-lb. cast iron using 300 lb. cast iron unions and schedule 40 nipples.

G. **Condensate pipe fittings:** Condensate lines that are 2-1/2" and larger shall be schedule 80 butt weld fittings with backing rings and steel weld neck or sip-on flanges that are the same pressure class as the valves. Condensate lines that are less than 2-1/2" shall be forged steel or socket weld using 300 lb. screwed unions and schedule 80 nipples.

H. **Condensate receivers:** All steam condensate receiver unit vents shall be run full size from unit to a safe discharge location.In no case is the discharge to be over a sidewalk or other public area. In addition, discharges shall not be located near air intakes.

I. **Insulation:** for high and low pressure steam and condensate lines above grade shall consist of calcium silicate. Below grade steam lines shall have a calcium silicate inner layer and a foamglas outer layer wrapped with glass fabric cloth and with proper mastic applied. Condensate lines below grade shall have foamglas insulation wrapped with glass fabric cloth and with proper mastic applied. Deviations from the above shall be approved by the Project Manager.

J. **Insulation attachments:** The attachments for the insulation below grade shall be stainless steel wiring or bands, or 16 gauge copper wire, on 9" centers.

K. **Below grade fitting insulation:** steam fittings are insulated with mitered segments of calcium silicate wired in place. Below grade steam flanges, unions, and valves are insulated with oversized pipe insulation.

L. **Manufacturer’s instructions:** All insulation materials shall be installed according to the manufacturer's instructions.

M. **Gauges:** All pressure and temperature gauges shall be 4-1/2" face, bottom connection, and industrial grade. All temperature gauges shall be mounted in wells.

N. **Steam pressure reducing valves:** All steam pressure reducing valves shall be Fisher, pilot operated. Contact Director of Utilities for currently approved alternates.

O. **Condensate pumping units:** All condensate pumping units shall be above grade and shall be duplex electric pumps with cast iron receivers and ceramic seals. The pumps shall be equipped with balanced mechanical seals. Steam pressure powered pumps are not acceptable.

P. **Water pumps:** shall be equipped with balanced mechanical seals.

Q. Utilitzation of the campus steam system: Whenever possible, utilize the campus steam system as a heating source with a pumped condensate return to the Central Utilities Plant.

R. Drip traps: Install drip traps before all thermostatic temperature-regulating valves and pressure reducing valves.

S. Bolts and nuts: shall be hex configuration, coarse threaded, and be of ASTM A-193, Grade B7 alloy steel such as USS Supertanium alloy, or equivalent.

2.4 - CENTRAL UTILITY PLANT (CUP) CENTRAL CHILLED WATER SYSTEM/BUILDING INTERFACES

A. General: The following are requirements for new building designs in order to best produce the most efficient utilization of the Central Utility Plant (CUP) system, utility distribution system, and the building.

1. The Central Utility Plants are designed as a variable flow system to achieve maximum energy economics. The design of the building shall be such as to operate over a varying pressure range.
2. The interface between the building and the Central Chilled Water Distribution System shall insure the chilled water temperature difference will equal to or exceed 15 degrees while satisfying the building design criteria. The interface will also insure that the building pump(s) and the distribution pump(s) will be completely decoupled. The Utilities Section will provide design and material requirements for the interface.
3. The CUP is operated to produce 45 to 48 degrees F. chilled water depending on overall system needs and energy conservation measures being utilized. The design professional shall verify this strategy with the project manager before design begins.
4. Existing pressures leaving the CUP vary from 50 to 85 psig. Be aware that the maximum operating pressure for the existing chilled water underground piping is 100 psig. Any additions to this system shall be designed for 150 psig.

2.5 - AIR CONDITIONING

A. General: Utilize the campus chilled water system for cooling if at all possible. The interface between the system and building is discussed in the section titled "Central Utility Plant Central Chilled Water system / Building interfaces". A fine mesh monel or stainless steel strainer shall be installed in the chilled water supply line of each building to prevent contamination of the building chilled water system. All chilled water strainers shall have a pressure gauge installed across the strainer so as to quickly determine when strainers are dirty.

B. If the campus chilled water system is not available: When the air conditioning system cannot be connected to the Central Chilled Water System, consider the use of water cooled condenser(s) utilizing a deep well water supply with injection return. For smaller systems (less than 200 tons) consider air cooled condensers.Utilize existing wells as practical. New well pumps shall be mounted above ground with a suitable enclosure. Provide water lubrication. Cooling towers are not desired by the University. The existing Northwest Florida Water Management District Consumptive Use Permit will have to be amended if a new well is to be installed. Be aware that

Leon County has a Wellhead Protective Ordinance that also will have to be complied with. All cooling well design and permitting must be coordinated with the Utilities Section.

C. **Air conditioning condensate lines:** All air conditioning condensate lines shall be of insulated type "L" copper or approved equal. Provide insulation details to insure vapor proof covering.

D. **Equipment surface condensation:** If condensation occurs on the outside of insulated ducts, HVAC equipment, VAV boxes, flex ducts, piping, etc. during the construction period, the Project Team shall take immediate action to determine the reasons, and initiate corrective action. Substantial Completion shall not be approved until corrections are agreed to in writing. The contractor shall be required to rework the insulation until satisfactory if condensation occurs on any cold surface at any time during the warranty period.

E. **Chilled water system taps:** All chilled water taps into the Central Chilled Water System shall be made without system interruption, <u>where feasible</u>. Each juncture shall be provided with a shut off valve and valve box for easy access. Note that much of the existing underground Chilled Water System piping is constructed of asbestos bearing material, i.e. Transite. "Hot tapping" details will be provided by the University. All chilled water connections, whether external or internal, must be coordinated with and approved by the Utilities Section. Initial coordination concerning the approved location of new connections must be done prior to completion of the Schematic Design Phase.

F. **Exterior chilled water piping:** shall be schedule 40 black steel with welded joints. The use of pre-insulated black steel pipe is permissible. <u>Contact Director of Utilities for currently approved types and manufacturers.</u>

G. **Chilled water pipe insulation:** Insulation for chilled water piping shall consist of foamglas that is covered with a .016 inch thick aluminum weatherproof jacket that has a factory applied integral vapor barrier. The foamglas shall be glued to the piping. Fasten with aluminum bands located not more than 12 inches apart. Insulation below grade shall be foamglas with Pittwrap cover.

H. **Variable flow chilled water requirement:** All building chilled water systems served from central chilled water shall be designed to have variable flow characteristics compatible with the central system.

I. **Chilled water shutoff valves:** All chilled water piping shall be installed with shut-off valves at each floor and at each AHU.

J. **Chilled water coil temperature rise:** All major air handling unit coils shall be designed for not less than 15 degrees Fahrenheit temperature rise, and be provided with two way control valving. The use of fan coil units is discouraged; however, if there is no other practical option, they may be utilized upon approval of the Director of Utilities. It is recommended that they not be installed above the ceilings. Insure that adequate ventilation is provided per ASHRAE Standard 62-1981R.

K. **Fan coil ventilation air:** If fan coils are approved for use, they shall be provided with ducted, pre-conditioned ventilation air if feasible. The direct connection of un-conditioned ventilation air to fan coil units is generally prohibited.

L. **Interior of air handling units:** A/C Air Handling Units shall be double wall construction with a solid inner liner (no insulation exposed to airstream).

M. **Internal vibration isolation:** Air Handling Units shall have fans mounted on internal vibration isolators (2" static deflection).

N. **Drain pan:** Air Handling Units shall have double wall insulated drain pan.

O. **Air handling units installed in spaces exposed to outdoor air conditions**: (such as attics) must be sufficiently insulated to prevent surface condensation.

P. Classroom ventilation: In classrooms, the HVAC system shall provide an adequate rate of "fresh air" to each student seat (18 cfm per student seat). Where feasible, CO2 sensors shall be utilitzed to reduce ventilation air under conditions of reduced occupancy.

Q. Non-tradional air handling units: other types of air handling units such as fan-wall systems may be utilized, where appropriate, and with the approval of the Director of Utilities.

2.6 - FUME HOODS

A. General: Due to safety and energy consumption implications of fume hoods and the constantly changing technology, the University has not established standards for fume hoods. Each installation shall be coordinated with the Project Manger and approved by Environmental Health and Safety and the Utilities Director. In general the intent is to use low flow hoods and to provide remote monitoring of the sash position through the campus energy management system.

B. Performance: Fume hoods shall meet the following performance requirements: Supplier to provide factory ANSI/ASHRAE 110-1995 test of hood. Hood to have a rating of 8.0 AM 0.05 using the above test. Hood to be tested using ANSI/ASHRAE 110-1995 after installation in lab (testing to be provided and paid for by the hood supplier) and shall achieve a rating of 8.0 AI 0.05. If the hood does not achieve the rating, and the CFM and static pressure meet the supplier performance data, the fume hood supplier shall be responsible for any system changes and upgrades needed to achieve the "as-installed" rating.

2.7 - REFRIGERANT MANAGEMENT REQUIREMENTS

A. General Requirements

1. The contractor and mechanical engineering design professionals shall work with the University's Refrigerant Manager, to identify specific requirements for each project and interpret requirements from this section as they pertain to upcoming work.
2. Mechanical engineering design professionals shall incorporate the requirements of this section in their equipment and contract specifications.
3. Contractor shall be responsible and accountable for compliance with the EPA Clean Air Act (CAA) Section 608, 40 CFR Part 82 and any state and local codes for all refrigerant-related work. Contractor shall ensure that all contractor employees are made aware of the content of these practices prior to beginning work on refrigerant containing equipment.
4. Contractor shall provide only proper level EPA certified technicians using EPA certified and registered recovery/recycle units to perform work on FO&M refrigerant equipment.

2.8 - BUILDING AUTOMATION AND CENTRAL MONITORING SYSTEMS

Contact the campus Director of Utilities for the current requirements at the beginning of the Design Development Stage of the project.

SECTION15952/BUILDING AUTOMATION SYSTEM

1 GENERAL

1.1 A complete microprocessor controlled compatible building automation and control systems tested and ready for operation.

1.2 Contractor shall furnish and install a direct digital control and building automation system (BAS). The BAS shall utilize electronic sensing, microprocessor-based digital control, and electronic actuation of dampers and valves to perform control sequences and functions specified. The BAS for this project will generally consist of monitoring and control of systems listed below. Reference also controls drawings, sequences of operation, and point lists.

1.3 Automation and/or monitoring for the various systems such as but not limited to:

1.3.1 Air Handlers
1.3.2 Air Handlers
1.3.3 Variable Frequency Drives
1.3.4 Zone Terminal Units
1.3.5 Fan Coil Units
1.3.6 Pumps
1.3.7 Heat Exchangers
1.3.8 UPS Equipment
1.3.9 Energy Recovery Equipment
1.3.10 Generators
1.3.11 Boilers
1.3.12 Energy Meters
1.3.13 Stand Alone Building Chiller
1.3.14 Campus Chiller
1.3.15 Occupancy Sensors

1.4 In addition to monitored and controlled equipment, this section also includes:

1.4.1 Communication and Low voltage cable and pathway requirements.

1.4.2 Power requirements.

1.4.3 Instrumentation – Product specifications and Installation requirements.

1.4.4 Other miscellaneous items required but not specified for a complete operational system.

1.5 Products supplied but not typically installed under this section:

1.5.1 Control Valves
1.5.2 Control Dampers
1.5.3 Instrument wells
1.5.4 Flow Meters
1.5.5 Energy Meters
1.6 Related Sections:

1.6.1 Section 15005 – Motors

1.6.2 Section 15520 – Valves

1.6.3 Section 15550 - Vibration Isolation

1.6.4 Section 15910 - Control Sequences

1.6.5 Section 159xx – Testing, Adjusting and Balancing

1.6.6 Section 159xx – Commissioning

1.6.7 Section 16130 - Raceway and Fittings

1.6.8 Section 16120 - Conductors and Cables

1.7 Related Sections:

1.7.1	FCC Part 15, Subpart J Class A	Computing Devices
1.7.2	UL 864/UUKL	Smoke Control Listing (Ninth Edition)
1.7.3	UL 873	Temperature-Indicating and Regulating Equipment
1.7.4	UL 916	Energy Management Systems
1.7.5	NEMA	Comply with NEMA Standards pertaining to components and devices for electrical controls
1.7.6	NFPA 70	National Electrical Code

1.8 Definitions: The following abbreviations, acronyms, and definitions apply to and are used within this Guide Specification:

1.8.1	Actuator	Control device to provide motion of valve or damper in response to control signal.
1.8.2	AHU	Air Handling Unit
1.8.3	AI	Analog Input
1.8.4	AO	Analog Output
1.8.5	Analog	A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values
1.8.6	Auto-Tune	Software routine used to adjust tuning parameters based on historical or real-time data
1.8.7	ASC	Application Specific Controller
1.8.8	BAS	Building Automation System
1.8.9	BLC	Building Level Controller – Supervisory control panel and the primary means of communication outside the building. May also act as a global controller, implementing building wide global strategies and energy management routines.

1.8.10	CxA	Commissioning Authority
1.8.11	Control Sequence	A BAS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
1.8.12	DDC	Direct Digital Control
1.8.13	DDCP	Direct Digital Control Panel
1.8.14	Discrete	A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level each separated by a defined deadband. Digital Inputs and Digital Outputs are examples
1.8.15	DI	Discrete Input
1.8.16	DO	Discrete Output
1.8.17	EEPROM	Electronically Erasable Programmable Read Only Memory
1.8.18	EMI	Electromagnetic Interference
1.8.19	EMT	Electrical Metallic Tubing
1.8.20	E-P	Electric to Pneumatic
1.8.21	Fat Client	A network computer with a hard disk drive.
1.8.22	FC	Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
1.8.23	FO	Fail Open position of control device or actuator. Device moves to open position on loss of control signal or energy source.
1.8.24	Furnish	Supply but not install.
1.8.25	GUI	Graphical User Interface
1.8.26	I/O	Input/Output (typically referring to points monitored by a system).
1.8.27	I/P	Current to pneumatic transducer
1.8.28	Instrument	Device used for sensing input parameters or used for actuation
1.8.29	IP	Internet Protocol
1.8.30	HOA	Hand Off Auto
1.8.31	Install	To mount, but not furnish.
1.8.32	LAN	Local Area Network
1.8.33	IT	Information Technology
1.8.34	LOT	Local Operator Terminal
1.8.35	Modulating	Movement of a control device through an entire range of values proportional to an infinitely variable input value.
1.8.36	Motorized	Control device with actuator.
1.8.37	NC	Normally Closed position of switch contacts after control signal is removed.
1.8.38	NO	Normally Open position of switch contacts after control signal is removed.
1.8.39	Node	DDCP, user workstation, or other control device connected to communications network.
1.8.40	Operator	Same as actuator
1.8.41	Owner	Florida State University (FSU Project Manager)
1.8.42	OWS	Operator’s Work Station (Personal Computer with Intranet / Internet capability)
1.8.43	PC	IBM-compatible Personal Computer from a recognized major manufacturer. PC “clones” assembled by a third-party subcontractor are not acceptable
1.8.44	PDA	Personal Digital Assistant

1.8.45	Peer-to-Peer	Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
1.8.46	P1/P2	Siemens primary Tier 2 and Tier 1 communication protocols
1.8.47	P	Proportional control, control mode with continuous linear relationship between observed input signal and final controlled output element.
1.8.48	PI	Proportional - Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controlled variable (Reset control).
1.8.49	PID	Proportional - Integral - Derivative control, control mode with continuous correction of final controlled output element versus input signal based on proportional error, its time history (reset), and rate at which it is changing (derivative).
1.8.50	PM	Project Manager capable of making project and personnel decisions.
1.8.51	PPD	Physical Plant Department (University of Florida)
1.8.52	Point	Analog or discrete instrument with addressable database value
1.8.53	Protocol	A set of rules and standards governing the on-line exchange of data between control systems of the same or different manufacturers.
1.8.54	Provide	To “furnish” and “install”
1.8.55	RF	Radio Frequency
1.8.56	RFI	Radio Frequency Interference
1.8.57	Router	Device for implementation of Network Layer Protocol
1.8.58	Self-Tune	Same as Auto-Tune
1.8.59	Solenoid	Electric two position actuator.
1.8.60	Software	Includes all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the control industry for real-time, on-line, integrated control system configurations.
1.8.61	Thin Client	A network computer without a hard disk drive.
1.8.62	Tier 1	LAN and/or WAN communication network. Building to building communication or high speed Ethernet communication level running within a specific building.
1.8.63	Tier 2	Building level communication or low speed tier running under a building level supervisory controller.
1.8.64	VAV	Variable Air Volume
1.8.65	VFD	Variable Frequency Drive
1.8.66	WAN	Wide Area Network

1.9 Systems Description

1.9.1 Acceptable control system manufacturer :

1.9.1.1 Siemens Industry, Inc.
1.9.2 Scope includes labor and materials including but not limited to:

1.9.2.1 Tools and other equipment
1.9.2.2 Software, licenses, configurations and database entries,
1.9.2.3 Interfaces, wiring, tubing, labeling,
1.9.2.4 Engineering and calculations
1.9.2.5 Calibration, testing, verifications, training and other services,
1.9.2.6 Documentation, samples, submittals,
1.9.2.7 Permits, professional licenses, etc.
1.9.2.8 Other Administrative fees such as parking, shipping, handling, etc.

1.9.3 Provide a complete system and be accessible via manufacturer's specific server system using a web browser interface implemented over the Owner's intranet as well as over the Internet.

1.9.4 The BAS network includes but is not limited to the following:

1.9.4.1 Operator PCs – fixed or portable
1.9.4.2 Connection to existing network servers.
1.9.4.3 Communications equipment needed to support the in-building communication BAS network.
1.9.4.4 Intelligent and addressable elements and end devices.
1.9.4.5 Third-party equipment interfaces.
1.9.4.6 Other components required for a complete and working BAS.
1.9.5 The BAS Network shall utilize an architecture capable of the following:

1.9.5.1 Utilizing standard Ethernet communications operating at a minimum speed of 10/100 Mb/sec.

1.9.5.2 The BAS network shall support both copper and optical fiber communication media at the Tier 1 level.

1.9.6 The BAS Network shall integrate to the following systems:

1.9.6.1 Lighting **[Division 16XXX]**
1.9.6.2 Power metering **[Division 16XXX]**
1.9.6.3 Generator **[Division 16XXX]**
1.9.6.4 Plumbing **[Division 15XXX]**
1.9.6.5 Other **[Division XXXXX]**
1.9.6.6 Chilled Water and Hot Water System Metering **[Division 15XXX]**

1.9.7 The system shall be compatible with the FSU IT network.

1.9.8 The BAS shall be fully expandable with the addition of hardware and/or software. Expansion shall not require removal of existing DDCP, sensors, actuators, or communication networks.

1.9.9 System must be of a modular design to ensure reliability and system performance.

1.9.10 All electrical work required as an integral part of this section is work of this section.

1.9.11 Provide final power connections including conduit, wire, and/or control panel disconnect switches to all control devices from appropriate electrical j-box.
1.9.12 Include the following integrated features, functions and services:

1.9.12.1 Operator information, alarm management and control functions at any operator's console without the need to purchase special software from the contractor or BAS manufacturer for those consoles.

1.9.12.2 Information management including monitoring, transmission, archiving, retrieval, and reporting functions

1.9.12.3 Diagnostic monitoring and reporting of BAS functions

1.9.12.4 Energy management

1.9.12.5 Wireless Device capability

1.10 Quality Assurance:

1.10.1 Provide components not specifically indicated or specified, but necessary to make system function within the intent of contract documents and sequence of operation.

1.10.2 All electrical products to be listed and labeled by UL and comply with NEMA Standards.

1.10.3 Control wiring shall be in accordance with National Electric Code.

1.10.4 The Contractor shall have qualified technicians within a 50 mile radius of Project Site and have the ability to comply with a two hour on-site response time.

1.10.5 Provide a competent and experienced Project Manager with a minimum of 5 years' experience with similar projects. Include resume in submittal package.

1.10.6 Engineering services shall be performed by factory-trained engineers. Include relevant documentation in submittal package.

1.10.7 System shall be installed by factory trained mechanical and electrical installers either in direct employ of this Contractor or by subcontractors who are under direct supervision of this Contractor.

1.10.8 Use only manufacturer trained technicians who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided under this section. Include relevant documentation in submittal package.

1.10.9 Coordinate with the Owner to ensure that the BAS will perform in the Owner's IT environment without disruption to any of the other activities taking place on that LAN or WAN.

1.10.10 Coordinate timely delivery of materials and supervise activities of other trade contractors to install inline devices such as immersion wells, pressure tappings, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items furnished under this section but installed by other trades.

1.10.11 Select sensors and transducers to most closely match the expected sensing or control range.

1.10.12 Mark and detail exact location of inline devices, wells, and taps to be installed by Mechanical Contractor on coordination drawings and confirm locations in the field.

1.10.13 Instrumentation with factory J-boxes shall not be used as junction boxes.

1.10.14 Install control equipment, wiring and air piping in neat and workmanlike manner to satisfaction of A/E, and in accordance with manufacturer's recommendations. Maintain clearances, straight length distances, etc. required for proper operation of each device.

1.10.15 Install control devices in accessible location. Coordinate all control device locations with other trade contractors. Contractor to report to A/E conditions that prevent reasonable accessibility.

1.10.16 Wire VFD's so that all safeties and interlocks remain operational (inclusive of isolation dampers, isolation valves, end switches, interlocks, safeties etc) when drive is placed in **[Auto, Hand or Bypass mode]**.

1.10.17 Provide weather protection cover or weatherproof control devices where required for control devices located outdoors.

1.10.17.1 All control devices located outdoors shall be rated for the anticipated environment.

1.10.17.2 Include provisions for supplemental ventilation when control devices must be located within outdoor control panels and when control devices are not rated the planned environment.

1.10.18 All digital equipment furnished under this contract shall have been tested and made to comply with limits for Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.

1.10.19 Acceptance Criteria: The system shall report all values with an end-to-end accuracy equal to or better than those listed below: The intent of this guideline is to establish criteria for the Control Contractor and **[Commissioning Agent]** with regard to calibration and acceptance. Reference specific instrumentation sections for required accuracies.

Measured Variable	Criteria
Space Temperature	+/- 1.0°F
Ducted Air (Single Probe)	+/- 0.5°F
Ducted Air (Averaging)	+/-2.0 °F
Outside Air	+/- 1.0 Deg F
Dew Point	+/- 2.0 Deg F
Water Temp	+/- 0.5°F
Relative Humidity (duct and space)	+/- 5% RH
Water Flow	+/- 5% (GPM) of reading
Air Flow (Terminal unit)	+/- 5% (CFM) of reading
Air Flow (Measuring Station)	+/- 5% (CFM) of full scale
Air Pressure (ducts)	+/- 0.10 in WC
Air Pressure (space)	+/- 0.01 in WC

Water Pressure	+/- 2% (psig/psid) of reading
Electrical (A, V, W, PF)	5% of reading
Carbon Monoxide (CO)	+/- 5% of reading
Carbon Dioxide (CO2)	+/- 75 ppm

1.10.19.1 Stability of Control: Control loops shall maintain measured variable at setpoint within the tolerances listed below and shall, upon any change to the feedback variable recover within 5 minutes of the initial event. The intent of this guideline is to establish criteria for the Control Contractor, A/E, and **[Commissioning Agent]** with regard to control loops and acceptance.

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure (ducts)	+/- 0.2 in WC	-6 to +6 in WC
Air Pressure (room)	+/- 0.010 in WC	-0.100 to +0.100 in WC
Air flow	+/- 100 CFM or 1% of setpoint (whichever is less)	
Temperature	+/- .5 Deg F	
Room Temperature	+/- 1.0 Deg F	
Humidity	+/- 3% RH	
Fluid Pressure	+/- 1.0 psi/psid	1 to 150 psi/psid
Carbon Dioxide (CO2)	+/- 50 ppm	100 to 2000 ppm

1.10.20 Provide all points required to implement control sequences specified, whether or not they are listed in schedules.

1.10.21 All outputs, whether sequenced or not, shall have separate programmable hardware outputs. For air handling units, minimum outside air, maximum (economizer) outside air, return, relief air, smoke dampers, heating valves, cooling valves, etc., shall each have a separate output.

1.10.22 Point and Alarming expectations: The system shall include points and alarms as described in Contract Drawings.

1.11 Commissioning:

1.11.1 Assist Testing Adjust Balance Contractor in verifying system operation for all modes of operation.

1.11.2 Demonstrate the sequence of operation for each system and/or sub-system to **[Commissioning Agent (CxA) and/or Engineer]**. Perform all other requirements and perform all services as required in Cx specification Section **[(#####) Commissioning Requirements]**.

1.11.2.1 Use vendor specific forms and **[Owner/3rd Party Cx Agent]** documentation to document the operation and performance of all control systems.

1.11.2.2 Demonstrate functional tests for each point, control sequence, and control loop.

1.11.2.3 Provide trends, schedules, printouts, etc to **[Cx Agent/Engineer]** as requested to document system performance.

1.12 Submittals:

1.12.1 Organized submittals based on specification numbers with major tabs to separate major sections and a master index indicating all elements of submittal.

1.12.2 Identify specific parts and accessories proposed for project. Order submittals based on the specification section and include the following:

1.12.2.1 BAS network architecture diagrams including all Tier 1 nodes, Tier 2 interconnections, and 3rd party integration. Include repeater locations.

1.12.2.2 Provide floor plans locating all control units, workstations, servers, LAN interface devices, gateways, etc. Include all Tier 1 and Tier 2 communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, address, device instance, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. As-built wire routing conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.

1.12.2.3 Schematic flow diagram of system showing all equipment and control devices. Diagram shall include designation of all inline devices, wells, taps and other devices furnished under this Section but installed by other trades.

1.12.2.4 Identification of immersion wells, pressure taps, associated shut-off valves, flow switches, level switches, flow meters, air flow stations and other such items furnished under this section but installed by other trades.

1.12.2.5 Setting or adjustable range of control for each control device.

1.12.2.6 Written description of detailed sequence of operations. Include all initial set-point values, time delay values, references to specific device names. The sequences shall be detailed and include all vendor specific pre-engineered logic. They should not be a duplication of the Engineer's sequences.

1.12.2.7 Points schedule for each real point in the BAS, including: Tag, Point Type, System Name and Display Units. Device Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number. Cable destination, terminal ID, slot number, etc… may also be identified in panel detail drawings.

1.12.2.8 Samples of each typical system Graphic Display screen and associated menu penetrations to show hierarchy and functional interrelationships for systems specified. Sample floor plan graphic showing all proposed components and colors.

1.12.2.9 Detailed Bill of Material list for each system, identifying quantity, part number, description, and optional features selected.

1.12.2.10 Relevant resumes and documentation for proposed project team members.

1.12.2.11 Control Dampers

1.12.2.11.1 Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Frame Type, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, Actuator Type, Actuator model number, Actuator torque rating and quantity of actuators required to ensure total closure of damper(s).

1.12.2.11.2 Leakage and flow characteristics data for all control dampers. Leakage ratings to be based on AMCA Standard 500 and dampers to bear AMCA leakage certification seal.

1.12.2.12 Control valve schedules including a separate line for each valve and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Actual Valve CV, Calculated CV, Design Pressure drop, Actual Pressure drop, Actuator Type and model number.

1.12.2.13 Room Schedule including a separate line for each terminal unit indicating terminal identification, minimum/maximum cfm, box area, thermostat/sensor location, Htg/Clg Setpoints and bias setting. The schedule shall include typical calibration factors to be filled in by TAB contractor during startup and verification.

1.12.2.14 Air Flow Measuring System Schedule including a separate line for each flow device and column for device type, model number, size, location.

1.12.2.15 Cabling indicate all required electrical wiring. Information including wire jacket colors for low voltage signal wiring, low voltage power wiring and communication cable. Indicate wire gauge for each type of cable.

1.12.2.16 Electrical wiring diagrams: Shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring which is existing, factory-installed and portions to be field-installed.

1.12.2.17 FCC compliance.

1.12.2.18 Training Plan – The Contractor shall submit a written training plan to the **[Owner, A/E, CxA]** for review and approval prior to training. The plan shall include the following elements:

1.12.2.18.1 Equipment (included in training)

1.12.2.18.2 Intended audience

1.12.2.18.3 Location of training

1.12.2.18.4 Objectives

1.12.2.18.5 Subjects covered (description, duration of discussion, special methods, etc.)

1.12.2.18.6 Duration of training on each subject

1.12.2.18.7 Instructor name and qualifications for each subject

1.12.2.18.8 Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)Training to be recorded by Contractor (Construction Manager)

1.12.2.19 Integration Plan

1.12.2.19.1 Coordination of vendor protocol and point list submission.

1.12.2.19.2 Workflow processes to integrate systems.

1.12.2.19.3 Include communication hardware, software, and protocols to implement full systems integration.

1.12.2.19.4 Identify proposed enhancements or deviations from project documents. Include specific drawings or specifications impacted.

1.12.2.19.5 Provide coordination information to accommodate complete integration of systems including:

1.12.2.19.5.1 Vendor protocol requirements.

1.12.2.19.5.2 Vendor point list, cross referenced to proposed BAS point list

1.12.2.19.5.3 Edit integration requirements and cross reference integration requirements with other sections.

1.12.3 Operating and Maintenance Manuals:

1.12.3.1 Include descriptions of maintenance for all components supplied under this section, including (but not limited to) sensors, actuators and controllers.

1.12.3.2 Include inspection requirements, periodic preventative maintenance recommendations, fault diagnosis, instructions for repair or replacement of defective components, calibration instructions, parts lists, name, address, and phone number of manufacturer's representative.

1.12.3.3 Provide product operational and maintenance data in electronic PDF format (Acrobat latest version- 9.0 or greater) on vendor specific server, and provide means to access this data using intuitive operator interaction (quick links from main system graphics).

1.12.3.3.1 Include name and 800 number of a 7 day a week 24 hour a day service line for needed service during the first year of operation

1.12.3.4 Software Tab Section:

1.12.3.4.1 As part of operating and maintenance manuals include a software tab. Divide this software tab section into separate parts with tabs for each part. A separate CD including all required information shall be included under this tab section which shall include the following:

1.12.3.4.1.1 As-built sequence of operation provided in Microsoft Word format.

1.12.3.4.1.2 All building level and system level programs. Application specific programs shall include all configuration files showing final menu selections and applicable default settings.

1.12.3.4.1.3 Describe general operating procedures, starting with system overview and printed graphic displays of all systems and provide trend graphs of all control loops with a minimum 24 hour trend at five minute intervals.

1.12.3.4.1.4 Where applicable the Contractor shall provide the latest Factory standard technical manuals in CD and hard copy format. Confirm existing FSU Facilities technical manuals are the latest versions for the systems provided under this project.

1.12.3.4.1.5 Software Backup: Upon successful completion of acceptance testing, include in this section, one archive copies of all accepted versions of source code and compiled code for all application programs and data files on compact disc media. All control software must be readily accessible by Owner using BAS server hardware and software. Software file naming for ASC controllers shall match ID reference on mechanical drawing – ID reference will be unique.

1.12.3.5 Record Drawings:

1.12.3.5.1 Submit as-built shop drawings indicating all changes made during project. The drawing files shall be in Adobe .pdf format and original control format software such as Visio or AutoCAD.

1.12.3.5.1.1 Install all as-built control drawings (and associated sequence of operation) in electronic format on specific server, and provide means to access this data using intuitive interaction by end users.

1.12.3.5.1.2 Each system web page shall allow for an automatic link to the associated control diagram product O&M data sheets and sequence of operation. Mark specific products and options used on project when posting product data sheets. Provide operator a way to access product and as-built control information from the associated system web page (e.g. AHU system, chilled water system, hot water system, VAV system, etc…)

1.12.3.5.2 Mount (within control panel) laminated control flow drawing, sequence, point schedule and control panel wiring diagrams indicating all field points connected.

1.12.3.5.2.1 The control panel wiring diagrams shall utilize the same field device tag names used within the associated control diagram and graphic interface.

1.12.3.5.2.2 Not required for room level controllers.

1.13 Warranty:

1.13.1 At the end of final startup, testing, and commissioning phase, if equipment and systems are operating satisfactorily, the A/E and each of the University's agents shall certify that the controls system's operation has been tested and accepted in accordance with the terms of this specification. The date of such certification shall be the start of the warranty period(s).

1.13.2 Submit warranty documentation upon substantial completion of project or phase (if applicable) and acceptance by Engineer and Owner.

1.13.3 Repair or replace systems or parts found defective at no cost to Owner during the warranty period.

1.13.4 Include parts, labor, and necessary travel during warranty.

1.13.5 Provide vendor specific and 3rd party warranty and registration information as applicable.

1.13.6 Provide services incidental to proper performance.

1.13.7 First year of warranty includes parts and labor for entire system (including 3rd party equipment). Adjust, repair, or replace, at no additional cost to the owner, control system failures during the 1st year (includes software issues).

1.13.8 Second year of warranty includes parts only.

1.13.8.1 Provide a minimum two year warranty for all parts (including 3rd party equipment) provided under this section. Warranty includes all cost to cover defective hardware replacement of like or equal product.

1.13.9 Warranty response time shall be as indicated. The designated FSU Facilities representatives representing the operations and service departments shall be the authorized callers and will determine the required response level.

1.13.9.1 Emergency service - must respond within two hours of being notified.

1.13.9.2 General warranty service - must respond within 4 hours of being notified.

1.13.9.3 Scheduled service – must respond within 48 hours of being notified.

1.13.10 Include server software, project-specific software, graphic software, database software, and firmware updates/patches which resolve known software deficiencies at no additional charge, during the 2 year warranty period.

1.14 <u>Owner Instruction</u>:

1.14.1 Training Requirements:

1.14.1.1 The following summarizes the required training tasks and objectives for the systems provided under this section. The scope and duration shall be determined by the Contractor and shall be commensurate to the project scope and complexity. The Contractor shall include the following elements:

1.14.1.1.1 Review BAS deliverables with respect to general content and organization:

1.14.1.1.1.1 Operations and Maintenance manuals.
1.14.1.1.1.2 As-Built Control Drawing Package
1.14.1.1.1.3 Graphical User Interface
1.14.1.1.1.4 Reporting packages and content
1.14.1.1.1.5 As-Built Control Sequences
1.14.1.1.1.6 Maintenance service agreements, state of warranty date and similar continuing commitments.
1.14.1.1.1.7 Review location of all BAS equipment / panel locations

1.14.1.1.2 Operations:

1.14.1.1.2.1 Startup procedures.
1.14.1.1.2.2 All equipment or system start-up procedures.
1.14.1.1.2.3 All equipment or system shut-down procedures.
1.14.1.1.2.4 Routine and normal operating sequence for all systems.
1.14.1.1.2.5 Special operating instructions and procedures not addressed above.
1.14.1.1.2.6 Seasonal and weekend operating instructions.
1.14.1.1.2.7 Software backup procedures and file locations

1.14.1.1.2.8 Emergencies:

1.14.1.1.2.8.1 Instructions on meaning of warnings, trouble indications, and error messages.
1.14.1.1.2.8.2 Instructions on stopping, manual overrides and BAS override procedures.
1.14.1.1.2.8.3 Safety device procedures and actions.
1.14.1.1.2.8.4 Operating procedures for system, subsystem, or equipment failure.
1.14.1.1.2.8.5 Shutdown instructions for each type of emergency.
1.14.1.1.2.8.6 Operating instructions for conditions outside of normal operating limits.
1.14.1.1.2.8.7 Special operating instructions and procedures.

1.14.1.1.2.9 Adjustments:

1.14.1.1.2.9.1 Proper adjustment procedures and points intended to be adjusted
1.14.1.1.2.9.2 Economy and efficiency adjustments.
1.14.1.1.2.9.3 Adjustments for efficient energy use.

1.14.1.1.2.10 Troubleshooting:

1.14.1.1.2.10.1 Diagnostic instructions procedures for each typical system installed.
1.14.1.1.2.10.2 Test and inspection procedures for each typical system installed.

1.14.1.1.2.11 Maintenance:

1.14.1.1.2.11.1 Inspection procedures.
1.14.1.1.2.11.2 Types of cleaning agents to be used and methods of cleaning.
1.14.1.1.2.11.3 Procedures for calibration.
1.14.1.1.2.11.4 Procedures for preventive maintenance.
1.14.1.1.2.11.5 Procedures for routine maintenance.
1.14.1.1.2.11.6 Instruction on use of special tools.

1.14.1.1.2.12 Repairs:

1.14.1.1.2.12.1 Diagnosis and repair instructions.
1.14.1.1.2.12.2 Disassembly; component removal, repair, and replacement; and reassembly instructions.
1.14.1.1.2.12.3 Instructions for identifying parts and components.
1.14.1.1.2.12.4 Review of spare parts needed for operation and maintenance.

1.14.2 In addition to the initial project training requirements above, the Contractor shall include an additional **[16]** hours of training to be delivered in accordance with FSU Facilities requirements.

2 PRODUCTS

2.1 Software:

2.1.1 Data Storage and Archiving:

2.1.1.1 Trend data shall be stored at the stand alone BLC/AAC panels, and uploaded automatically to server hard disk storage when archival is desired or when local trend storage capacity drops below 20%. All all critical points or controlled points shall be trended and stored on Vendor specific server. Storage capacity shall be based on an initial sample rate for all points at 15 minutes. Server capacity shall support a minimum five years of trend data. The contractor is responsible for upgrading existing server as needed to support the additional project points and required memory. Ensure the server will maintain no less than 100% spare capacity.

2.1.2 Control Software Description for BLC/AAC include:

2.1.2.1 The ability to perform the following pre-tested stand-alone control algorithms:

2.1.2.1.1 Two-position control

2.1.2.1.2 Proportional control

2.1.2.1.3 Proportional plus integral control

2.1.2.1.4 Proportional, integral, plus derivative control

2.1.2.1.5 Automatic tuning of control loops with enable/disable capabilities

2.1.2.1.6 Equipment Cycling Protection: Include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

2.1.2.1.7 Heavy Equipment Delays: Provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads (user selectable).

2.1.2.1.8 Power Fail-Motor Restart: Upon the resumption of normal power, the BLC/AAC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

2.1.2.2 The ability to perform all of the following energy management routines:

2.1.2.2.1 Time-of-day scheduling
2.1.2.2.2 Calendar-based scheduling
2.1.2.2.3 Holiday scheduling
2.1.2.2.4 Temporary schedule overrides
2.1.2.2.5 Start-Stop Time Optimization
2.1.2.2.6 Automatic Daylight Savings Time Switch-over
2.1.2.2.7 Night setup and setback control
2.1.2.2.8 Enthalpy switch-over (economizer)
2.1.2.2.9 Peak demand limiting
2.1.2.2.10 Totalization (runtime, flow, Btu…)

2.1.2.3 Read and display the value of any property, including all required properties, supported optional properties, and proprietary extensions of every object located within each networked device.

2.1.2.4 The ability to execute custom, job-specific processes to automatically perform calculations and special control routines.

2.1.2.4.1 Incorporate measured or calculated data from other DDC controllers on the network.

2.1.2.4.2 Issue commands to points in other DDC controllers on the network.

2.1.2.4.3 Support 30 characters, English language point names, structured for searching and logs.

2.1.2.4.4 Directly send a text message to a specified device or cause the execution of an alarm message at any connected thin client PC, dial-up connection to a remote device or cause the execution of a remote connection to a remote device such as a printer, pager, PDA or cell phone.

2.1.2.4.5 Include a HELP function key.

2.1.2.4.6 Incorporate comment lines for program clarity.

2.1.3 Alarm management:

2.1.3.1 Monitor and direct alarm information to operator devices.

2.1.3.2 Generate custom written operator alarm message (to be developed by the Contractor and Owner in conjunction with the project) and advisories to operator I/O devices.

2.1.3.3 Perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost.

2.1.3.3.1 At no time shall the ability of the BLC/AAC to report alarms be affected by either a remote PC, local I/O device or communications with other panels on the network.

2.1.3.3.2 All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2.1.3.4 Authorized users shall have the ability to manually inhibit alarm reporting for each point.

2.1.3.5 Alarm destinations shall be included so that alarms are indicated and printed at a pre-defined FSU reporting device, or transaction log.

2.1.3.5.1 Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hour's destinations) and/or based on priority.

2.1.3.5.2 Alarms shall directly send an alarm message to specified client PC destination or cause the execution of a connection to a remote device (owner to designate) and cause the execution of a communications connection to a remote wireless device (pager, hand held, email or Pocket PC device).

2.1.3.5.3 Alarm messages, and point graphic assignments alarms shall have accurate descriptions and response instructions, so that alarms may be quickly associated with appropriate graphic display.

2.1.3.6 Alarm reports shall be sent to multiple WEB connected PC's, cell phones or PDA's and shall send alarm reports.

2.1.4 A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for points as specified in the I/O summary.

2.1.4.1 Any point, physical or calculated shall be capable of trending.

2.1.4.2 Any point, regardless of physical location on the network, may be collected and stored in each BLC/AAC point group.

2.1.4.3 Two methods of collection shall be allowed: either by a pre-defined schedule or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided.

2.1.4.4 Each BLC/AAC shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.

2.1.4.5 BLC/AAC units shall provide high resolution sampling capability for verification of control loop performance.

2.1.4.6 Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.

2.1.5 BLC/AAC units shall be capable of automatically accumulating and storing run time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

2.1.6 The building level network shall allow the BLC/AAC units to access any data from or send control commands and alarm reports directly to any other BLC/AAC or combination of controllers on the network without dependence upon a central or intermediate processing device.

2.1.7 The building level network shall also allow any BLC/AAC to access, edit, modify. add, delete, back up , and restore all system point database and all programs.

2.1.8 Failsafe hardware shall be provided such that BAS failures result in immediate return to local control. If the controller uses database values from other controllers, and the communication network fails or malfunctions, control loop outputs shall continue to function using last value received from BAS.

2.1.9 The BLC/AAC shall automatically call for a new database download from the server upon loss or corruption of a database. An operator with sufficient access privileges may in addition, activate a database download manually from the server.

2.2 Building Level Controller **(Primary interface between building Tier1/Tier2 controllers and FSU WAN)**:

2.2.1 BLC units shall be a general purpose multiple application direct digital controller (DDC) used to manage global programs, complex system control, local data storage, building level communications, and remote server interface.

2.2.1.1 Controller size shall be sufficient to fully meet the requirements of this specification. Controllers at Tier 2 level shall not exceed 75% of available trunk capability.

2.2.2 The BLC shall perform the function of monitoring all system variables, including but not limited to:

2.2.2.1 Hardware points, software points and controller parameters such as setpoints.

2.2.2.2 The BLC shall manage and direct all information traffic on the Tier 1 network, between the Tier 1 and Tier2 networks, and to servers.

2.2.2.3 Each BLC shall be able to extend its performance and capacity through the use of Advanced Application Controllers (AAC) and remote Application Specific Controllers (ASC's).

2.2.2.4 BLC shall provide an RS-232C serial data communication port or Ethernet RJ45 connection for operation of local operator I/O devices independent of the LAN used for primary access, such as industry standard printers, operator terminals, modems and portable laptop operators/terminals. BLC shall allow temporary use of portable devices without interrupting the normal operation of permanently connected Ethernet, modems, printers or terminals.

2.2.2.5 Each BLC shall have sufficient memory to support its own operating system and databases, Including:

2.2.2.5.1 Control processes
2.2.2.5.2 Energy management applications
2.2.2.5.3 Alarm management applications including custom alarm messages for each level of alarm for each point in the system:
2.2.2.5.4 Historical / trend data for points specified

2.2.2.5.5 Maintenance support applications
2.2.2.5.6 Custom processes
2.2.2.5.7 Operator I/O
2.2.2.5.8 Ethernet/Dial-up communications
2.2.2.5.9 Manual override monitoring

2.2.2.6 Configuration and Download: The BLC shall have the capability of receiving configuration and program loading by means of the following: 1) locally, via a direct connect portable laptop service tool or USB port, 2) over the network, from the portable laptop service tool, and 3) from the server or associated thin client PC, via the communication networks.

2.2.2.7 Configuration and Upload: The BLC shall have capabilities of uploading configurations program to be archived on local operator terminal and/or remote server.

2.2.2.8 Each BLC shall contain both software and firmware to perform global control strategies.

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

2.2.2.10 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point termination's to suppress voltage transients consistent with ANSI/IEEE Standard c62.41 – 1983.

2.2.2.11 In the event of the loss of normal power, there shall be an orderly shutdown of all BLC's to prevent the loss of database or operating system software.

2.2.2.11.1 Upon restoration of normal power, the BLC shall automatically resume full operation without manual intervention. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.

2.2.2.11.2 Should BLC memory be lost for any reason, the user shall have the capability of reloading the BLC via the local RS-232C port or from an Internet client or server PC.

2.2.2.11.3 **[All BLC units shall include an internal or external UPS power supply unit to insure reliability of network communications through any power outage event. UPS shall be sized for 50% spare capacity. The UPS shall be complete with batteries, external bypass and line conditioning]**.

2.2.2.12 The BLC shall be capable of direct connection to multiple field busses.

2.3 <u>Advanced Application Controllers-Hardware (AAC)</u> **<u>(AHU ##, EF ##, Heating Hot Water, Chilled Water, etc…)</u>**

2.3.1 AAC units shall be a general purpose multiple application direct digital controller (DDC) used to manage complex system control, local data storage, and building level communications.

2.3.2 At minimum, Include the following:

2.3.2.1 AAC shall be capable of operating in a stand-alone capacity, or within a Tier 1 or Tier 2 environment.

2.3.2.2 Support non-volatile flash memory, input/output, 12 bit A to D conversion, hardware clock/calendar and voltage transient and lightning protection devices.

2.3.2.3 Include full multi-tasking, multi-user real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules.

2.3.2.4 Include firmware revisions to the module shall be made from the central server remotely over the Intranet.

2.3.2.5 Each AAC shall accommodate multiple I/O expansion via a designated expansion I/O bus port.

2.3.3 Each AAC shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

2.3.4 Each AAC shall provide an RS-232C/RS-485 serial data communication port for operation of local operator I/O devices independent of the LAN used for primary access, such as industry standard printers, operator terminals, modems and portable laptop operators/terminals.

2.3.4.1 Allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

2.3.4.2 The operator shall have the ability to manually override DO automatic or centrally executed commands at the AAC via local terminal or controller DO manual H/O/A point for digital control type points. Relay override, starter override, or VFD override may satisfy this requirement if feedback is included.

2.3.4.2.1 Switches shall be mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2.3.4.2.2 Monitor the status of all overrides and inform the operator that automatic control has been inhibited. The AAC shall also collect override activity information for reports.

2.3.4.2.3 The operator shall have the ability to manually override AO automatic or centrally executed commands at the AAC via local display terminal or controller AO manual Hand/Auto point for analog control type points. Local terminal display unit (IF USED) shall be permanently installed in each AAC panel and shall be password protected.

2.3.4.2.4 Override switches shall be mounted within the AAC'S key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. Local display units shall be password protected.

2.3.4.2.5 The AAC shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. The AAC shall also collect override activity information for reports.

2.3.4.3 Each AAC shall have sufficient memory to support its own operating system and databases, Including:

2.3.4.3.1 Control processes
2.3.4.3.2 Energy management applications
2.3.4.3.3 Alarm management applications including custom alarm messages for each level of alarm for each point in the system
2.3.4.3.4 Historical / trend data for points specified
2.3.4.3.5 Maintenance support applications
2.3.4.3.6 Custom processes
2.3.4.3.7 Operator I/O
2.3.4.3.8 Manual override monitoring

2.3.4.4 Configuration and Download: The AAC shall have the capability of receiving configuration and program loading by means of the following: 1) locally, via a direct connect portable laptop service tool, 2) over the network, from the portable laptop service tool, and; 3) from the server or associated client PC, via the communication networks.

2.3.4.5 Configuration and Upload: The AAC shall have capabilities of uploading configurations program to be archived on local operator terminal and remote server.

2.3.4.6 Each AAC shall contain both software and firmware to perform full DDC Proportional, Integral, Derivative (PID) control loops and programs.

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

2.3.4.8 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point termination's to suppress voltage transients consistent with ANSI/IEEE Standard c62.41 - 1983.

2.3.4.9 In the event of a loss of normal power, there shall be an orderly shutdown of all AAC'S to prevent the loss of database or operating system software. Nonvolatile flash type memory shall be incorporated for all critical controller configurations and battery backup shall be provided to support the real-time clock and volatile memory for a minimum of 72 hours.

2.3.4.9.1 Upon restoration of normal power, the AAC shall automatically resume full operation without manual intervention. Vendor / Installer shall add custom programming to sequentially start all controlled equipment with a time delay between each command.

2.3.4.9.2 Should AAC memory be lost for any reason, the user shall have the capability of reloading the controller via the local RS-232C port or from an Internet client or server PC.

2.3.4.9.3 **[All AAC units shall include an internal or external UPS power supply unit to insure reliability of network communications through any power outage event. UPS shall be sized for 50% spare capacity. The UPS shall be complete with batteries, external bypass and line conditioning.]**

2.3.4.10 All AAC units shall be expandable and shall act as one control unit. In addition to the specified I/O point requirements and capacity requirements the Contractor shall provide two spare DI's, DO's, AI's, and AO's per panel.

2.4 Application Specific Controllers (ASC'S) **(VAV ##, FCU #, Laboratory Control)**

2.4.1 Performance and capacity of AAC/BLC units shall be extended through the use of stand-alone remote ASC'S for VAV terminals, fan coil units, unit ventilators, heat pumps, small single zone air handlers etc.

2.4.1.1 Controllers shall be capable of field configuration and program uploads and downloads.

2.4.1.2 Controllers shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network.

2.4.1.3 Controllers shall be a microprocessor-based, multi-tasking, real-time digital control processor.

2.4.2 Alarm Management: Each ASC shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2.4.3 ASC'S shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 4-20ma proportional signals, 0-5 Vdc or 0-10 Vdc proportional signals allowing for interface to a variety of modulating actuators.

2.4.4 VAV Terminal Controllers

2.4.4.1 The unit controller used for VAV applications shall support the air terminal unit used as the basis of design for this project, including the air terminal unit damper actuator and multi-point, center averaging velocity sensor. The controller shall be capable of controlling the air terminal unit in all control strategies as described in contract documents.

2.4.4.2 Setpoints, flow limits, and occupancy schedules shall be maintained indefinitely in each controller's non-volatile memory. No batteries shall be required.

2.4.4.3 It shall be possible to monitor flow in CFM and to adjust flow limits, temperature setpoints, and schedules, without direct access to the terminal unit, by plugging in a standard laptop computer or PDA device at the room temperature sensor.

2.4.4.4 Each controller shall control by modulating the terminal unit electrically actuated device(s) using a proportional/integral (PI) algorithm with programmable PI coefficients.

2.4.4.5 If required by the sequence of operation, ASC's used as a VAV terminal unit controller shall be able to accept a relay input from an occupancy sensor. This input shall toggle the air terminal unit between occupied and unoccupied modes and override occupied/unoccupied scheduling information the air terminal unit receives from the BLC or AAC.

2.4.4.6 Location of terminal unit to be indicated on ceiling grid. Use a permanent tag engraved with Box Number and Room Number of thermostat location. Use black lettering with white background.

2.4.4.7 Provide a means of automatically disconnecting the differential pressure sensing lines to ensure a true no flow condition during automatic recalibration events.

2.5 Control Wiring and Pathways:

2.5.1 All cables (< 50 VAC/VDC) used within control system shall contain an overall jacket (plenum rated).

2.5.2 Refer to Section **[16XXX]** for conductors, except as noted.

2.5.3 Refer to Section **[16XXX]** for pathways except as noted.

2.5.4 Instrumentation I/O Conductors (<50 Volts and Under):

2.5.4.1 No wire smaller than #18 AWG shall be used unless otherwise specified such as thermostat wiring.

2.5.4.2 Provide isolated instrument grounding system per manufacturer's recommendations and project requirements.

2.5.4.3 Conductors shall have UL listed plenum rated teflon insulation.

2.5.5 Communication Cable:

2.5.5.1 Manufacturer approved cable labeled “BAS Communication” no less than 10 ft. intervals. Provide additional shielding and grounding per applicable manufacturer’s recommendations and/or job site conditions. Conductors shall have UL listed plenum rated teflon insulation.

2.6 Air Piping:

2.6.1 Copper Tubing:

2.6.1.1 Type L, hard or soft seamless, ASTM B88, wrought copper soldered fittings, ANSI B16.22 except at connections to apparatus, where brass compression-type fittings shall be used.

2.6.1.2 Solder joints shall be made with ASTM B32, 95-5 tin-antimony solder-joint, Bridgit or Silvabrite.

2.6.2 Plastic Tubing:

2.6.2.1 Fire resistant virgin polyethylene, meeting stress-crack test ASTM D1693-60T.

2.6.2.2 Individual tube polyethylene or multi-tube instrument tubing bundle shall be classified as flame retardant under UL 94 and polyethylene material shall be rated as self-extinguishing when tested in accordance with ASTM D 635.

2.6.3 Isolation valves for air piping to be threaded or soldered, two piece, bronze ball valves. Valves shall be suitable for intended service and pressure.

2.7 Air Supply System

2.7.1 Central Supply Source:

2.7.1.1 Control air will be supplied from the existing central campus main air pneumatic system at approximately 80 psig (when available).

2.7.2 Air Compressor Assembly:

2.7.2.1 Manufacturers: Quincy, Ingersol Rand.

2.7.2.2 Assembly shall be duplex type complete with air storage tank, automatic tank drain trap, belt guards, gauges, low resistance sub-micron type intake air filter and silencer, safety valve and all necessary accessories including automatic start-stop pressure switches. Furnish necessary reducing valves to reduce pressure to that required for automatic control purposes with integral relief valve. Mount compressors on single air storage tank or base mounted compressors with separate tank as required.

2.7.2.3 Air storage tank to be ASME constructed and stamped for pressure 50 percent greater than operating pressure but not less than 150 psig.

2.7.2.4 Air intake silencer to have minimum 35 dB attenuation capability at 2000 HZ frequency.

2.7.2.5 Provide vibration isolation per FSU Design and Construction Standards.

2.7.2.6 Each compressor and storage tank shall provide sufficient supply air to entire control system while operating no more than 1/3 of time with maximum of 3 starts per compressor per hour and maximum of 6 total compressor starts per hour for entire compressor system.

2.7.2.7 Motors shall be **[XXX]** volt, 3 phase, or **[XXX]** volt, single phase provided with magnetic starter, fusible disconnect and proper overload protection. Provide automatic alternator, which shall switch lead compressor after each running cycle. Alternator shall be capable of bringing on both compressors if one cannot handle load, and either shall continue to function on failure of the other.

2.7.3 Refrigerated Air Dryer Assembly:

2.7.3.1 Manufacturers: Hankison Model 8010, 8015 or 8025, Ingersol Rand.

2.7.3.2 Refrigerated air dryer assembly shall be complete with pressure regulator (single or dual), filter station, 3-way bypass valve, automatic drain, power-on status light, high temperature alarm light, and safety pressure relief. Air capacity shall be 120% of compressor system capacity. Dryer shall have hot gas bypass control to maintain continuous operation and constant dew-point control. Outlet dew-point shall be not higher than 38°F at 20 psig main pressure.

2.7.3.3 Filter assembly shall be housed in clear plastic and be replaceable element type. Filter rating shall remove 99% of total oil present, 100% of solid particles .6 micron or larger, 98% of solid particles .4 micron or larger.

2.8 Local Control Panels

2.8.1 Local control panels shall be constructed of steel, high strength composite, or extruded aluminum with hinged door and keyed lock, with baked enamel finish of manufacturer's standard color. Construction shall comply with NEMA 1 standards for interior panels, NEMA 4 for exterior panels.

2.8.2 Panel mounted controlling instruments, temperature indicators, relays, switches and gauges shall be factory installed and permanently labeled. Devices shall be located inside or flush mounted on face of panel.

2.9 Network Routers & Bridges:

2.9.1 The BAS shall use the campus Wide Area Network (WAN) for communication to the campus vendor specific server.

2.9.2 The communication between the central server and the buildings DDC controllers shall be Siemens P2.

2.10 Electrical Power Meter:

2.10.1 Manufacture Siemens DEM

2.10.2 Insulation Class 600VAC†

2.10.3 Sample Rate 1280Hz.

2.10.4 Internal Isolation 2500VAC

2.10.5 Operating Temp. Range 0 to 50°C (<95%RH, non-condensing)

2.10.6 Storage Temp. Range -40°C to 70°C

2.10.7 Systems Accuracy ±1% of reading from 2% to 100% of the rated current of the CTs. accomplished by matching the CTs with a meter and calibrating them as a system.

2.10.8 Power Consumption 50VA

2.10.9 Electrical Services:

2.10.9.1 Any service where the phase A-N voltage is≤300VAC and the phase -to-phase voltage is≤480VAC nominal with neutral

2.10.9.2 Frequency 50/60Hz.

2.10.9.3 Protection Class NEMA 1

2.11 Servers:

2.11.1 Servers are existing

2.12 Control Valves:

2.12.1 General:

2.12.1.1 Use 2 port (normally open or closed based on sequence of operation) or 3 port ball type valves for control unless otherwise noted.

2.12.2 Globe Valves (Steam Control Applications Only):

2.12.2.1 Valves shall be bronze or brass body, threaded, 150 psi rating for 2" and smaller, iron body bronze mounted, flanged, 125 psi rating for 2-1/2" and larger.

2.12.2.2 Valves shall have stainless steel stems, spring-loaded teflon packing, replaceable seats and discs.

2.12.3 Ball Valves (Hot Water and Cooling Coil Applications)

2.12.3.1 Valves shall be bronze or brass body, 150 psi rating. Ball valves larger than 4" are not permitted.

2.12.3.2 Valves shall have stainless steel ball and stem, valve stem seals with dual EPDM O-Rings, rangeability must be greater than 150:1, and shall have equal percentage flow characteristics.

2.12.4 Butterfly Valves (Hot Water and Cooling Coil Applications 4" and larger)

2.12.4.1 Butterfly valves may be used for water system control valves 4" and larger provided that valves meet pressure and temperature requirements.

2.12.4.1.1 High performance butterfly valves shall be used for modulating applications.

2.12.4.1.2 General-purpose butterfly valves may be used for two-position control.

2.12.5 Solenoid Valves:

2.12.5.1 Brass or bronze body. Valves shall be selected to match required temperatures and pressure, and shall have materials which are compatible with intended working fluid.

2.12.5.2 All line voltage actuators shall be Class "H" (high temperature) and listed by UL or CSA.

2.13 Control Dampers

2.13.1 General:

2.13.1.1 If control damper sizes are not shown or scheduled, refer to Part 1 of this Section for sizing criteria.

2.13.1.2 Modulating control dampers shall be opposed blade or parallel blade type and two position (open/close) dampers shall be parallel blade type.

2.13.1.3 All blade linkage hardware shall have corrosion-resistant finish (stainless steel) and be readily accessible for maintenance.

2.13.2 Standard Modulating and Two-Position Dampers:

2.13.2.1 Manufacturers and acceptable model numbers:

Johnson Controls (VD-1250 or better)
Ruskin (CD50 or better)
Tamco (1500 or better)
Greenheck (VCD-43 or better)

2.13.2.2 **[Aluminum/stainless]** steel damper frame shall not be less than .125” in wall thickness. **[Aluminum/stainless]** steel frame shall be clear anodized to a minimum thickness of 0.7mil (18 microns) deep. Where screws are used, they must be 316 stainless steel.

2.13.2.3 Extruded **[Aluminum/stainless]** steel blades shall be clear anodized to a minimum thickness in accordance with 215R1. **[Aluminum/stainless]** steel blade pivot rods shall be clear anodized. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.

2.13.2.4 Dampers shall have a maximum leakage of 8 CFM/sqft at 4” WG differential static pressure. Leakage shall meet AMCA Class 1 Standards.

2.13.2.5 Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot within the blade extrusions and shall be mechanically fastended to each blade.

2.13.2.6 Linkage hardware to be installed in the frame side and out of the air stream. All aluminum linkage hardware parts shall be clear anodized. All non-aluminum linkage hardware parts shall be 300 series stainless steel. Adjustable hexagon drive rod, U-bolt fastener and retaining nuts are to be 300 series stainless steel.

2.13.2.7 Axles: Minimum shall be stainless steel or plated steel.

2.13.2.8 Dampers are to be designed for operation in temperatures ranging between -72°F (-58°C) and 212°F (100°C).

2.13.2.9 Dampers shall be available with either opposed blade action or parallel blade action.

2.13.2.10 Dampers shall be made to size required without blanking off free area.

2.13.2.11 Dampers shall be available in two mounting types: i.e., "Installed in Duct" or "Flanged to Duct".

2.13.2.12 All performance data shall be documented using AMCA 500-D Laboratory Methods for Testing Dampers for Ratings and be AMCA licensed as a Class 1A Damper.

2.14 Damper and Valve Actuators:

2.14.1 Damper and valve actuators for major equipment **[Central Utility Plant, AHU's, Lab Exhaust Fan Systems, etc]** located in mechanical rooms shall be **[pneumatic type/electric type]**. Actuators for all remote terminal devices **[VAV Terminal Units, Reheat Coils, FCU's, Heat Pumps, etc…]** located in spaces outside of mechanical rooms shall be electric type.

2.14.2 Each actuator shall be full-proportioning or two-position type as required or specified, and shall be provided with spring-return for fail open or fail closed position for fire, freeze, occupant safety, equipment protection, moisture, heating or cooling protection on power interruption as indicated and/or as required. Smoke dampers and steam valves serving pressure rated heat exchangers or convertors shall fail closed.

2.14.3 Pneumatic Diaphragm with Spring Return: Actuators shall be same manufacturer as valve body and shall be selected to match maximum diaphragm air pressure, fail position, stroke, shutoff pressure, temperature, torque, etc., required for intended service. Unless otherwise scheduled, diaphragm air pressure shall be enough to provide 100% valve shutoff at least equal to pump shutoff head or 125% of rated flow head for water systems, or full rated pressure for steam systems. Select spring ranges to match intended service. If valves or dampers are sequenced, spring ranges shall not overlap.

2.14.4 Pneumatic Piston Actuator: Provide dual action piston actuators for large torque applications. Actuators shall be sliding piston type with appropriate linkage and mounting hardware. Provide units suitable for 60 to 100 psig compressed air operation, self-draining body, position indicator, and spring return if fail position required. Body shall be aluminum or fiberglass with aluminum piston, BUNA-N or PTFE piston seals, and open/close travel stops.

2.14.5 Pilot Positioners (Pneumatic Actuators Only):

2.14.5.1 Provide pilot positioners with mechanical feedback of actual actuator position. Pilot positioners may use 3-15 psi pneumatic input signal with a full range 3-15 psi pneumatic output. Input ranges and gain factors shall be field adjustable.

2.14.6 Analog Electronic:

2.14.6.1 Actuators shall be electric motor/gear drives which respond proportionally to analog voltage or current input. Stroke time for major equipment shall be **[90 seconds]** or less for 90° rotation. Stroke time for terminal equipment shall be compatible with its associated local controller, but no more than **[6 minutes]**.

2.14.6.2 Provide spring return feature for fail open or closed positions as required by control sequence and for critical application devices.

2.14.6.3 Reheat terminal units - Utilize factory assembled ball valve with horizontal mount; non-spring return proportional actuator (0-10 Vdc, 0-5Vdc, or 4-20ma). Electric actuator installed on ball valves shall have a separate and distinct operating handle used to position the valve into any desired position once power is removed or a valve failure occurs. Similar to Belimo B2 CCV Series valve/actuators

2.14.6.4 Actuators for terminal heating/cooling equipment shall be configured to fail to last position.

2.14.6.5 Provide standard cable from actuator to controller unit.

2.14.7 Discrete Two-Position Electric:

2.14.7.1 Actuators shall be hydraulic or electric motor/gear drives for two-position control. Stroke time shall be **[90 seconds]** or less for 90° rotation.

2.14.7.2 Provide spring return feature for fail open or closed positions as required by control sequence.

2.14.7.3 Provide adjustable end switches as required by control sequence.

2.15 General Instrumentation:

2.15.1 Pressure Gauges:

2.15.1.1 Air pressure indicating gauges to be at least 1-1/2" diameter. Gauge faces to be marked with range of unit being controlled.

2.15.1.2 Pressure gauges used for panel-mounted indicators shall be marked in appropriate units and with appropriate range of values. Panel mounted indicators shall be minimum 4-1/2" in diameter and have accuracy of 1% of scale range.

2.15.2 Analog Electronic Instrument Indicators:

2.15.2.1 Electronic indicators, used for displaying sensor and/or output values as measured by current or voltage, shall be panel mount type and at least 2" square. Output may be analog needle type or digital with 1/2" high LED or backlit LCD displays.

2.15.2.2 Electronic indicators shall be marked in appropriate units (Degrees, psi, %RH, gpm, cfm, etc.) and with appropriate range of values. Panel mounted indicators shall have minimum accuracy of 1% of scale range. Digital units shall be scaled to show 3 digits plus 1 decimal point.

2.16 Discrete Electric Instrumentation:

2.16.1 General:

2.16.1.1 Electrical devices, switches, and relays shall be UL listed and of type meeting current and voltage characteristics of the project.

2.16.1.2 Outdoor unit enclosures shall be NEMA 4 with concealed adjustment.

2.16.1.3 Ratings of normally open and closed contacts shall be adequate for applied load (Minimum 5 amps at 240 volts).

2.16.1.4 Accuracy of devices shall be ± 1% of scale with adjustable offset unless otherwise specified.

2.16.2 Temperature Switches (Electric Thermostats):

2.16.2.1 Line voltage or low voltage type suitable for application with adjustable setpoint and setpoint indication.

2.16.2.2 Low voltage type to have heat anticipation.

2.16.2.3 Thermostats with remote sensing bulb shall have liquid filled sensing element and exposed setpoint adjustment.

2.16.2.4 Wall mounted space thermostat enclosure shall have concealed sensing element and exposed setpoint adjustment.

2.16.2.5 Unless otherwise stated, space thermostat covers shall be factory standard cover.

2.16.3 Temperature Low Limit Switches:

2.16.3.1 Electric 2-position 4 wire, 2 circuit temperature sensing element with manual reset. Controls shall be capable of opening circuit if any one-foot length of sensing element is subject to temperature below established setpoint.

2.16.3.2 Sensing element shall not be less than one lineal foot per square foot of coil surface area. Unless otherwise indicated, calibrate temperature switch setpoint to 38°F.

2.16.3.3 Low Limit switches shall be hardwired into safety circuit of motor control device. Additional contact shall be used for BAS feedback.

2.16.3.4 Location of installed device – must be accessible from outside of unit, must be protected from the water and must be mounted no more than 60” AFF. Provide remote (hardwired) reset switch when conditions require device to be mounted above 60” AFF.

2.16.3.5 Provide multiple devices for large AHUs where required to ensure complete coverage.

2.16.4 Relays:

2.16.4.1 Equal to IDEC type or RIB series. Coil shall match control circuit characteristics. All relays shall include LED indication of status.

2.16.4.2 Where HOA capability is required (i.e. AAC), relays must include an integral HOA function with override feedback.

2.16.4.3 Provide DIN rail mountable (Snap type) mounting sockets.

2.16.5 Pressure Switches:

2.16.5.1 Adjustable set point, differential pressure type. Select switches for accuracy, ranges (20 to 80% of operating range) and dead-band to match process conditions, electrical requirements and to implement intended functions.

2.16.5.2 Pressure differential switches for air systems shall have pressure rating of at least 10" WG.

2.16.5.3 Pressure indicating differential switches for air systems shall be equal to Cleveland AFS series photohelic gauge.

2.16.5.4 Pressure differential switches for water systems shall be rated for 150 psig unless otherwise noted. Chilled water pressure differential switches shall be provided with totally sealed vapor tight switch enclosure on 300 psi body. Differential pressure switches to have 3-valve manifold for servicing. Taps for TAB shall be provided.

Maximum Temperature Rating:	300°F
Repeatability:	± 1%

2.16.6 Target Type (Paddle) Flow Switches:

2.16.6.1 Adjustable set point, paddle type. Select switches for accuracy and ranges to match process conditions, electrical requirements, and to implement intended functions.

2.16.6.2 Air sensing switches shall be for duct mounting, top, side, or bottom. Mounting in vertical duct with downward flow is not allowed.

2.16.6.3 Water-sensing switches shall include NPT fittings suitable for mounting on piping. Switches shall be rated for 150 psi. Chilled water switches shall be rated for 300 psi.

Maximum Temperature:	200°F
Repeatability:	±1%
Pressure Rating:	300 psi for chilled water 150 psi for other applications

2.16.7 E-P Switches (Solenoid Valves):

2.16.7.1 Manufacturers: Asco, Johnson Controls, Siemens Industry.

2.16.7.2 E-P switches shall provide control air for operation of fan isolation dampers, smoke or smoke/fire dampers, or other On/Off actuators. Line voltage actuators shall be Class "H" (high temperature) and listed by UL or CSA.

Valve Body:	Brass or bronze
Valve Type:	2-way or 3-way
Operating Voltage:	24 VDC, 24 VAC, 120 VAC or as specified
Operating Temperature:	32 to 104°F
Operating Pressure:	Greater than maximum supply pressure
Pipe Size:	1/4" NPT
Enclosure Rating:	NEMA 4

Conduit Connection: 3/4”

2.16.8 Position Switches (End Switches

2.16.8.1 Rotary switches shall consist of switch mounted on a ½” damper crank arm (Similar to Kele & Associates TS-475).

2.16.8.2 Door position switches shall be magnetic proximity type.

2.16.9 Current Switches:

2.16.9.1 Induction type sensor clamped over a single phase of AC electrical power conductor shall be solid-state sensor with adjustable threshold and normally open contacts. Each current switch shall be selected for proper operating range of current.

2.16.9.2 VFD and NON-VFD Applications (Similar to Hawkeye Model 904,934).

2.16.9.2.1 The sensor shall be capable of detecting motor belt or coupling loss when mounted on the load side of variable frequency drives

2.16.9.2.2 The current sensor shall be factory programmed to detect motor undercurrent situations (belt or coupling loss) on variable or constant volume loads, no calibration required.

2.16.9.2.3 The current sensor shall store the motor current operating parameters in non-volatile memory.

2.16.9.2.4 The current sensor shall have a push button reset to clear the memory if the operating parameters change or the sensor is moved to a different load.

2.16.9.2.5 Transition current: 75 mA at 1 A setpoint
2.5 A at 10 A setpoint

2.16.9.2.6 Hysteresis: 0.015 A at 1 A setpoint
0.20 A at 10 A setpoint

2.16.9.2.7 Response Time: less than 0.5 seconds

2.17 Analog Electronic Instrumentation:

2.17.1 Differential Pressure Transmitter:

2.17.1.1 Manufacturers: Ashcroft, BAPI, Setra, Veris (w/LCD Display).

2.17.1.2 Pressure sensor and integral 4-20 mA VDC transmitter. Select instrument for intended usage (differential pressure, gauge pressure, level, etc.), range, maximum pressure/temperature. Sensor shall be capacitance or strain gauge type. Enclosure to be NEMA 4. Compound filter differential pressure sensor range to be +/- 2.5”w.c.

2.17.1.3 Differential pressure transmitters shall have 3-valve manifold for servicing.

2.17.1.4 Differential pressure sensing lines shall include a dedicated test port on both the high and low side sensing lines.

2.17.1.5 Diaphragm Material: Stainless Steel or Hastelloy

2.17.1.6 Process Connection: 1/2" NPT Stainless Steel

2.17.1.7 Power Supply Voltage: 13 - 35 VDC unregulated

2.17.1.8 Over Pressure: 1000 psig or 2 times maximum operating pressure whichever is greater.

2.17.1.9 Accuracy: ± 0.25% of calibrated span, including effects of linearity

2.17.1.10 Drift: ± 0.1% of upper limit for 6 months.

2.17.1.11 Power Supply Effect: Less than 0.01% of output span per volt.

2.17.1.12 Static Pressure Effect: Zero Error: ± 0.1% of upper range limit per 1000 psi.

2.17.1.13 Span Error: ± 0.075% of reading per 1000 psi.

2.17.1.14 Temperature Effect: ± (0.025% upper range limit plus 0.125% span) per 50°F.

2.17.1.15 Zero control shall be continuously adjustable between ± 50% of upper range limit. Total calibrated span and zero adjustment cannot exceed upper range limit. Zero span shall be independently field-adjustable with no interaction.

2.17.2 Wall Mounted Space Sensors:

2.17.2.1 Sensors shall be platinum or nickel RTD type, with the following minimum performance:

2.17.2.1.1 Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C

2.17.2.1.2 Accuracy: ± 0.1% at 32°F (Class B)

2.17.2.1.3 Conformance: DIN-IEC 751

2.17.2.1.4 Operating Range: -50 to 500°F
0 to 99% RH

2.17.2.2 Thermistors will be acceptable in lieu of platinum or nickel RTD provided thermistor carries 5 year guarantee that device will maintain its accuracy within tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.

2.17.2.3 Unless otherwise stated, space sensor covers shall be factory standard cover

2.17.3 Room Thermostats:

2.17.3.1 Setpoint range shall be resettable only from remote BAS or from any server/client PC. Temperature sensors shall be compatible with the associated controlled devices (e.g. DDC air terminal controller). Mounting box shall be recessed type unless otherwise indicated, or required by the building construction materials.

2.17.3.2 Room Temperature Sensors shall incorporate a thermistor/RTD element and an integral portable operator terminal plug-in port.

2.17.3.3 Temporary override push-button/timers shall be installed at all locations.

2.17.3.4 Provide warmer/cooler setpoint adjustment. Minimum and maximum adjustable range shall be set through the BAS only.

2.17.3.5 Unless otherwise stated, Room Thermostat covers shall be factory standard cover.

2.17.3.6 Unless otherwise stated, room thermostat shall not include a local LCD display.

2.17.4 Duct Mounted Probe Temperature Sensors:

2.17.4.1 Nickel or platinum RTD type, with the following minimum performance:

Temperature Coefficient:	.00385 ohm/ohm/°C
Accuracy:	+/- 0.1% at 32°F (Class B)
Conformance:	DIN-IEC 751
Operating Range:	0 to 150°F
	0 to 99% RH

2.17.4.2 Thermistors or nickel RTD will be acceptable in lieu of platinum RTD provided thermistor carries 5 year guarantee that the device will maintain its accuracy within a tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.

2.17.4.3 Furnish sensors as shown on drawings or required for proper operation.

2.17.5 Wet Insertion Temperature Sensors:

2.17.5.1 Nickel or platinum RTD type, with the following minimum performance:

Temperature Coefficient:	.00385 ohm/ohm/°C
Accuracy:	+/- 0.1% at 32°F (Class B)
Conformance:	DIN-IEC 751
Operating Range:	-50 to 170°F
	0 to 99% RH

2.17.5.2 Thermistors or nickel RTD will be acceptable in lieu of platinum RTD provided thermistor carries 5 year guarantee that the device will maintain its accuracy within a tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.

2.17.5.3 Furnish sensors and wells as shown on drawings or required for proper operation.

2.17.5.4 Coordinate the installation of sensor wells.

2.17.5.4.1 Wells mounted in pipe 3" and larger may be installed in horizontal or vertical lines provided element is always in flow (for condensate and other gravity return lines, install in bottom of pipe).

2.17.5.4.2 Wells mounted in pipe 2-1/2" and smaller shall be installed at a 90° pipe junction consisting of tee fitting (2" minimum size) and appropriate reducing fittings.

2.17.5.4.3 Wells shall be brass or stainless steel and include thermal grease to ensure adequate heat transfer.

2.17.5.5 Install sensor well pointed upstream in tee.

2.17.6 Duct Mounted Averaging Temperature Sensors: (Not applicable to terminal units).

2.17.6.1 Rigid averaging temperature probes are unacceptable.

2.17.6.2 Nickel or platinum RTD type, with the following minimum performance

Temperature Coefficient:	.00385 ohm/ohm/°C
Accuracy:	± 1.0% at 32°F (Class B)
Conformance:	DIN-IEC 751
Operating Range:	-50 to 170°F, 0 to 99% RH

2.17.6.3 Provide non-metal support system to ensure correct minimum bend radius.

2.17.7 Dew Point Temperature Transmitter:

2.17.7.1 Manufacturers: General Eastern, Hy-Cal, Vaisala.

2.17.7.2 Chilled mirror type primary dew point temperature measurement using platinum RTD, 4 wire, 100 ohm temperature sensing element with 4-20 mA transmitter.

Accuracy:	± 1°F
Repeatability:	± 0.1°F
Hysteresis:	None
Sensor Range:	-10°F to +140°F dew point 32°F to 140°F ambient

2.17.7.3 Unit shall be selected for proper application (wall or duct mounted).

2.17.8 Critical Area: Space Humidity Sensors/Transmitters:

2.17.8.1 Manufacturers: General Eastern, TCS, Hy-Cal, Rotonic or Vaisala.

2.17.8.2 Space humidity sensors shall be wall mount type with cover to match room thermostats and/or temperature sensors.

2.17.8.3 Sensing element shall be resistive bulk polymer, or thin film capacitive type. Sensor/transmitter shall have the following minimum performance.

Accuracy:	± 2% RH at 25°C over 20-95% RH including hysteresis, linearity and repeatability.
Temperature Effect:	Less than 0.06% per °F.
Sensitivity:	0.1% RH.
Repeatability:	0.5% RH.
Hysteresis:	Less than 1%.
Long Term Stability:	Less than 1% RH drift per year.
Adjustment:	± 20% RH zero, non-interactive. ± 10% RH span, non-interactive.
Operating Range:	0-99% RH, non-condensing, sensor. 0-95% RH, non-condensing, electronics.
Output:	4-20 mA, 0-10Vdc, 0-100% linear, proportional
Power:	12-36 VDC.

2.17.8.4 Space humidity sensor covers shall be factory standard cover unless otherwise stated.

2.17.9 Critical Area: Duct Mounted Humidity Sensors/Transmitters:

2.17.9.1 Manufacturers: General Eastern, TCS, Hy-Cal, Rotonic or Vaisala.

2.17.9.2 Probe type, temperature compensated, resistive bulk polymer or thin film capacitive type. Sensor/transmitter shall have the following minimum performance.

Accuracy:	± 2% RH at 25°C over 20-95% RH including hysteresis, linearity and repeatability.
Temperature Effect:	Less than 0.06% per °F.
Sensitivity:	0.1% RH.
Repeatability:	0.5% RH.
Hysteresis:	Less than 1%.
Long Term Stability:	Less than 1% drift per year.
Adjustment:	20% RH zero, non-interactive. 10% RH span, non-interactive.
Operating Range:	0-99% RH, non-condensing, sensor. 0-95% RH, non-condensing, electronics.
Output:	4-20 mA, 0-10Vdc, 0-100% linear, proportional
Power:	12-36 VDC.

2.17.10 Non Critical Area: Space Humidity Sensors/Transmitters:

2.17.10.1 Manufacturers: Siemens, Johnson Controls, BAPI, Veris or approved equal.

2.17.10.2 Space humidity sensors shall be wall mount type with cover to match room thermostats and/or temperature sensors.

2.17.10.3 Sensing element shall be resistive bulk polymer, or thin film capacitive type. Sensor/transmitter shall have the following minimum performance.

Accuracy:	± 3% RH at (50°F-95°F) over 20-80% RH
Calibrated Range:	10-90% RH

Hysteresis:	n.n%
Long Term Stability:	+/- n% RH drift per year
Operating Range:	32 to 131°F, 10 to 95% RH non-condensing
Output:	4-20 mA, 0-10Vdc, 0-100% linear, proportional
Power:	12-36 VDC/VAC

2.17.10.4 Space humidity sensor covers shall be factory standard cover unless otherwise stated.

2.17.11 Non Critical Area: Space Humidity Sensors/Transmitters:

2.17.11.1 Manufacturers: Siemens, Johnson Controls, BAPI, Veris or approved equal.

2.17.11.2 Probe type, temperature compensated, resistive bulk polymer or thin film capacitive type. Sensor/transmitter shall have the following minimum performance.

Accuracy:	± 3% RH at (50°F-95°F) over 20-80% RH
Calibrated Range:	10-90% RH
Hysteresis:	n.n%
Long Term Stability:	+/- n% RH drift per year
Operating Range:	32 to 131°F, 10 to 95% RH non-condensing
Output:	4-20 mA, 0-10Vdc, 0-100% linear, proportional
Power:	12-36 VDC/VAC

2.17.12 Air Flow Sensors/Transmitters:

2.17.12.1 Manufacturers: Tek-Air or Ebtron Gold Series with the following characteristics:

2.17.12.1.1 Velocity measured by each sensor shall be linearized, summed, averaged, and converted to 4-20 mA output signal proportional to air flow rate (CFM) by transmitter electronics.

2.17.12.1.2 Measured value converted to airflow (CFM) shall have accuracy within 2% rate ± 0.1% full scale throughout velocity range and temperature and humidity change of 40 to 130°F, and 10-95% RH (non-condensing).

2.17.12.1.3 Transmitter shall be provided as part of air flow sensor, and shall include integral diagnostics with on-line zeroing and sensor operation verification.

2.17.12.2 Manufacturer shall provide all cabling required to connect probe assemblies and transmitter electronics. Transmitter and/or systems, which require periodic calibration to maintain accuracy specified shall not be acceptable.

2.17.12.3 Provide a local display to indicate calculated cfm.

2.17.13 P-E Transducers (Pressure Transmitters):

2.17.13.1 Manufacturers: Ashcroft, Mamac, Setra, BAPI or Veris

2.17.13.2 Units shall have the following characteristics:

Input:	Pressure 0-15 psig, minimum

Output Signal:	4-20 mA, 0-5 VDC, 1-5 VDC, 1-10 VDC
Accuracy:	1% of span
Operating Temperature	32 to 125°F
Power Requirements:	24 VDC (10-30 VDC)

2.17.14 Provide local LCD display.

2.17.15 Ducted Air System Static Pressure and Differential Pressure (Velocity) Transmitters:

2.17.15.1 Manufacturers: Ashcroft, BAPI, Mamac, Setra, Veris.

2.17.15.2 Provide transducers/transmitters to convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.

2.17.15.3 Unit shall be capable of transmitting linear 4 to 20 mA DC output signal proportional to the differential (total minus static or static minus ambient) pressure input signals with the following minimum performance and application criteria:

Span:	Not greater than twice duct static or velocity pressure at maximum flow rate, nor more than 16 times velocity pressure at minimum flow rate.
Accuracy:	± 1.0% of span or 1.0% of full scale
Dead Band:	Less than 0.5% of output
Hysteresis:	Within 0.5% of span or within 0.5% of full scale
Linearity:	Within 1.0% of span or within 0.5% of full scale
Repeatability:	Within 0.5% of output
Response:	Less than 1 second for full span input

2.17.15.4 Return and exhaust air system static pressure transducers/transmitters shall be furnished with protective integral air filters on pressure sensing lines from the static pressure sensing stations, and static air probes to prevent migration of moisture or particulate matter into transducers. Supply air system sensors do not require integral air filters.

2.17.15.5 Provide local LCD display.

2.17.16 Building and Space Pressure Differential Transmitter:

2.17.16.1 Manufacturers: BAPI, Mamac, Setra, Veris.

Accuracy:	± 1.5% full scale, 0.5% reading
Repeatability:	± 0.2% of full scale
Probe Temperature Range:	-40°C to 121°C (-40°F to 250°F)
Pressure Range:	150 psig, max
Response Time:	400 msec. to within 63% of final value
Output Signal:	4-20 mA

Sensor location to be on record drawings.

2.17.16.2 Provide local LCD display.

2.17.17 Electric to Pressure Transducers:

2.17.17.1 Manufacturers: Veris EP 3000 series

2.17.17.2 Provide pressure transducers integral to DDC panels or separate components to convert digital analog signal to variable pneumatic air pressure signal. Units to have following characteristics:

Input	4-20 mA or 0-5 VDC
Linearity	1% of span
Hysteresis	0.75% of span
Maximum air consumption	0.008 scfm @ 20 psi

Incorporate a manual override switch and, in the manual mode, the pressure shall be increased or decreased.

2.17.17.3 Carbon Dioxide Sensor: (Space or Duct Mounted)

2.17.17.4 Manufacturer: Valtronics Model 2089, Veris CXD, Siemens or approved equal.

2.17.17.5 Provide non-Dispersive Infra Red (NDIR) carbon dioxide sensor suitable for room mounting. 4-20 ma output signal corresponding to input CO2 concentration.

Input	4-20 mA
Range	0-2000 PPM
Accuracy	+/- 3% of full scale
Repeatability	.1% of full scale
Calibration frequency	No less than every 3 years

2.18 Energy Metering:

2.18.1 General: The sensor /transducer shall be appropriately selected to most closely match the expected sensing range. If, upon startup and balancing, a sensor/transducer is operating below 20% or above 80% of its sensing range, the sensor/transducer shall be replaced at no additional cost with an appropriate range such that the measured value (operating at normal conditions) is between 30% and 70% of the range.

2.18.2 Btu Energy Meter:

2.18.2.1 The entire energy metering system shall be built and calibrated by a single manufacturer, ONICON Incorporated, and shall consist of a flow meter, two temperature sensors, a Btu **[chilled water/hot water]** calculator, temperature thermowells, and all required mechanical installation hardware. A certificate of NIST* traceable calibration shall be provided with each system. All equipment shall be covered by the manufacturer's two year warranty.

2.18.2.2 Btu Meter: Provide an ONICON System-10 Btu Meter. The Btu meter shall provide the following points both at the integral LCD and as outputs to the building control system: Energy Total **[ktonhr/MBtu]**, Energy Rate **[tons or MBtu/hr]**, Flow Rate (GPM), Flow Total (KGal) Supply Temperature (DEGF) and Return Temperature (DEGF). Output signals shall be serial network protocol conforming to Siemens-P1. Each Btu meter shall be factory programmed for its specific application, and shall be re-programmable using the front panel keypad (no special interface device or computer required).

2.18.2.3 Temperature sensors: Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application. The calculated differential temperature used the energy calculation shall be accurate to within ±0.15 (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).

2.18.2.4 Flow Meter: Refer to the following flow meter sections for specific flow meter requirements. The flow meter shall be installed either in the supply or return pipe of the system to be measured following the manufacturer's instructions with particular attention to upstream and downstream straight pipe runs.

2.18.3 [Chilled Water // and // Heating Hot Water Flow Meter] [USE THIS WHEN PIPE IS SMALLER THAN 3"]

2.18.3.1 Provide an ONICON F-3100 Series Inline Electromagnetic Flow Meter complete with integral or remote Series 3900 Converter. The converter shall include a backlit graphic display and keypad. The flow meter shall be installed either in the supply or return pipe of the system to be measured following the manufacturer's instructions.

2.18.3.1.1 The flow meter size shall be selected based on the minimum and maximum flow range for the application.

2.18.3.1.2 Connections to the piping shall be ANSI class 150 flanges (ANSI Class 300 where required).

2.18.3.1.3 The installing contractor is responsible for providing suitable mating flanges and any required reducer/expander.

2.18.3.1.4 The flow tube shall be epoxy coated steel; the sensing electrodes shall be 316SS; the liner shall be polypropylene for low temperature service, PFTE for hot water service.

2.18.3.1.5 Each flow meter shall be individually wet-calibrated and accurate to within ±0.2% of reading from 3 to 33 feet per second velocity. A certificate of calibration shall be provided with each flow meter.

2.18.3.1.6 Output signals shall be 4-20 mA and programmable pulse.

2.18.3.1.7 The flow meter shall be capable of measuring bi-directional flow.

2.18.3.1.8 For installations in non-metallic pipe, an internal grounding electrode shall be provided which eliminates the need for external grounding rings.

2.18.3.1.9 Each flow meter shall be factory programmed for its specific application, and shall be reprogrammable using the integral keypad on the converter (no special interface device or computer required).

2.18.3.2 Flow Display: Provide a D-1200 Series Display Module for local or remote indication of flow rate and/or total.

2.18.4 [Chilled Water // and // Heating Hot Water Flow Meter] [USE THIS WHEN PIPE SIZE IS 3" OR LARGER]

2.18.4.1 Provide an ONICON Model F-3500 Insertion Electromagnetic Flow Meter, complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.

2.18.4.2 The flow meter shall be hand-insertable up to 400 psi.

2.18.4.3 Materials of construction for wetted metal components shall be 316 SS.

2.18.4.4 The flow meter shall average velocity readings from two sets of diametrically opposed electrodes.

2.18.4.5 Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to National Institute of Standards and Technology (NIST). A certificate of calibration shall be provided with each flow meter.

2.18.4.6 Accuracy shall be within ±1% of rate from 2-20 ft/s.

2.18.4.7 Output signals shall be completely isolated and shall consist of the following:

2.18.4.7.1 High resolution frequency output for use with peripheral devices such as an ONICON display module or Btu meter

2.18.4.7.2 Analog output; 4-20mA, 0-10V, or 0-5V jumper selectable, and provide scalable dry contact output for totalization.

2.18.5 Flow Display: Provide a D-1200 Series Display Module for local or remote indication of flow rate and/or total.

2.18.6 Steam Flow Meter

2.18.6.1 Furnish and install an Yokogawa Model YF100 Vortex flow meter with remote converter capable of providing a 4-20 mA DC signal proportional to flow rate. Accuracy of meter shall be ±0.8% of reading with a repeatability of 0.2%.

2.18.6.2 The flow meter shall be sized by the manufacturer for each specific application and installed according to manufacturer’s recommendations. Provide a flow straightener, if required to meet the manufacturer’s minimum upstream straight pipe run requirement. Provide lateral and horizontal supports as required to minimize vibration at the meter location.

2.18.6.3 Each flow meter shall be individually calibrated at five points from 0-250 ft/s against the manufacturer’s flow standards. The manufacturer shall provide a certificate of calibration for each meter.

2.18.6.4 The flow meter shall be programmed by the manufacturer for each specific application and shall be ready to use upon delivery.

2.18.6.5 Construction: Meter shall hae no moving parts. Body shall be ASTM A296 Grade CF8M (ANSI 316) Hastelloy C. Shedder bar shall be duplex stainless steel Hastelloy C. Gasket shall be stainless steel with Teflon coating. Housing and cover shall be aluminum alloy.

2.18.6.6 Converter: Furnish remote mounted converter in NEMA 4X enclosure. Provide signal cable to connect meter and converter.

2.18.6.7 Installation: Mount meter with 20 upstream and 5 downstream diameters of straight pipe. Flow meter may be mounted vertically, horizontally or at any other angle.

2.18.7 Natural Gas Meter

2.18.7.1 Furnish and install an F-5100 Series Thermal Mass Flow Meter complete with integral density compensation to provide direct mass flow output. The flow meter shall calculate mass flow rate (Cfh) and mass flow consumption (therms) directly and shall not require additional pressure or temperature compensation.

2.18.7.2 The flow meter shall be sized by the manufacturer for each specific application and installed according to manufacturer's recommendations. Provide lateral and horizontal supports as required to minimize vibration at the meter location.

2.18.7.3 Each flow meter shall be individually calibrated at five points against the manufacturer's flow standards. The manufacturer shall provide a certificate of calibration for each meter.

2.18.7.4 The flow meter shall be programmed by the manufacturer for each specific application and shall be ready to use upon delivery.

2.18.7.5 Mass flow accuracy shall be within ±2.0% of actual reading over the range of the meter, including all errors associated with velocity measurement, temperature and/or pressure measurement, and density compensation.

2.18.7.6 The meter shall be provided with wetted metal components 316 stainless steel.as required to meet system requirements. The maximum operating temperature shall be 200° F.

2.18.7.7 The flow meter body shall be constructed of 300 series stainless steel and include a weather-tight NEMA-4 aluminum electronics enclosure.

2.18.7.8 The meter shall display mass flow rate with an integral LCD display and support field programming of all parameters. The meter shall also have integral diagnostics to verify installation conditions and the proper operation of the meter.

2.18.7.9 The meter shall provide a loop-powered 4-20 mA output signal calibrated in direct mass flow rate units for connection to the BAS. In addition, an integral pulse output for mass flow totalization shall be provided. All outputs shall be linear with mass flow rate.

2.18.7.10 Remote Serial Network Interface Module: Provide an ONICON D-100 Network Interface. The network interface shall transmit Mass Flow Rate **[Cfh]** and Total Mass data **[therms]** via a serial network conforming to one of the following protocols: Siemens P1.

2.18.8 Domestic Water Flow Meters: Provide for Domestic Water (building main, make up water).

2.18.8.1 Inline Flow Meter with pulser:

2.18.8.1.1 Construction: Provide brass sensor housing and electronics enclosure for indoor use. Provide optional outdoor enclosure for meters exposed to the environment. Rotors shall be low mass, non-metallic and run on tungsten carbide shafts.

2.18.8.1.2 Application: Maximum operating pressure of 250 psi and operating temperature of 180ºF.

2.18.8.1.3 Electronics: Provide the following output signals: dry contact pulser.

2.18.8.1.4 Approved Manufacturers: ASCO. No other manufacturers are acceptable.

3 EXECUTION

3.1 Software:

3.1.1 Coordinate graphics and points for consistency with existing campus system. Contractor shall be responsible for data base clean-up when a project is renovated. The graphic database, user view data base and software will be modified to reflect the final project.

3.1.2 Continuously archive all data in standard database platform. Including but not limited to:

3.1.2.1 I/O points

3.1.2.2 Software points such as:

3.1.2.2.1 Alarm limits
3.1.2.2.2 Setpoints
3.1.2.2.3 Parameters

3.1.2.3 Schedules

3.1.2.4 Alarm messages

3.1.2.5 Reports

3.1.2.6 Trends/History

3.1.3 Provide BAS Reports including:

3.1.3.1 Alarm Summary
3.1.3.2 Schedules
3.1.3.3 Control Loop Performance
3.1.3.4 Equipment specific energy performance calculations such as Energy Recovery Devices.
3.1.3.5 Measurement and verification reports consistent with the requirements of the M+V plan developed by a separate 3rd party agent.

3.1.4 The Contractor shall implement long term trending for all physical input and output points and all set-points. The initial trend interval settings shall be set to 15 minutes. In addition, the Contractor shall increase the resolution of all control loop trending to every 5 minutes during the testing/acceptance phase (minimum of 2 weeks). Control loop trending shall include controlled variable, setpoint, and output from actuated device. Coordinate all trending requirements with **[Commissioning Agent/Engineer]**.

3.1.5 Alarming:

3.1.5.1 The Contractor shall create enhanced alarm programs for all system points. These points shall be programmed for appropriate seasonal high or low alarm limits. Enhanced alarm programs shall prevent abnormal alarms from occurring when the associated system has been deactivated. For example: air handler mixed air, preheat, cooling, humidity, and static pressure control points, building chilled water, heating water system control points, etc. Alarms shall occur only while systems are active and being supplied with chilled/hot water or steam at normal operating temperatures and pressures. Alarm destinations, alarm messages, and point graphic assignments shall be included so that alarms are indicated and printed at a pre-defined Owner reporting device and recorded on a transaction log. Alarms shall have accurate descriptions and response instructions, so that alarms may be quickly associated with appropriate graphic display.

3.1.5.2 The Contractor shall define the specific system reactions for each point. Alarms shall be enhanced and prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. The Contractor shall initially define all point priority levels for handling of all system alarms. Users shall have the ability to manually inhibit alarm reporting for each point.

3.1.5.3 Alarm reports and messages shall be directed to a user-defined list of operator devices or PCs based on time (after hour destinations) and/or based on priority.

3.1.5.4 In addition to the point=s descriptor and the time and date, the Contractor shall create, print, display and store an alarm message for each point to more fully describe the alarm condition or to direct operator response. Alarm events may be configured to send an alarm message to a specified client e-mail address, cellular phone number via SMS text messaging.

3.1.6 Graphic Displays:

3.1.6.1 Provide a color graphic system flow diagram display for each system with all points as indicated on the point list.

3.1.6.2 Provide graphics for each floor plans of the building as a minimum. Coordinate with the Architect/Engineer (A/E). Size graphics to allow the operator to read room numbers and descriptions. Incorporate the capability to navigate section to section as required to view entire floor and to navigate floor to floor.

3.1.6.3 Color shall be used to indicate normal and alarm conditions within all spaces. Color or common border lines shall be used to link HVAC equipment with zone(s) served.

3.1.6.4 User shall be able to access the various system schematics and floor plans via a graphical penetration scheme and/or menu selection.

3.1.6.4.1 User shall be able to penetrate from floor plan to associated HVAC system text based display.

3.1.6.5 Create enhanced alarm programs for all system points. These points shall be programmed for appropriate seasonal high or low alarm limits.

3.1.6.6 Refer to the following graphics guideline section and Graphic Standards - Appendix B for additional examples and samples.

3.2 Graphical Standard Guidelines:

3.2.1 Legend: The legend screen will show the user the color coding intent of the graphics and instructions to help the operator with various viewing commands. There will be links to the site map and previous screen in the top left corner. Bottom of the page will contain the following outdoor readings: Dry bulb, relative humidity and wet bulb and include time and date information.

3.2.2 Site Map: After initiating the building automation graphics the first screen to appear will be the FSU Site Map. The site map will display a portion of the FSU map with non-integrated buildings colored gray. The FSU buildings connected to the BAS will be colored with one of two colors – red or green. The green colored buildings will show the user that there are no alarms active in the building, while red color will indicate that one or more of building systems are in an alarm state. The user will have the ability to adjust building alarm activation trigger based on alarm priority. The buildings in alarm shall flash red continuously until alarm is acknowledged and remain solid as long as the alarm condition remains active.

3.2.3 In order to see the name of each building the user will be able to hover the cursor over the building icon, this feature will only be assigned to the integrated buildings. Each building icon will act as an active link to transfer the user to the buildings home screen.

3.2.4 At the bottom of the screen will be displayed current outdoor air conditions this information is acquired from a designated campus weather station or sensors located within the building. The cells will not act as links.

3.2.5 The bottom of the screen will also contain current time and date information.

3.2.6 Top left corner of the screen will have a link to the previous screen.

3.2.7 Home Screen: The building home screen will provide the user with an overview of the building energy consumption and building pressurization. A picture of the building will appear in the left hand corner of the screen adding to the esthetic character of the graphic, the picture will not act as an active link.

3.2.7.1 Under the building picture will be several links to building systems, floor plans, air systems, water systems, miscellaneous systems and energy reports. When the Air Systems cell is activated, for example, it will expand and show all AHUs, EFs and standalone FCUs which serve the building. Floor plan cell will expand, listing links to all floors. The Water Systems cell will expand to show heating hot water system, chilled water system and/or domestic hot water system. The Energy report link will show current building energy data: Building kW, kWh, tons, kton-hr, Btu/h, Btu w/sqft, sqft/ton, or as installed. Miscellaneous Systems cell will expand to show all remaining systems having graphics which were not covered by previous cells (i.e. compressed air, vacuum, equipment alarms, etc…)

3.2.7.2 The alarm bell located further below the building picture will be an indicator and an active link. Bell will have one of two colors – green or red. Green color will inform the user that all building systems are operating normally, while a red color will notify the user that there are systems within the building which are in alarm mode. The alarm bell red color activation will be adjusted per user preference to trigger only if high priority alarms exist in the building. The bell alarm activation will be coordinated to correspond to building color on the site map. It will also allow for a direct link to the alarm management screen.

3.2.7.3 Building pressurization indicator will show the building pressure with respect to outdoor. The bar will be divided into green and red area, the green area will represent positive building pressure and the red area will tell the user that the building is negatively pressurized. The numerical indicator cell below the bar will display current building pressure as reported by the building differential pressure sensor. If more than one DP sensor serves the building, the cell will display the worst case building differential pressure.

3.2.7.4 Energy demand gauges will display current energy consumption for each measured utility. The gauges scale and resolution will be adjusted to correspond to peak design conditions. The indicator arrows will show the same value as displayed in a cell below the gauge.

3.2.7.5 The weather information displayed on the bottom of the screen will feature all outputs from a designated weather station.

3.2.7.6 Top left hand corner of the screen will have two links to previous screen and the site map.

3.2.8 Large Area Floor Plan Graphic: When a link to a particular floor is selected, the screen will show an overall floor plan view divided into sections. This intermediate screen is necessary in large buildings where detailed floor plan view with room numbers and sensors displaying room air conditions are not possible. In the case of a building with floor plans containing few rooms per floor, this screen can be omitted. The floor plan will accurately represent the as-built layout of rooms in the building.

3.2.8.1 The divisions of the partial floor plan sections should be based on the zones served by different air handling equipment. If that strategy does not produce the desired effects, the second best option is to divide the floor plan in equal parts.

3.2.8.2 Each section will actively inform user of any alarm conditions within the section by changing from a green to red background color.

3.2.8.3 Each section will have a link to take the user to a more detailed floor plan screen. In the bottom left hand corner of the screen are links to other floors arranged in a tree, the three shall also indicate alarm conditions present on each floor.

3.2.8.4 Floor Plan Section: The floor plan section screen shows the floor plan layout in more detail with room numbers and sensors displaying room environmental conditions. Each sensor and room number act as a link to the corresponding room system graphic, room background color is green under normal operation and red when any of the analog or binary inputs are outside their alarm limits.

3.2.8.5 The bottom left hand corner of the screen features links to different floors described previously, as well as a key plan of the sectioned view of the overall floor plan. Each section acts as an indicator and a link, when any room is in alarm mode in a particular section, that section turns red, otherwise it remains green. The user can move between section screens by selecting the appropriate link. Bottom of the page will have links to associated as-built HVAC, electrical, and piping plans.

3.2.8.6 Locations of panel mounted static pressure sensors and building pressure sensors reference points will be indicated on the floor plan graphic.

3.2.9 Office: When user selects a link to an office space (by clicking on a room sensor) the graphics screen will bring up a detailed view of the room air terminal and associated sensors. The Screen title block will list the room number which is currently displayed with air terminal name in parentheses. Supply airflow sensor will have the airflow, airflow set-point and velocity pressure listed. Zone temperature will be listed with effective/actual (after local adjustments) heating and cooling set-points, if the temperature deviates outside those set-points the point will go into alarm mode. A parameter list block will act as a link to all points not displayed on the screen. The user will have the ability to change all set-points and settings. All analog inputs will be read only type points with the user having the option of taking the readings out of service. Bottom of the page will have links to associated as-built reference material.

3.2.10 General Lab: When user selects a link to general lab space the graphics link will bring up a room with relevant air valves and their associated control points. Air valves will have their respective tags displayed on their icons, (per as-built drawings). The air valve command position and air valve feedback will be listed next to each air valve.

3.2.10.1 The screen title block will list the room number with the air valves listed in the parentheses.

3.2.10.2 The air change rate information shall be calculated and based on the room volume and the air flowing out of the room. Positive rooms shall use the total supply and negative rooms shall use the total exhaust.

3.2.10.3 Zone temperature will have its effective/actual (after local adjustment) heating and cooling set-points listed, if temperature deviates outside those values the point will go into alarm mode.

3.2.10.4 All analog will have their corresponding set-points displayed, the parameter list button will be a link to all settings not shown on the room screen. The user will be able to change all settings, all analog and binary inputs will be read only points with the user having the ability to take them out of service.

3.2.11 Air Handling Unit – Supply: AHU screen title will show the equipment name.

3.2.11.1 All analog points will have their corresponding set-points displayed on the equipment graphic. When the input values are outside their respective set-points, their cells will turn red to show the user that the reading is in an alarm state.

3.2.11.2 The user will be allowed to override all output points (AO and DO) settings, all input (AI and DI) settings will be read only with an option of taking their value out of service.

3.2.11.3 The outside air damper and return air dampers will have their % open value command and feedback displayed in their indicator cells. The supply air damper status will be indicated by indicator cell and dynamically by making the damper blades move with respect to feedback information.

3.2.11.4 Fan status will be shown by color coding the fan wheel green and dynamically spinning the fan wheel when the fan is ON, when fan is OFF the fan wheel will not spin and the fan wheel color will be white. When fan is in alarm mode the fan wheel color will be red. When AHU is equipped with fan array all fans will be shown. VFD box above the fan will provide the user with active links to variable frequency drive integrated information. Supply fan VFD command cell will display the speed of the drive in 0-100%, if the VFD is allowed to exceed 60Hz during normal operation, 100% will correspond to the maximum speed the VFD is allowed to go to. Actual fan hz will be displayed.

3.2.11.5 Cooling coil valve command indicator cells will display the % open amount of valve full span and feedback. Chilled water returning from the cooling coil will have its temperature displayed in the indicator cell.

3.2.11.6 Filter status will be indicated in the cell and shall flash red when in an alarm state. Filter DP device settings shall be included in graphic when pressure settings are set locally.

3.2.11.7 Low temperature alarm, high static alarm and smoke alarm indicator cells will have a green background and display “Normal” when in normal mode, during alarm mode the cell background color will change to red and display will read “Alarm”.

3.2.11.8 Information used in discharge temperature reset control loop such as maximum zone temperature and humidity will be displayed in the corner of the screen.

3.2.12 Exhaust System with Bypass Damper: Exhaust fan screen title will show the equipment name.

3.2.12.1 All analog inputs will have their corresponding set-points listed either on the equipment graphic or in the system parameter box. When the input values are outside their respective set-points, their indicator cells will turn red to show the user that the reading is in alarm mode.

3.2.12.2 The user will be allowed to override all output points (AO and DO)settings, all input (AI and DI) settings will be read only with an option of taking their value out of service.

3.2.12.3 The bypass dampers will have their % open value and feedback displayed in their indicator cells. The damper status will be indicated by indicator cell and dynamically by making the damper blades move close when damper is closed and open when damper is open.

3.2.12.4 Fan status will be shown by color coding the fan wheel green and dynamically spinning the fan wheel when the fan is ON, when fan is OFF the fan wheel will not spin and the fan wheel color will be white. When fan is in alarm mode the fan wheel color will be red. Indicator cell displaying fans lead-lag listing will be shown below each fan, as the fan rotation occurs, the indicator cells will display updated lead lag status in each cell.

3.2.12.5 Low static alarm indicator cells will have a green background and display “Normal” when in normal mode, during alarm mode the cell background color will change to red and display will read “Alarm”.

3.2.13 Variable Fan Speed Exhaust System with Bypass Damper: Exhaust fan screen title will show the equipment name.

3.2.13.1 All analog inputs will have their corresponding set-points listed either on the equipment graphic or in the system parameter box. When the input vales are outside their respective set-points, their indicator cells will turn red to show the user that the reading is in alarm mode.

3.2.13.2 The user will be allowed to override all output points (AO and DO) settings, all input (AI and DI) settings will be read only with an option of taking their value out of service.

3.2.13.3 The bypass dampers will have their % open value and feedback displayed in their indicator cells. The damper status will be indicated by indicator cell and dynamically by making the damper blades move close when damper is closed and open when damper is open.

3.2.13.4 Fan status will be shown by color coding the fan wheel green and dynamically spinning the fan wheel when the fan is ON, when fan is OFF the fan wheel will not spin and the fan wheel color will be white. Fan status will be derived from the output power reading of the VFD. When fan is in alarm mode the fan wheel color will be red. VFD box above the fan will provide the user with active links to variable frequency drive integrated points. VFD command cell will display the speed of the drive in 0-100%, if the VFD is allowed to exceed 60Hz during normal operation, 100% will correspond to the maximum speed the VFD is allowed to go to. Indicator cell displaying fans lead-lag listing will be shown below each fan, as the fan rotation occurs, the indicator cells will display updated lead lag status in each cell.

3.2.13.5 Low static alarm indicator cells will have a green background and display “Normal” when in normal mode, during alarm mode the cell background color will change to red and display will read “Alarm”.

3.2.14 Chilled Water and Hot Water System: Chilled water system screen title will show the system name.

3.2.14.1 All analog inputs will have their corresponding set-points listed either on the equipment graphic or in the system parameter box. When the input values are outside their respective set-points, their indicator cells will turn red to show the user that the reading is in alarm mode.

3.2.14.2 The user will be allowed to override all output points (AO and DO) settings, all input (AI and DI) settings will be read only with an option of taking their value out of service.

3.2.14.3 Valves will have their % open value and feedback displayed in the indicator cells. The pump isolation valve status will be indicated by indicator cell.

3.2.14.4 Status will be shown by color coding the impeller wheel green and dynamically spinning the impeller wheel when the pump is ON, when pump is OFF the impeller wheel will not spin and the wheel color will be white. Pump status will be derived from the output power reading of the VFD. When pump is in alarm mode the impeller wheel color will be red. VFD box above the pump will provide the user with active links to variable frequency drive integrated points. Pump VFD command cell will display the speed of the drive in 0-100%, if the VFD is allowed to exceed 60Hz during normal operation, 100% will correspond to the maximum speed the VFD is allowed to go to. Indicator cell displaying pumps lead-lag listing will be shown below each pump, as the pump rotation occurs, the indicator cells will display updated lead lag status in each cell.

3.2.14.5 Include flows and energy data.

3.2.15 Variable Frequency Drive: Upon activation of a VFD link on any of the equipment screens the user will be directed to the VFD display screen. The name of the equipment will be displayed in the title block of the screen.

3.2.15.1 The picture of the VFD will show the actual piece of equipment installed in field. All available analog and binary inputs will be shown with appropriate names and units. When VFD is offline all of the indicator cells will turn black.

3.2.16 All system graphics shall include links to as-built control diagrams, sequences and product technical data.

3.2.17 System Summary Screens: Summary screens shall be developed for each system as described below. All summaries shall be customized for the specific project and application. All system summary screens shall be linked to the specific system graphic, floor plan and/or home page as applicable.

3.2.17.1 General system summary screens (can be generated within any reporting tool)

3.2.17.2 All points in the building.

3.2.17.3 All points in a user-defined group of points including per system log reports.

3.2.17.4 All points currently in alarm in the building.

3.2.17.5 All schedules.

3.2.17.6 All points in an override condition.

3.2.17.7 System specific summary screens.

3.2.17.8 Include an AHU terminal unit summary screen for each AHU that serves multiple terminal units. The summary screen shall include the following information and shall be continuously updated with real time data.

Air Terminal Summary													
Room #	Device ID	Room Temp	Room Target	SA Temp	CLG VLV Cmd	HTG VLV Cmd	Fan S/S	Fan Status	Heat/ Cool	Dmpr Cmd	Air Flow	AHU #	Design CFM

3.2.17.9 Within Air Terminal Summary graphic, the following equipment dynamic data will be displayed (AHU Summary) and Physical Plant information:

AHU Summary							
Unit #	SA Temp	RA Temp	CLG VLV Cmd	HTG VLV Cmd	VFD Speed	Static Pressure	Static Setpoint

Cooling Supply
Cooling Return
Cooling Flow
Cooling DP (for the associated building)
Heating Supply
Heating Return
Heating Setpoint
Heating Hot Water Pump Status (s)

3.2.17.10 Include a chilled water summary screen for each building. The summary screen shall include the following information:

Chilled Water Summary									
UNIT #	Supply Air Actual	Supply Air Stpt	% Error	CHW Coil LW Temp[1]	CHW Coil EW Temp[2]	Delta T	CHW Valve Command	CHW Valve Feedback	% Error

Note 1: Obtained directly from the associated AHU return water temperature sensor LW – Leaving Water
Note 2: Obtained from the main building chilled water supply sensor EW – Entering Water

3.2.17.11 Include a hot water summary screen for each building. The summary screen shall include the following information for each central air handling unit:

Hot Water Summary									
UNIT #	Supply Air Actual	Supply Air Stpt	% Error	HHW Coil EW Temp[2]	HHW Coil LW Temp[1]	Delta T	HHW Valve Command	HHW Valve Feedback	% Error

Note 1: Obtained directly from the associated AHU heating hot water return water temperature sensor LW – Leaving Water
Note 2: Obtained from the main building hot water supply sensor EW – Entering Water

3.2.17.12 Include a heating hot water terminal unit summary screen for each building. The summary screen shall include the following information:

Hot Water Reheat Summary			
Terminal #	Heating Coil Supply temp	Htg Valve Command	Actual Airflow
Total			

3.2.17.13 Include an AHU laboratory summary screen for each AHU that serves multiple laboratories. The summary screen shall include the following information:

Laboratory Air Terminal Summary											
Lab #	Supply CFM[1] Actual	General CFM[1] Actual	Fume CFM[1] Actual	CFM Offset Stpt	CFM Offset Actual	% Error	Reheat Valve Command	Htg Coil Sup Temp	Htg Stpt	Temp Actual	Clg Stpt
Total											

Note 1: Sum all supply air terminal, general exhaust terminals and all fume exhaust terminals as applicable.

General Note: $\%Error = \frac{\text{Actual Setpoint}}{\text{Setpoint}} \times 100\%$

3.3 Control Wiring and Pathways:

3.3.1 Provide all electrical wiring required for a complete and functional control system, including power circuit to control panels and field devices in accordance with all applicable local codes and the latest version of National Electric Code and NFPA when applicable.

3.3.2 Sizing of cable, conduit, j-boxes and raceways to accommodate system with 25% spare capacity. Minimum conduit size shall be ¾” at all locations. All wall mount devices shall be in conduit and routed to nearest accessible ceiling location stubouts shall be a minimum of 12” from wall line.

3.3.3 Labeled wiring with unique tag to match I/O device identifier tag (e.g. sensor DA-T wire shall be labeled at panel and device as “DA-T”). Communication cable shall be labeled with Loop/Trunk #, previous and destination device (e.g. L1VAV101/VAV102 would be used to label the loop 1 communication bus between VAV101 and VAV102)

3.3.4 Low voltage wiring concealed above accessible ceilings does not require raceway, however, cables run above accessible ceilings shall be run within a j-hook pathway system spaced no more than 4 ft apart. Cables run in concealed areas or within un-accessible spaces shall be installed in EMT. Run pathways and cables parallel and perpendicular to building structure.

3.3.5 Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit shall be UL listed.

3.3.6 Run direct current instrument conductors separately from alternating current conductors. Where allowed by NEC wiring classification, AC-DC route crossings shall be at 90 degrees. Install special sensor to converter cables in accordance with drawings or in compliance with manufacturer's instructions. Extra precautions shall be taken when pulling and shortening these "vendor furnished" cables. Any extra length on these cables shall be neatly coiled into minimum 3" diameter coils and installed into junction box.

3.3.7 BAS Network Communication Cable:

3.3.7.1 Run communication or low voltage power cable in separate pathways or in j-hooks with proper clearances.

3.3.7.2 Install special cable connectors in accordance with manufacturer's recommendations.

3.3.7.3 BAS network communication cable shall not be spliced unless a terminal strip enclosure is used.

3.3.7.4 BAS network communication shall be shielded with the shields taped back where applicable.

3.3.8 All control wiring located in mechanical or exposed spaces shall be run in EMT.

3.3.9 All Input / Output wiring shall be shielded in accordance with equipment requirements.

3.3.10 Refer to Division 16 for additional requirements, except as noted.

3.3.11 Control panels and operator's terminals serving equipment fed by emergency power shall also be served by emergency power. Locate LOT and its UPS where shown on plans.

3.3.12 Power wiring to control compressors and dryers shall be as indicated on electrical power plans. Provide field mounted starters to Electrical Contractor for installation and supervise installation.

3.3.13 Raceway Identification. All the covers to junction and pull boxes of the BAS raceway system shall be painted white.

3.4 Air Piping:

3.4.1 Conceal all piping, except for piping in mechanical rooms and other areas where mechanical system piping is exposed.

3.4.2 Install exposed piping and conduit parallel to or at right angles to building structure and support adequately at uniform intervals. Use only tool-made bends.

3.4.3 Polyethylene tubing not exceeding 18" may be used for final connection to instrument or actuator except in high temperature locations such as mechanical rooms with steam heat exchangers or areas exposed to outside environment. Use hard copper for these applications.

3.4.4 Install polyethylene tubing with no concealed splices and number code all tubing.

3.4.5 Make tests on sectional piping during progress of installation to ensure no leakage.

3.4.6 Provide cartridge type desiccant dryers for air lines passing through outside air stream or through unheated spaces where space temperatures can be below 30°F.

3.4.7 Piping type shall be as follows:

3.4.7.1 Inside Panels:

3.4.7.1.1 Use polyethylene tubing.

3.4.7.2 Piping Serving Smoke Dampers and Combination Fire-Smoke Dampers:

3.4.7.2.1 Use hard copper for mains and exposed piping and hard or soft copper for branches and concealed piping.

3.4.7.3 Exposed Spaces:

3.4.7.3.1 Use hard copper tubing or

3.4.7.3.2 Polyethylene tubing may be used if run in fully enclosed EMT raceway where environment is within temperature limits of polyethylene tubing.

3.4.7.3.3 Use PVC coated copper tubing for wet environments.

3.4.7.4 Concealed:

3.4.7.4.1 Use hard copper, soft copper or polyethylene tubing.

3.4.8 Concrete Buried:

3.4.8.1 Use hard copper, soft copper or polyethylene tubing in metal or plastic conduit.

3.5 Air Supply System:

3.5.1 Provide an appropriate air pressure reducing station connected to the existing piping system and providing a new refrigerated air dryer assembly for the piping extension, all having the required system capacity to serve the devices included in the Vendor / Installer's work.

3.5.2 Install air compressor assembly where indicated on drawings.

3.5.2.1 Pipe tank drain to nearest floor drain.

3.5.2.2 Install vibration isolators as recommended by manufacturer.

3.5.3 Install air dryer assembly where indicated on drawings or suitable location adjacent to air compressor assembly.

3.5.3.1 Mount air dryer on wall with suitable supports.

3.5.3.2 Pipe unit drain to nearest floor drain.

3.6 Local Control Panels:

3.6.1 Provide local control panel for each system where more than one control device requires field mounting (air handling units, miscellaneous control system including pump controls, etc.). Single devices may be mounted exposed on piping or ductwork. Install local control panel where indicated on drawings or suitable location adjacent to system served. Do not mount panels on equipment.

3.6.2 Mount panel on wall with suitable brackets or on floor with self-supporting stand.

3.6.2.1 Mount top of panel no higher than 6 feet above floor.

3.6.2.2 Install panels so front cover door can swing full open without interference and maintain a minimum of 36" clearance.

3.6.3 Unless otherwise indicated, mount controllers, adjusting switches, pressure gages, temperature indicators and other indicating or manually operated devices inside panel with permanent labels identifying device and controlled device or function.

3.6.4 In-line pneumatic gages shall be hard mounted to back panel and shall include permanent labels identifying end device. Other factory standard labeling methods are acceptable as long as the device name and function is clearly identified and is permanent. Labels shall correspond to control drawing tags and identifiers.

3.6.5 Labels shall correspond to control drawing tags and identifiers.

3.6.6 Panel will be labeled with location and breaker number of power feed.

3.7 <u>Network Routers & Bridges</u>:

3.7.1 Coordinate final location with Owner and other trades.

3.8 <u>Building Level Controller</u>:

3.8.1 Provide controllers as required.

3.8.2 Coordinate final location with Owner other trades.

3.9 <u>Advanced Application Controllers – Hardware (AAC)</u>:

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

3.9.2 Size controller to meet the requirements of this specification and the project point I/O schedule +15% additional capacity of each point type.

3.10 <u>Application Specific Controllers (ASC's)</u>:

3.10.1 Provide the following types of application specific controllers (embedded or as a predefined software application) as a minimum:

3.10.1.1 Variable Air Volume (VAV) boxes
3.10.1.2 Constant Air Volume (CAV) boxes
3.10.1.3 Fan Coil Units
3.10.1.4 Unit Conditioners
3.10.1.5 Heat Pumps

3.10.1.6 Unit Ventilators
3.10.1.7 Small AHU'S
3.10.1.8 Room Pressurization

3.11 Electrical Power Meter:

3.11.1 Furnish power meter as shown on drawings and/or as required to perform control sequence specified.

3.11.2 Provide communication to the BAS.

3.11.3 Coordinate location and power requirements with other trades.

3.12 Servers:

3.12.1 Archive all historical data such as trends, alarm and event histories, and transaction logs on existing server.

3.13 Control Valves:

3.13.1 Furnish control valves as shown on drawings and/or as required to perform control sequence specified.

3.13.2 Coordinate the installation of control valves.

3.13.3 Control valves furnished by this contractor shall be installed by **[Division 15XXX Contractor]** under coordinating control and supervision of this Contractor.

3.13.4 Sizing:

3.13.4.1 Select control valves to meet their intended service without cavitations. Provide cavitation calculations for modulating globe control valves over 250°F and all modulating butterfly valves over 60°F.

3.13.4.2 Valve body ratings indicated in Part 2 are minimum required. Valve body, trim and packing selected shall be designed to withstand maximum pressure and temperature encountered in the systems.

3.13.4.3 Submit engineering calculations used for sizing modulating control valves. Control valves serving terminal devices may be sized based on flow ranges for each pump system.

3.13.4.4 Calculations for sizing modulating valves shall be based on actual characteristics of equipment and system being installed.

3.13.4.4.1 Valve calculations shall include information such as pump head or available pressure; branch piping circuit losses including all pipe, fittings, valves, and coils; flow rates; and pressure losses of other in-line devices.

3.13.4.4.2 Obtaining adequate system information necessary for sizing valves.

3.13.4.5 Design criteria for sizing modulating valves shall be based on two port, or 3 port, fail open or fail closed, as shown on plans, equal percentage valves unless otherwise specified.

3.13.4.6 Heating control valves shall be full port ball valve and shall be selected for a minimum of 25% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.

3.13.4.7 Size three-way mixing or diverting valves not directly associated with pump sub-circuit, for **[3-5]** psi pressure drop.

3.13.4.8 Terminal reheat control valves shall be ball type and shall be selected for a minimum of 25% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.

3.13.4.9 Cooling control valves may be full port ball, or butterfly type and shall be selected for minimum of 10% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.

3.13.4.10 Select control valves based on pressure drop calculations using Cv values at 100% stroke.

3.13.4.11 Subcircuit is defined as all branch supply and return piping to terminal device, including all valve, coil, control valves, and balance valve.

3.13.5 Steam Valves:

3.13.5.1 Modulating steam control valves shall be straight-through globe type with linear characteristics for 90% of closing stroke and equal-percentage for final 10%.

3.13.5.2 For steam inlet pressure less than 15 psig, size valves for pressure drop equal to 75 to 80% of gauge inlet steam pressure.

3.13.5.3 For steam inlet pressure of 15 psig or greater, size valves for pressure drop equal to 50% of absolute inlet pressure.

3.14 Control Dampers:

3.14.1 Furnish control dampers as shown on drawings and/or as required to perform control sequence specified except those furnished with other equipment.

3.14.2 Coordinate the installation of control dampers.

3.14.3 Control dampers furnished by this Contractor will be installed by **[Division 15XXX Contractor]** under coordinating control and supervision of this Contractor.

3.14.4 Blank-off plates or transitions required to facilitate dampers will be provided by **the [Division 15XXX Contractor]**.

3.15 Actuators and Pilot Positioners:

3.15.1 Provide actuator for each automatic damper or valve with sufficient capacity to operate damper or valve under all conditions. Select actuators to provide tight shut off against maximum system temperatures and pressure encountered.

3.15.2 [Provide pilot positioners for pneumatic modulating valves and dampers for major equipment such as air handling unit coils, humidifiers, heat exchangers, converters, major water system temperature controls, etc.]

3.15.3 Valve and damper operating speeds shall be selected or adjusted so operators will remain in step with controller without hunting regardless of load variations.

3.15.4 Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5% hysteresis in either direction (actual movement of valve stem/damper shaft/ideal movement) due to deflection of actuator mounting.

3.15.5 Sizing

3.15.5.1 Calculations for sizing dampers shall be based on actual characteristics of ductwork system being installed.

3.15.5.2 Opposed blade dampers shall be sized for minimum of 10% of duct section pressure drop. Parallel blade dampers shall be sized for minimum of 30% of duct section pressure drop. Duct section is defined as ductwork containing flow control damper starting with inlet or branch tee and ending with outlet or branch tee.

3.15.5.3 Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of ASHRAE Handbook of Fundamentals.

3.15.5.4 If control system fixes pressure drop, use those pressure setpoints. Use duct blank-offs to provide additional pressure drop as required to obtain linear damper response.

3.15.5.5 Contractor is responsible for obtaining adequate system information necessary for sizing.

3.15.5.6 Contractor to provide dampers as shown on drawings or as scheduled.

3.15.5.7 Two position dampers shall be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

3.16 General Instrumentation:

3.16.1 Pressure Gauges (Pressure Indicators):

3.16.1.1 Install pressure gauges for indication of supply and control pressure in pneumatic systems at output of I/P transducers, electric air solenoid valves and pressure switches, actuators and other points where visible indication of air pressure is required for operating and maintenance purposes (include a pressure gage with 12 inches of controlled device).

3.16.1.2 Furnish pressure gauges with tappings for piping.

3.16.1.3 Provide pressure gages in control panel and at end device (pneumatic actuators). End device pressure gage shall be mounted so that gage can be easily seen from eye level.

3.16.2 Water Differential Pressure Sensors

3.16.2.1 Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device. Transmitter range shall be selected for mid-range values while operating under normal operating range.

3.16.2.2 Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines. Test ports shall be included for 3rd party verification.

3.16.2.3 Differential pressure transmitter shall include a separate pressure gage scaled to indicate normal operating range of device. This pressure gage shall be installed in parallel with sensing lines.

3.16.2.4 The transmitters shall be installed in an accessible location whenever possible.

3.17 Discrete Electric Instrumentation:

3.17.1 General:

3.17.1.1 Terminate at terminal blocks inside enclosures unless otherwise specified.

3.17.1.2 Include auxiliary contact for remote status indication of safety devices.

3.17.2 Temperature Switches (Electric Thermostats):

3.17.2.1 Provide temperature switches as shown or as required for sequence of operation.

3.17.3 Low Limit Temperature Switches (Freeze Stats):

3.17.3.1 Install low limit controls where indicated on drawings or as specified. Unless otherwise indicated, install sensing element at downstream side of heating coils.

3.17.3.2 Distribute sensing element across entire area of medium being sensed. Install controls at accessible location with suitable mounting brackets and element duct collars where required.

3.17.3.3 Serpentine sensing element, starting at the lowest point (6” above coil bottom) of the coil being protected. Operation of low limit trip shall provide protection to associated coils.

3.17.3.4 Low limit trip activation shall cause all water coils to be overridden to full flow.

3.17.4 Relays:

3.17.4.1 Provide control relays where indicated on drawings or as required to accomplish sequences.

3.17.4.2 Provide DIN mounted relays in control panels.

3.17.4.3 Provide RIB type relays for field control devices mounted on exterior of starter or VFD.

3.17.4.4 Mount relay for easy accessibility.

3.17.4.5 Mount relay for easy visual accessibility.

3.17.5 Pressure Switches:

3.17.5.1 Provide pressure switches where indicated on drawings or as required to accomplish sequences.

3.17.5.2 Coordinate installation of flow switches for proper location and installation.

3.17.6 Pressure Switches (Air Side):

3.17.6.1 Pressure Switches: Provide pressure switches where indicated on drawings or as required to accomplish sequences.

3.17.6.2 Coordinate installation of flow switches for proper location and installation.

3.17.6.3 Alarm setpoint value to be indicated on field installed device.

3.17.7 Target Type (Paddle) Flow Switches:

3.17.7.1 Furnish paddle switches as required.

3.17.7.2 Coordinate installation of flow switches for proper location and installation.

3.17.8 Flow Switches:

3.17.8.1 Furnish flow switches as required.

3.17.8.2 Coordinate installation of flow switches for proper location and installation.

3.17.9 E-P Switches (Solenoid Valves):

3.17.9.1 Provide E-P switches where indicated on drawings or as required to accomplish sequences.

3.17.10 Position Switches (End Switch):

3.17.10.1 Provide position switches where indicated on drawings or as required to accomplish sequences.

3.17.11 Current Switches:

3.17.11.1 Provide current switches where indicated on drawings or as required to accomplish sequences.

3.17.11.2 Locate in starter or VFD or in an appropriate adjacent enclosure.

3.17.12 Transmitters and Indicators:

3.17.12.1 Locate transmitters at sensing device or within 100 ft for remote mounted transmitters. For hot systems (150°F and higher) mount electronics on side of pipe or remotely mount. For indicating type instruments, locate indicating element within 6 ft of floor with readout easily visible from floor level. Provide remote readouts if necessary.

3.18 Analog Electronic Instrumentation:

3.18.1 Metering and Totalization:

3.18.1.1 Coordinate the delivery and installation of meter.

3.18.1.2 Installation where indicated on drawings.

3.18.1.3 Mount remote display unit at eye level in accessible location.

3.18.2 Differential Pressure Transmitter:

3.18.2.1 Provide differential pressure transmitter for building **[chilled water/hot water]** differential pressure.

3.18.2.2 Coordinate the location with other trades.

3.18.3 Wall Mounted Space Sensors:

3.18.3.1 Install space thermostats/sensors where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.3.2 Mount space sensors 4 ft above floor unless otherwise indicated.

3.18.3.3 Any room sensor mounted on exterior walls shall be mounted on thermally insulated sub-base.

3.18.3.4 Relocate room sensors if required due to draft, interferences with cabinets, writing board, etc., or improper sensing.

3.18.3.5 Room sensors in gymnasium, locker rooms and **[XXX]** shall be protected by heavy-duty cast and die formed guard.

3.18.3.6 Provide a conduit from sensor box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.

3.18.4 Room Thermostats

3.18.4.1 Install space thermostats where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.4.2 Mount thermostats at 4 ft above floor unless otherwise indicated.

3.18.4.3 Any room thermostat mounted on exterior walls shall be mounted on thermally insulated sub-base.

3.18.4.4 Relocate room thermostats if required due to draft, interferences with cabinets, writing board, etc., or improper sensing.

3.18.4.5 Provide thermostats in gymnasium, locker rooms and **[XXX]** heavy-duty cast and die formed guard.

3.18.4.6 Provide a conduit from thermostat box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.

3.18.5 Duct Mounted probe Sensors:

3.18.5.1 Provide sensors where shown or drawings or to accomplish sequences.

3.18.5.2 Install outside air sensors in weatherproof, non-corrosive solar shield.

3.18.6 Insertion Temperature Sensors

3.18.6.1 Provide sensors where shown or drawings or to accomplish sequences.

3.18.6.2 Install wet sensors in stainless steel or brass wells with thermal grease.

3.18.7 Duct Mounted Averaging Temperature Sensors:

3.18.7.1 Use where temperatures are prone to stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required. All sensors located within the AHU compartment shall be averaging.

3.18.7.2 Serpentine sensor in duct to maximize coverage of measured area.

3.18.7.3 Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

3.18.7.4 Mounted to suitable supports using factory approved non-metal element holders.

3.18.8 Dew Point or Wet Bulb Temperature Transmitter:

3.18.8.1 Provide dew point transmitters where indicated or to accomplish sequences.

3.18.9 Space Humidity Sensors/Transmitters:

3.18.9.1 Install space humidity sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.9.2 Mount sensors at same height as temperature sensors.

3.18.9.3 Any sensor mounted on exterior walls shall be mounted on thermally insulated sub-base.

3.18.9.4 Relocate room thermostats if required due to draft, interferences with cabinets, chalkboards, etc., or improper sensing.

3.18.9.5 Provide sensors in gymnasium, locker rooms and **[XXX]** heavy-duty cast and die formed guard.

3.18.9.6 Provide a conduit from sensor box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.

3.18.10 Duct Mounted Humidity Sensors/Transmitters:

3.18.10.1 Provide duct humidity sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.11 Thermal Dispersion or Vortex Shedding Air Flow Sensors/Transmitters:

3.18.11.1 Provide air flow sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.12 P-E Transducers (Pressure Transmitters):

3.18.12.1 Provide transducers as required to perform specified controls, or directed to meet job site conditions.

3.18.12.2 Mount transducers in control panels.

3.18.12.3 Provide gauge for all transducers.

3.18.13 Ducted Air System Static Pressure and Differential Pressure (Velocity) Transmitters:

3.18.13.1 Provide transducers/transmitters to convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.

3.18.13.2 Mount transducers in control panels.

3.18.13.3 Terminate transducers directly to the controller that is implementing control loop.

3.18.14 Building and Space Pressure Differential Transmitter:

3.18.14.1 Provide directional mass flow transmitter installed in 2" thin-wall rigid conduit (EMT) or PVC between spaces to measure relative velocity created by the pressure difference.

3.18.14.2 Extend 2" EMT or PVC pipe between spaces for room pressure control, or between space and outside for building static pressure control.

3.18.14.3 Provide algorithm in software to convert air velocity to pressure differential (DP = C (V/4005)2). Field determine coefficient C by calibrated measurement.

3.18.14.4 Construct shroud of aluminum, painted to match building exterior.

3.18.15 Electric to Pressure Transducers:

3.18.15.1 Provide pressure transducers integral to DDC panels or separate components to convert digital analog signal to variable pneumatic air pressure signal.

3.18.15.2 Provide output gauge for all transducers.

3.18.15.3 Mount in control panel.

3.18.16 Carbon Dioxide Sensor:

3.18.16.1 Provide carbon dioxide sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.

3.18.17 Terminal Unit Location Identification:

3.18.17.1 Provide a label directly below terminal unit devices mounted above ceiling. Label the approximate location on ceiling grid. Where associated devices such as reheat valves are not mounted with the terminal unit provide additional labels to indicate all device locations.

3.19 Spare Parts:

3.19.1 Contractor shall provide to the Owner the following spare parts:

3.19.1.1 Three (3) APPLICATION SPECIFIC CONTROLLERS (ASC) as used on the project.

3.19.1.2 Three (3) each of each analog temperature and pressure sensors used on the project.

3.19.1.3 Three (3) each of each digital input devices (current sensors, pressure switches, etc.) used on the project.

END OF SECTION

Sheet List	
Sheet Number	Sheet Name
G-0	COVER SHEET
IC-0	LEGEND AND ABBREVIATIONS
IC-1	100% OUTSIDE AIR - PREHEAT, COOLING CONTROL DIAGRAM
IC-2	100% OUTSIDE AIR - PREHEAT, COOLING, HUMIDIFIER, FAN ARRAY CONTROL DIAGRAM
IC-3	100% OUTSIDE AIR - ENERGY RECOVERY, PREHEAT, COOLING CONTROL DIAGRAM
IC-4	100% OUSIDE AIR - PREHEAT, HEAT PIPE, COOLING, HUMIDIFIER CONTROL DIAGRAM
IC-5	MIXED AIR - COOLING, REHEAT CONTROL DIAGRAM
IC-6	MIXED AIR - COOLING CONTROL DIAGRAM
IC-7	MIXED AIR - PREHEAT, COOLING CONTROL DIAGRAM
IC-8	CHILLED WATER - BUILDING PUMPING CONTROL DIAGRAM
IC-9	FCU - HEATING, COOLING CONTROL DIAGRAM
IC-10	FCU - COOLING CONTROL DIAGRAM
IC-11	HOT WATER HEAT EXCHANGER - SINGLE CONTROL DIAGRAM
IC-12	HOT WATER HEAT EXCHANGER - DUAL CONTROL DIAGRAM
IC-13	LABORATORY - SUPPLY, EXHAUST, TRACKING CONTROL DIAGRAM
IC-14	LABORATORY - SUPPLY, FUME, EXHAUST, TRACKING CONTROL DIAGRAM
IC-15	VAV TERMINAL UNIT - COOLING ONLY CONTROL DIAGRAM
IC-16	VAV TERMINAL UNIT - WITH REHEAT CONTROL DIAGRAM
IC-17	EXHAUST SYSTEM - 3 FAN MANIFOLD CONTROL DIAGRAM

FSU CONTROL STANDARDS

FSU W.O. 686601/001

FLORIDA STATE UNIVERSITY
VIRES ARTES MORES
1851

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ABBREVIATIONS

BAS	BUILDING AUTOMATION SYSTEM
COND	CONDENSATE
CHWP	CHILLED WATER PUMP
COMM	COMMUNICATIONS
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
EA	EXHAUST AIR
F/A	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FC	FAIL CLOSED
FO	FAIL OPEN
HHWS	HEATING HOT WATER SUPPLY
HHWR	HEATING HOT WATER RETURN
OA	OUTSIDE AIR
PRV	PRESSURE REDUCING VALVE
RA	RETURN AIR
SA	SUPPLY AIR
VFD	CARIABLE FREQUENCY DRIVE

LEGEND

AMS	AIR MONITORING STATION
CO2	CARBON DIOXIDE SENSOR
CSR	CURRENT SENSING RELAY
D	DUCT SMOKE DETECTOR
DP	DIFFERENTIAL PRESSURE
ES	DAMPER END SWITCH
FM	FLOW METER
FS	FLOAT SWITCH
HHL	HUMIDITY HIGH LIMIT
HI	HIGH PRESSURE SAFETY
HS	HUMIDITY SENSOR
LL	LOW LIMIT SAFETY
LO	LOW PRESSURE SAFETY
M	MOTORIZED ACTIVATOR
CM	CONDUCTIVITY SENSOR
OS	OCCUPANCY SENSOR
DC	DOOR CONTACT SENSOR
PS	PRESSURE SENSOR
SP	STATIC PRESSURE SENSOR
T	THERMOSTAT
TS	TEMPERATURE SENSOR
1	HIGH/LOW PRESSURE SAFETY
2	DAMPER INTERLOCK (ACTUATOR)
3	DAMPER INTERLOCK (PROOF)
4	LOW LIMIT INTERLOCK
5	FLOAT SWITCH INTERLOCK
AI	ANALOG INPUT
AO	ANALOG OUTPUT
BI	BINARY INPUT
BO	BINARY OUTPUT

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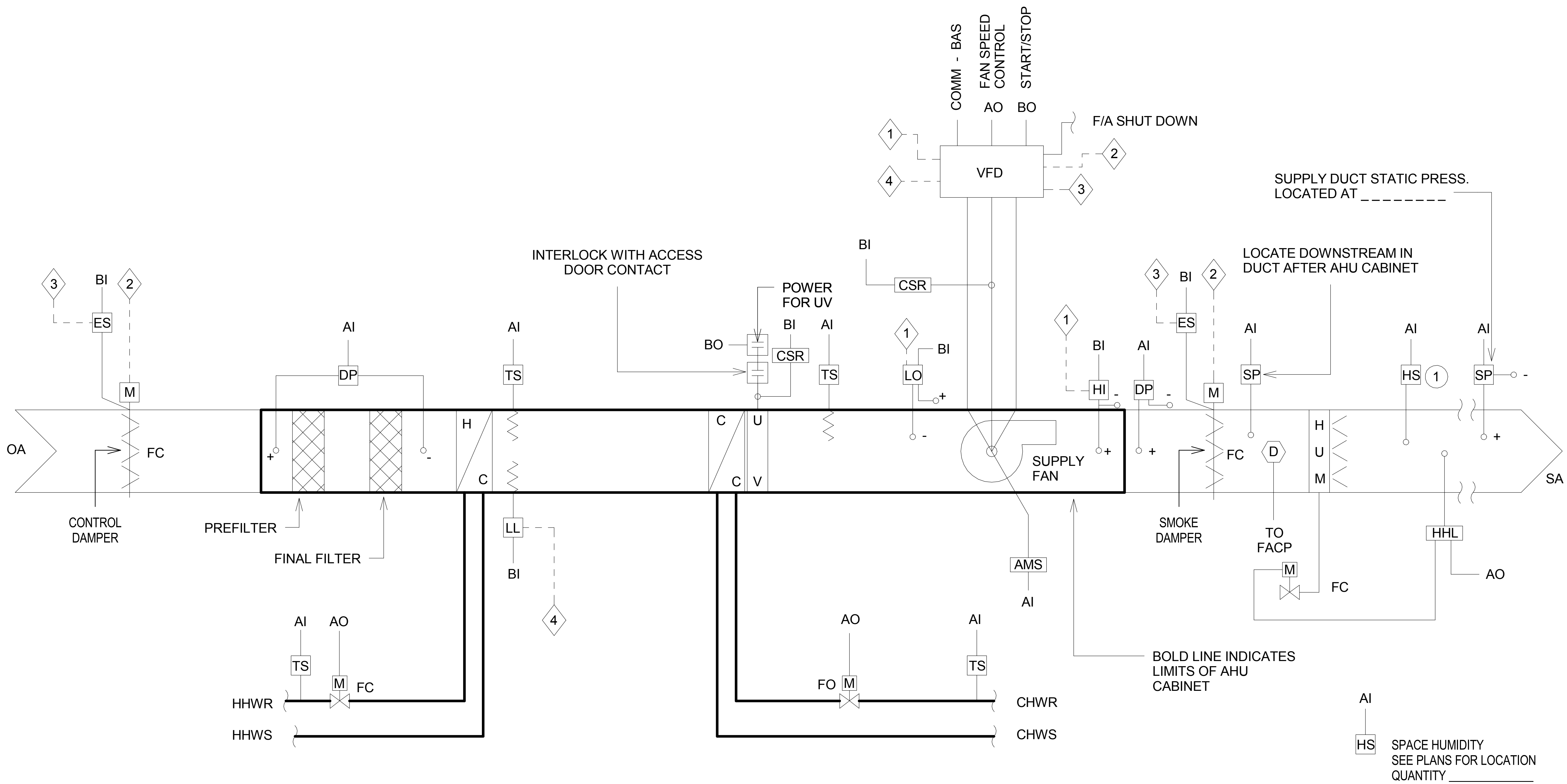
TITLE

DATE

DESIGNED BY

11034

1 MAINTAIN A MINIMUM DISTANCE OF 15 FT DOWNSTREAM OF HUMIDIFIER.



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TITLE
FSU CONTROL STANDARDS
100% OUTSIDE AIR -
PREHEAT \ COOLING

DATE

DESIGNED BY

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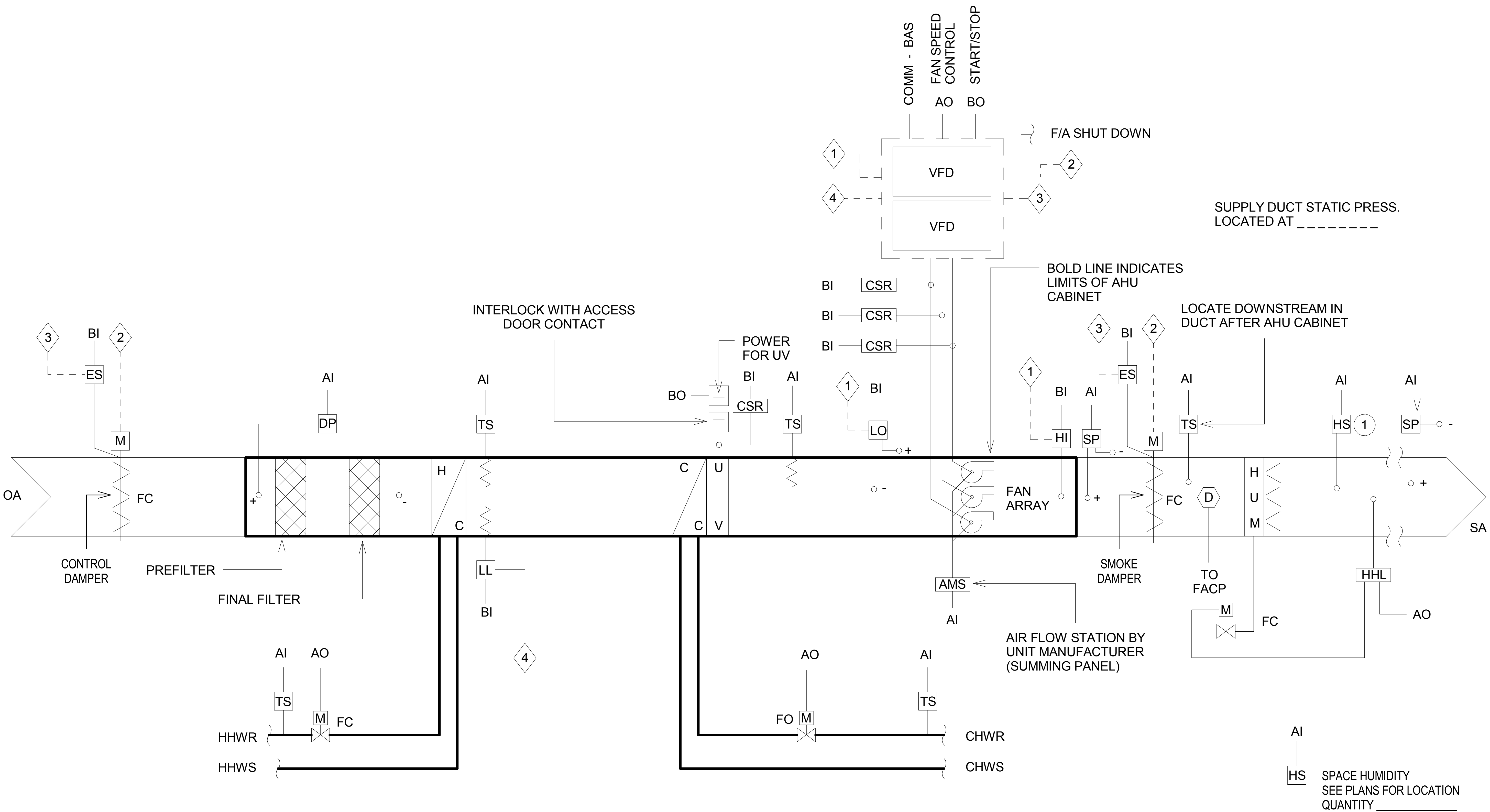
IC-1

1 MAINTAIN A MINIMUM DISTANCE OF 15 FT DOWNSTREAM OF HUMIDIFIER.



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TITLE

FSU CONTROL STANDARDS
100% OUTSIDE AIR -
PREHEAT / COOLING / HUMIDIFIER / FAN ARRAY

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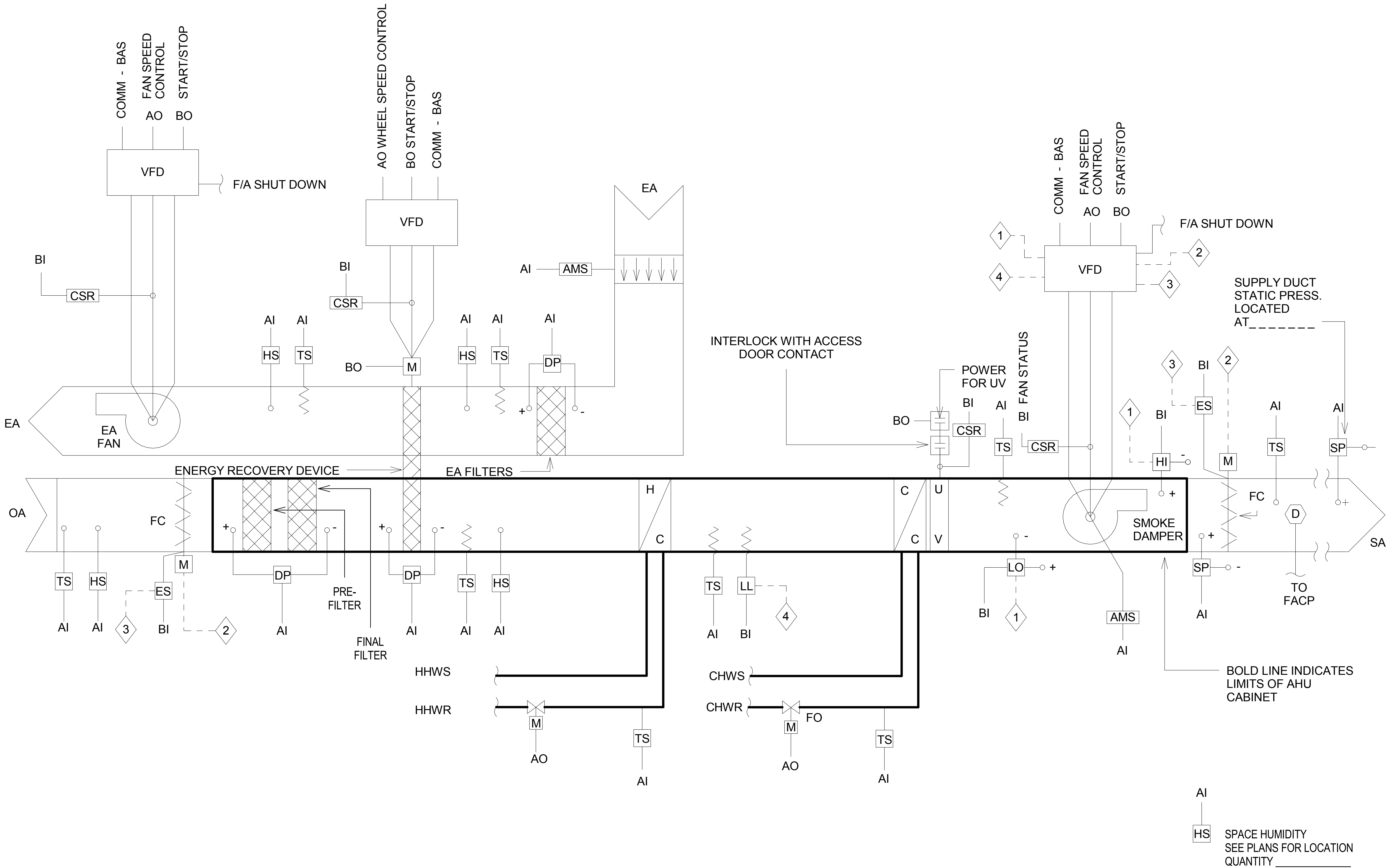
IC-2

353



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TITLE

FSU CONTROL STANDARDS
100% OUTSIDE AIR -
ENERGY RECOVERY / PREHEAT / COOLING

DATE

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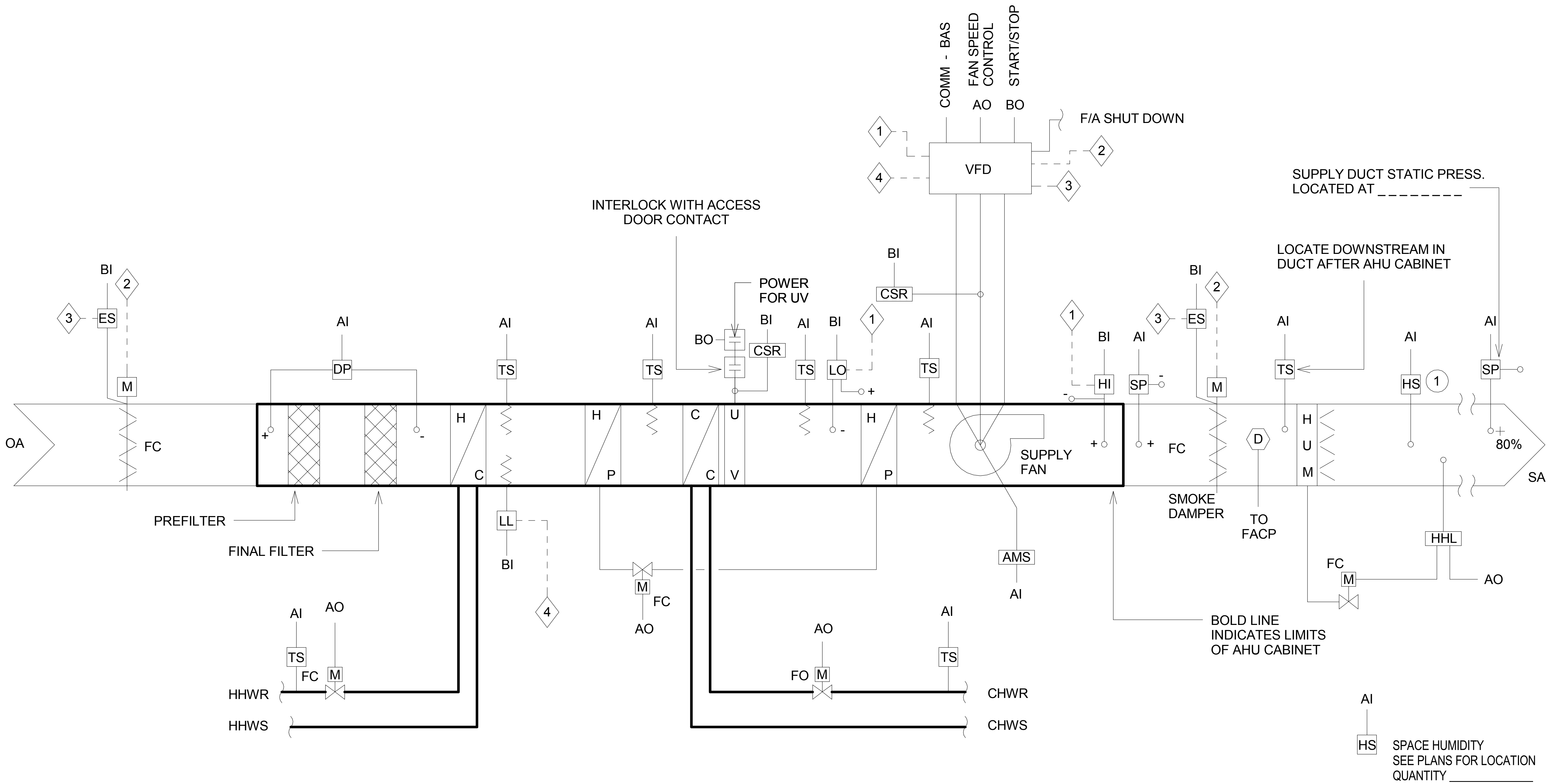
IC-3

1 MAINTAIN A MINIMUM DISTANCE OF 15 FT DOWNSTREAM OF HUMIDIFIER.



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TITLE
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100% OUTSIDE AIR -
PREHEAT / HEAT PIPE / COOLING / HUMIDIFIER

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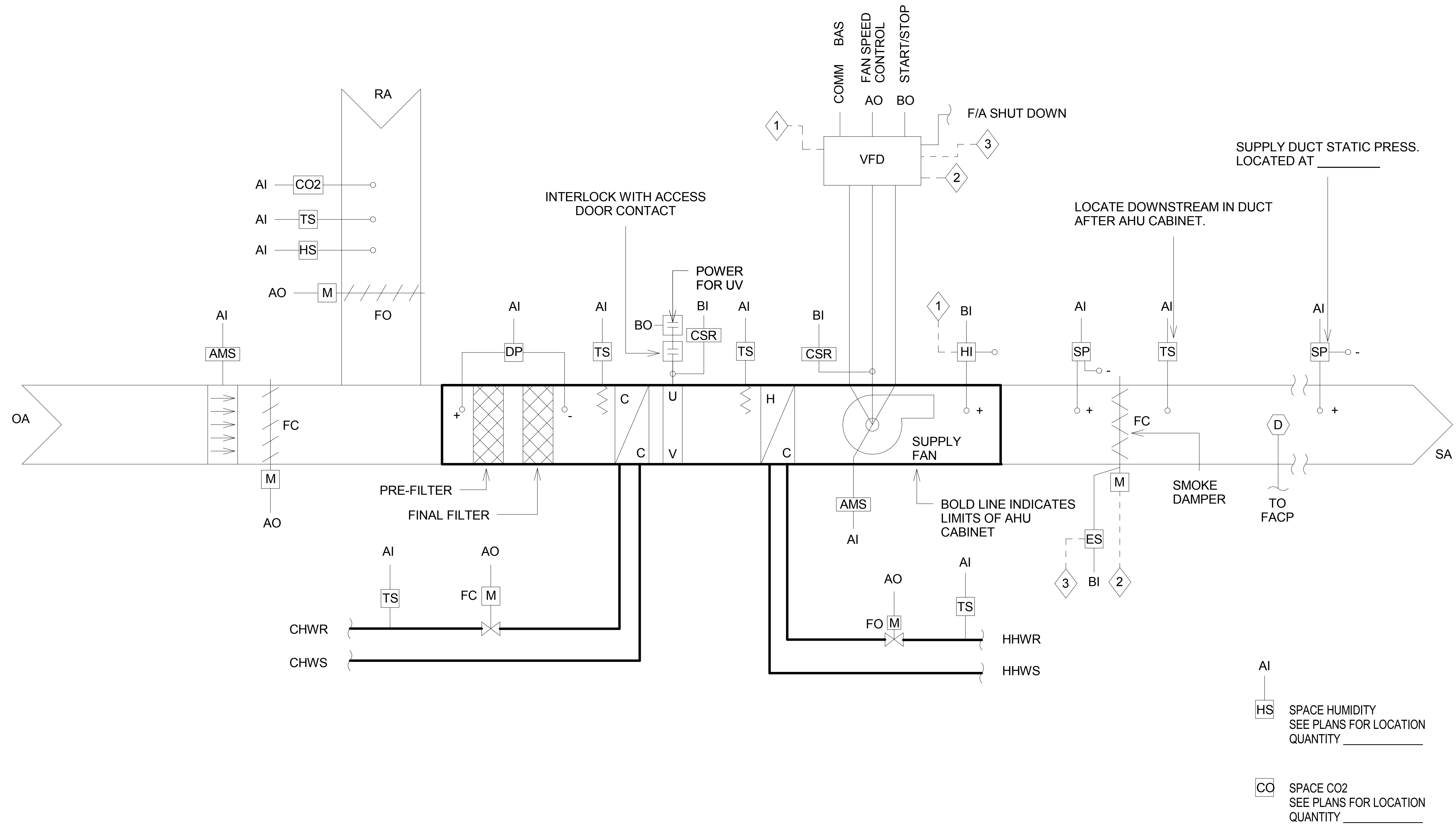
IC-4



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TITLE

FSU CONTROL STANDARDS
MIXED AIR - COOLING / REHEAT

DATE

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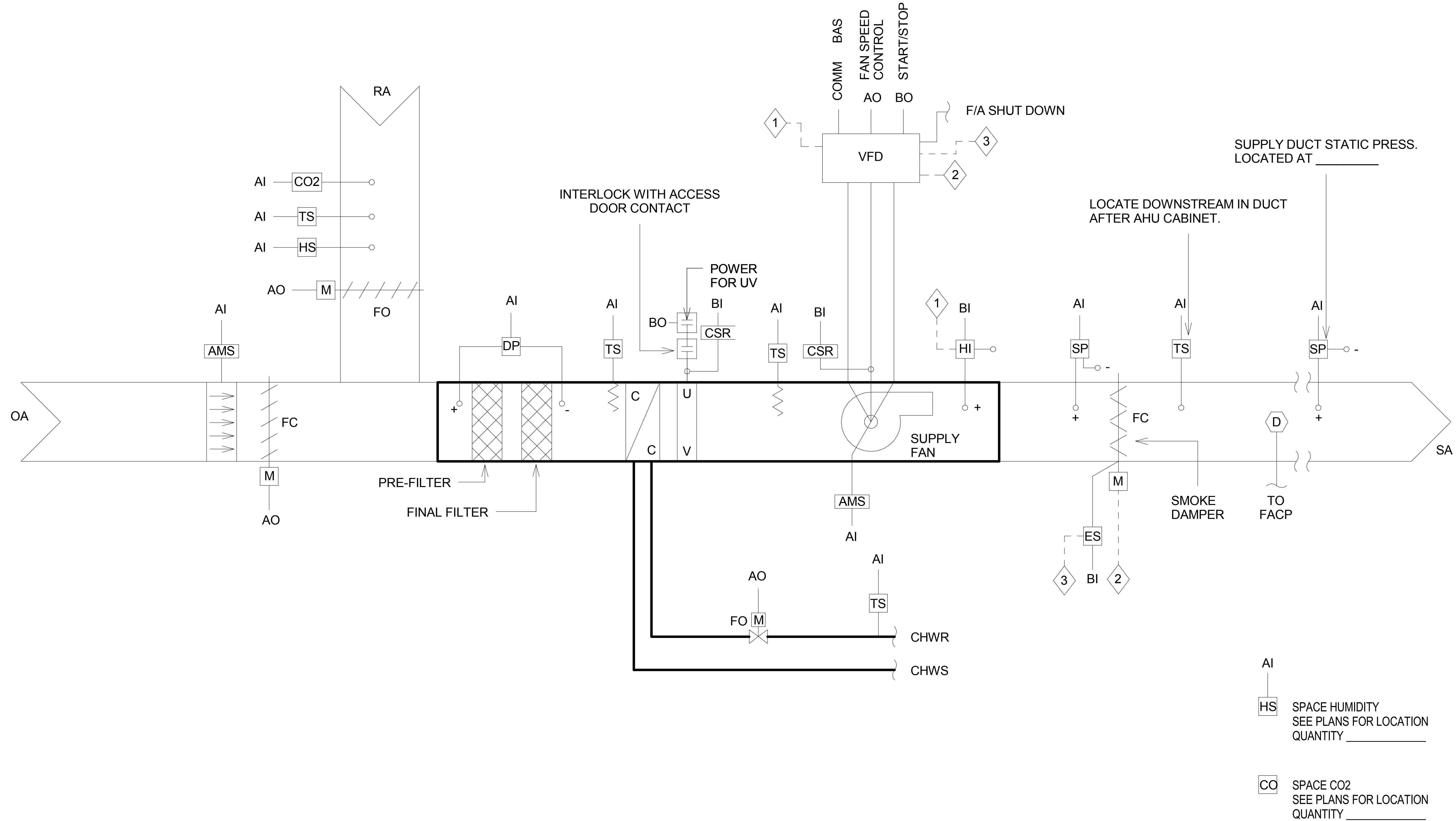
IC-5



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TITLE
FSU CONTROL STANDARDS
MIXED AIR - COOLING

DATE

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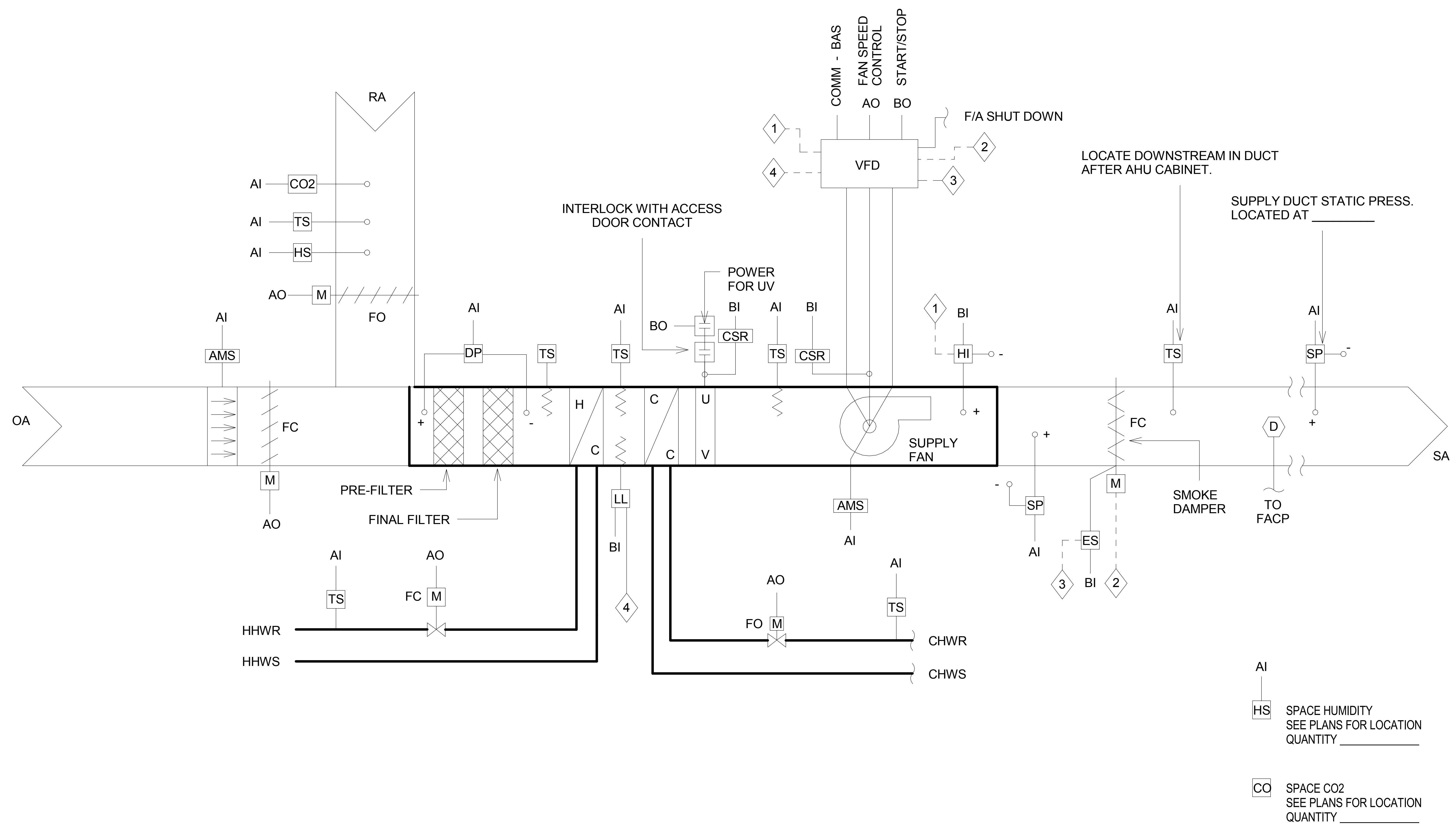
IC-6



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FSU CONTROL STANDARDS

MIXED AIR - PREHEAT / COOLING

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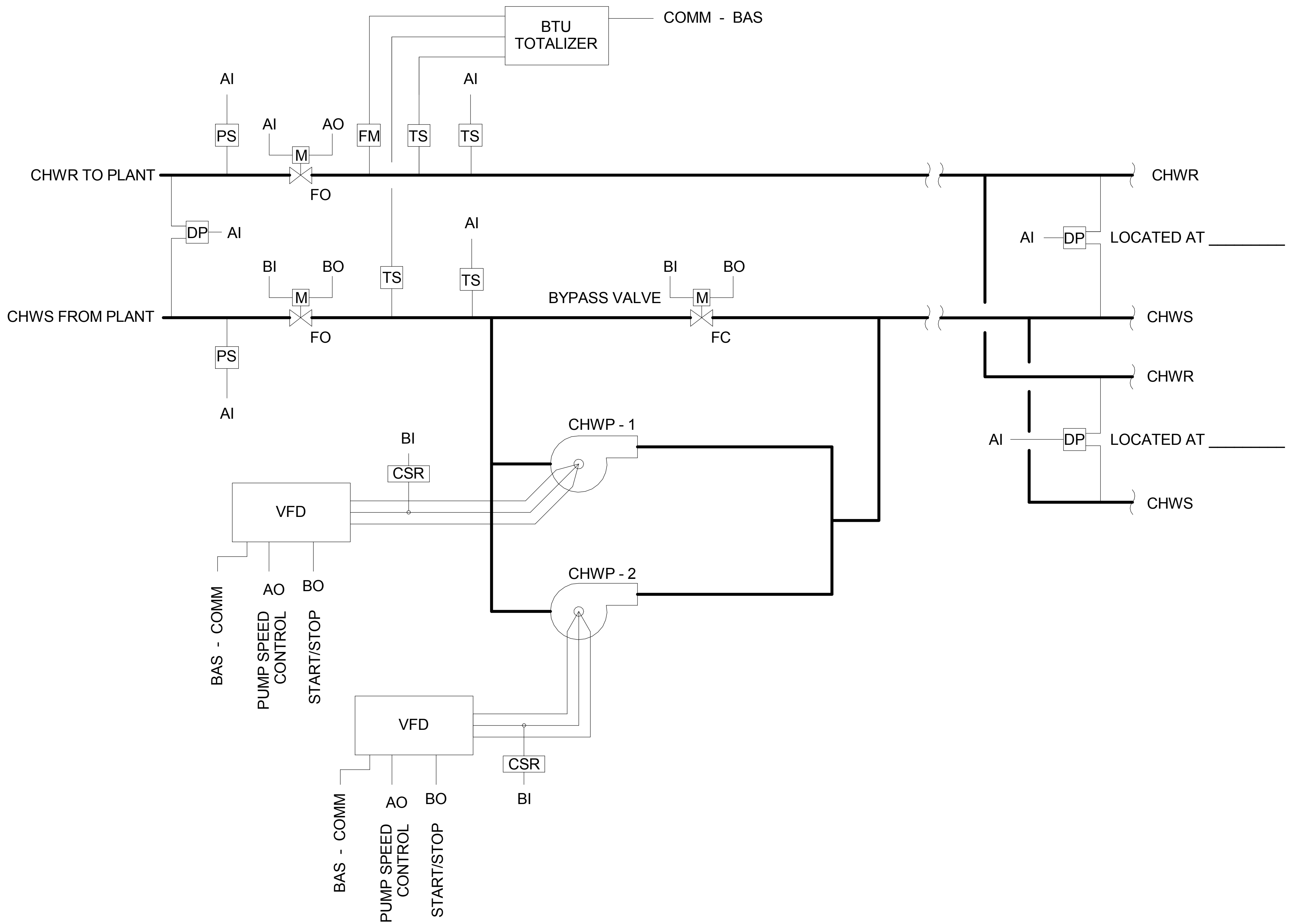
IC-7



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TITLE
FSU CONTROL STANDARDS
CHILLED WATER - BUILDING PUMPING

DATE

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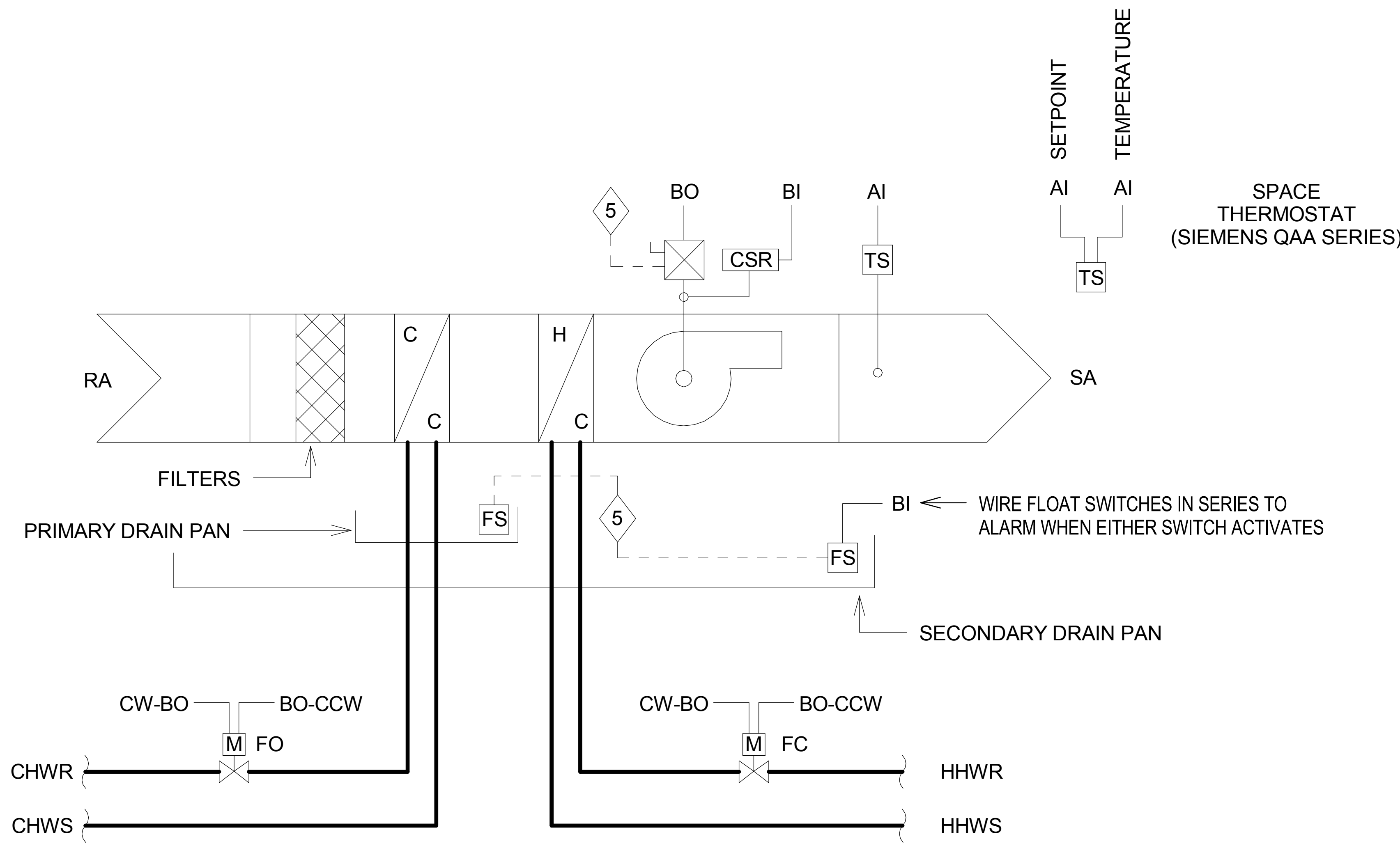
IC-8



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FSU CONTROL STANDARDS
FCU - HEATING / COOLING

DATE

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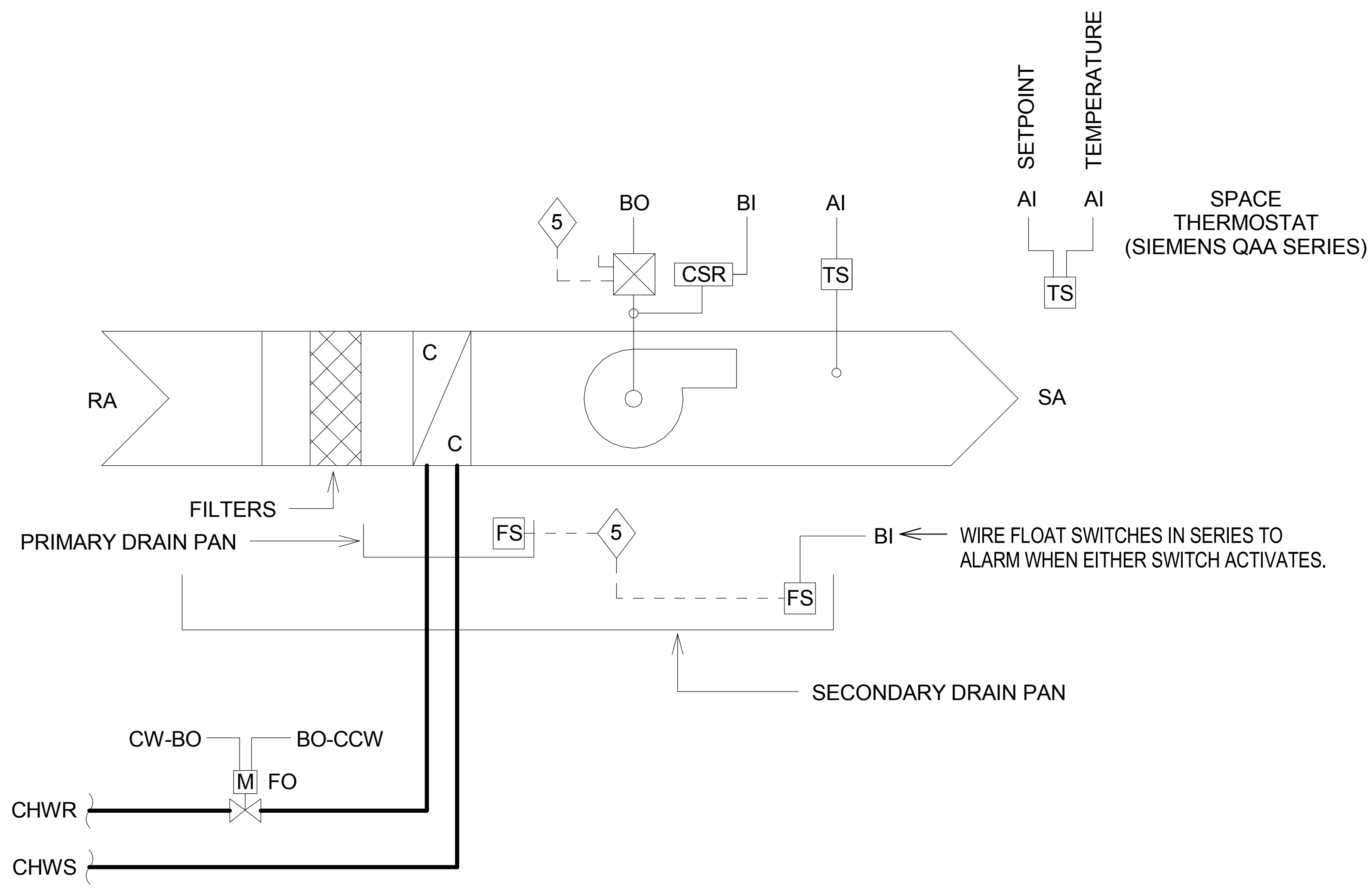
IC-9



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FCU - COOLING

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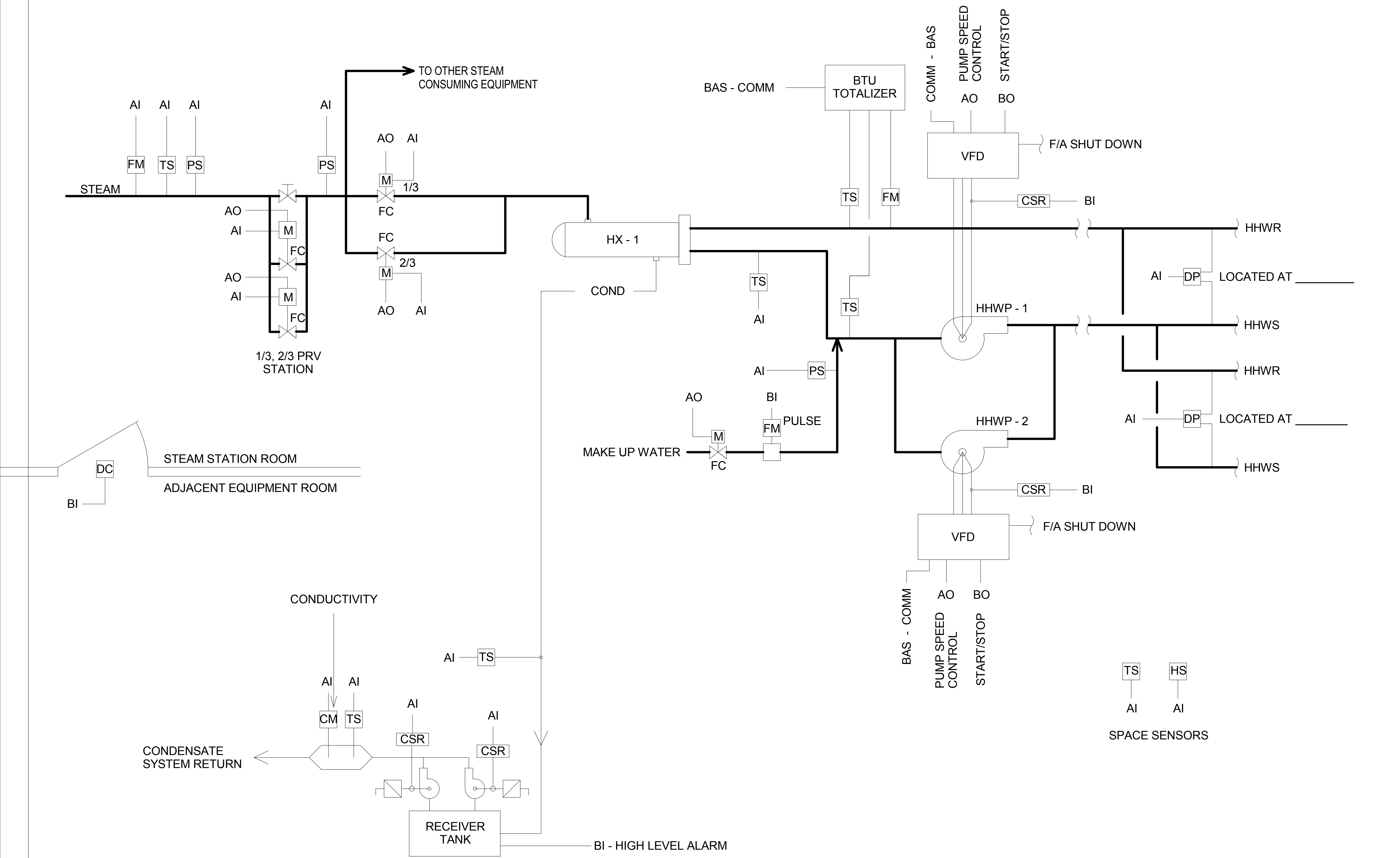
IC-10



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TITLE
FSU CONTROL STANDARDS
HOT WATER HEAT EXCHANGER - SINGLE

DATE
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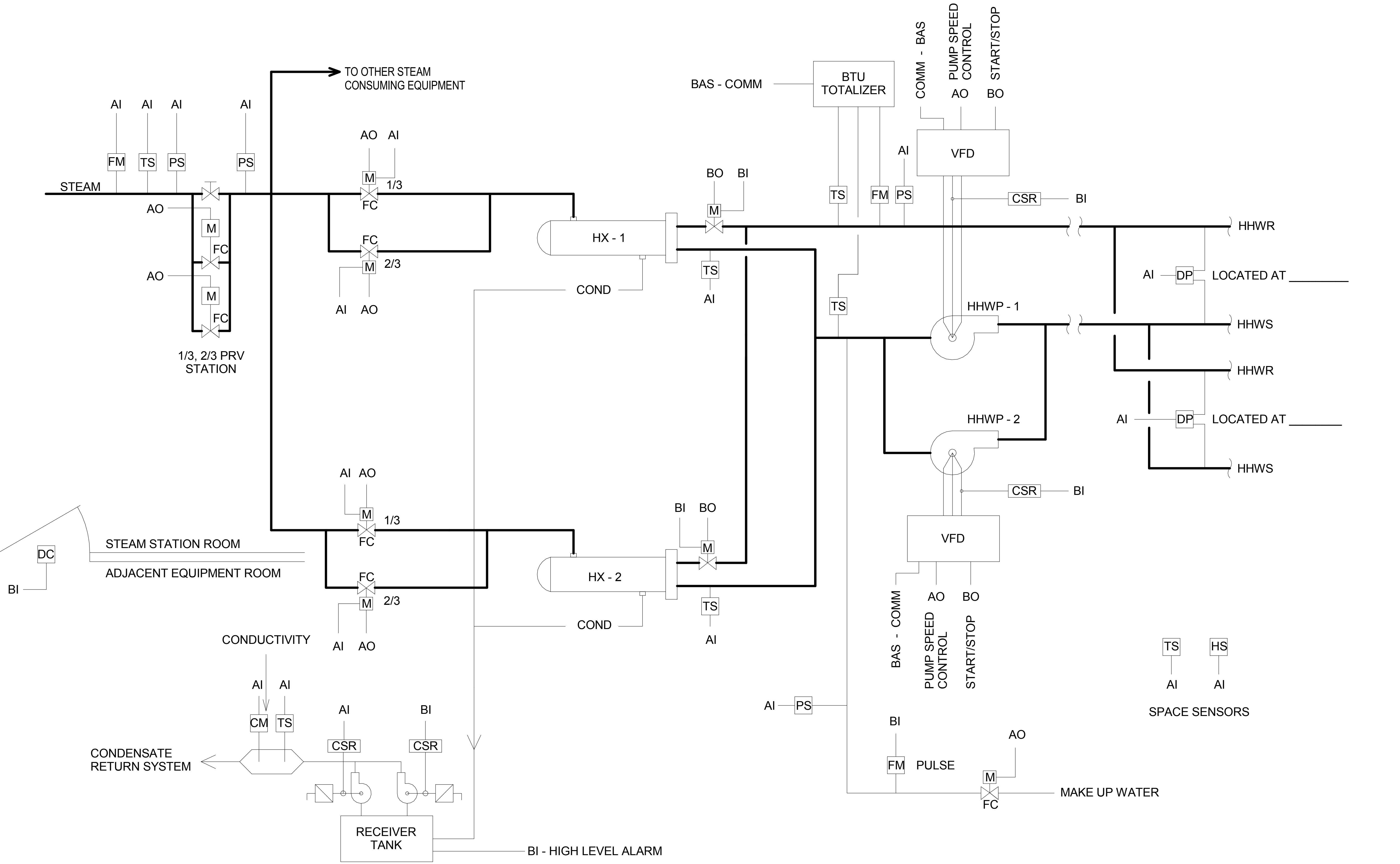
IC-11



MOSES & ASSOCIATES

MOSES LEBO AKIN BROOKS FRASIER

INTELLIGENT BUILDING SYSTEMS ENGINEERING

TITLE

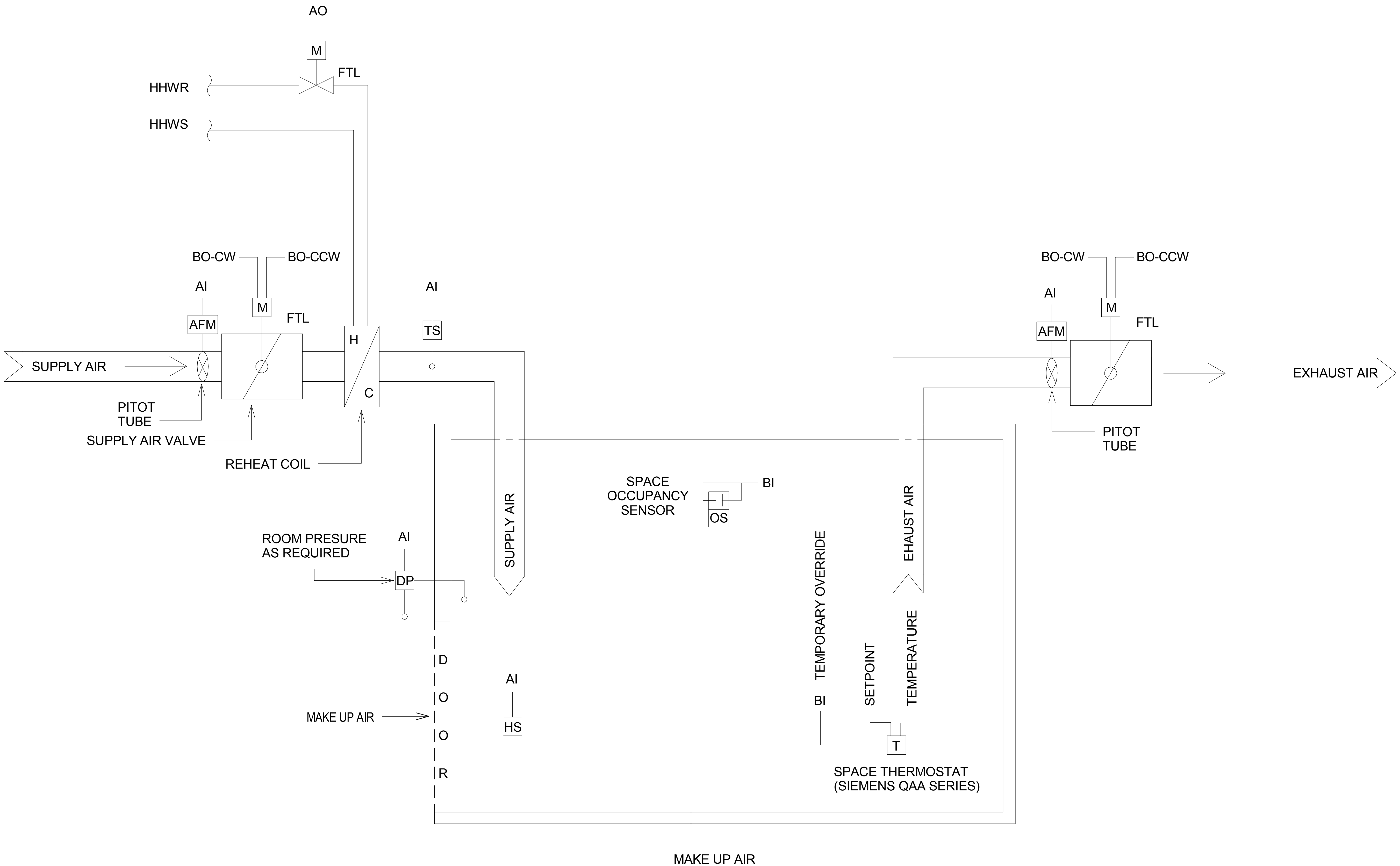
FSU CONTROL STANDARDS
HOT WATER HEAT EXCHANGER - DUAL

DATE

DESIGNED BY

11034

IC-12



MOSES & ASSOCIATES
MOSES LEED AKN BROOKS FRASIER
INTELLIGENT BUILDING SYSTEMS ENGINEERING

TITLE

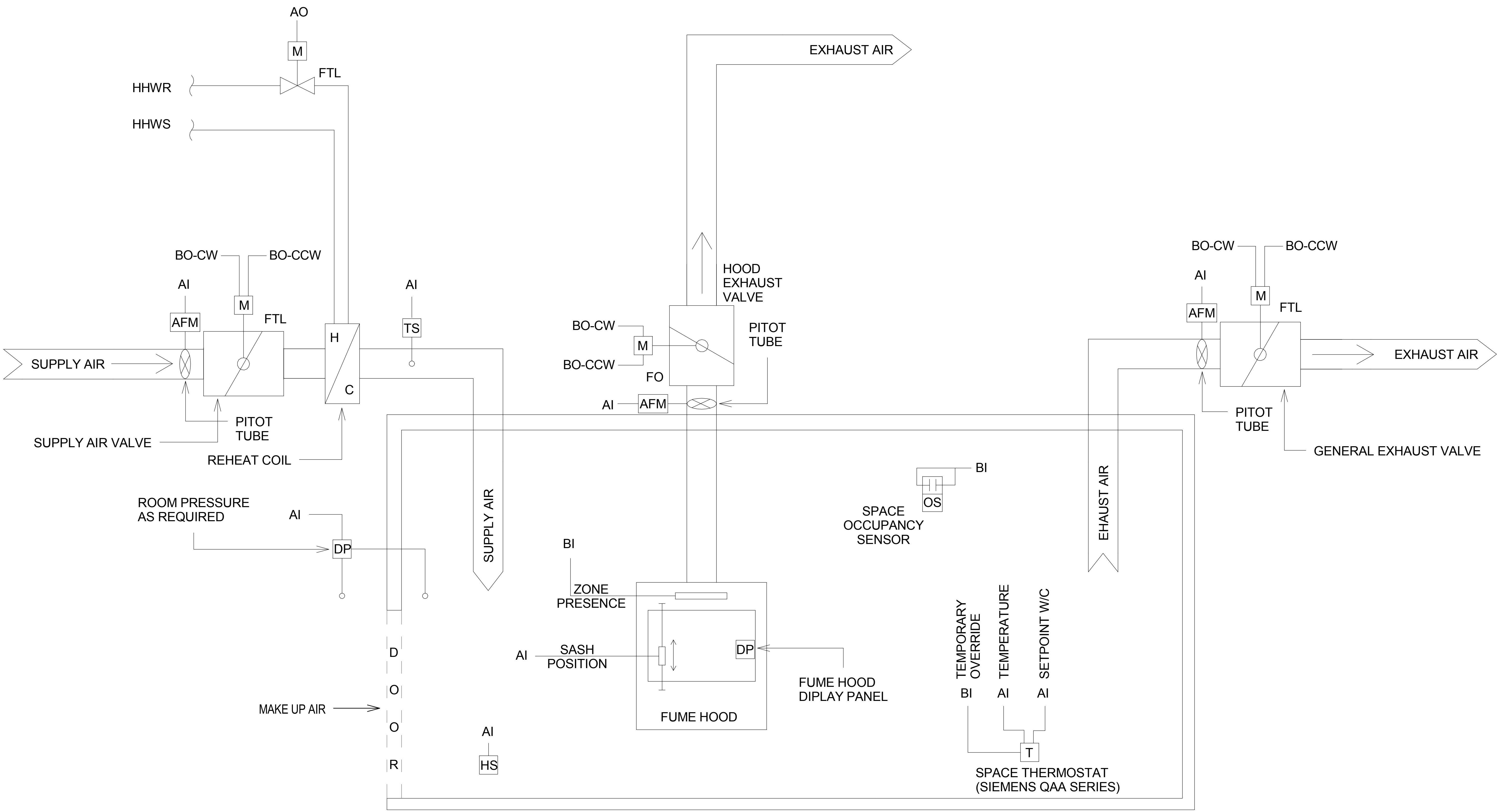
FSU CONTROL STANDARDS
LABORATORY - SUPPLY / EXHAUST / TRACKING

DATE

DESIGNED BY

11034

IC-13



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TITLE

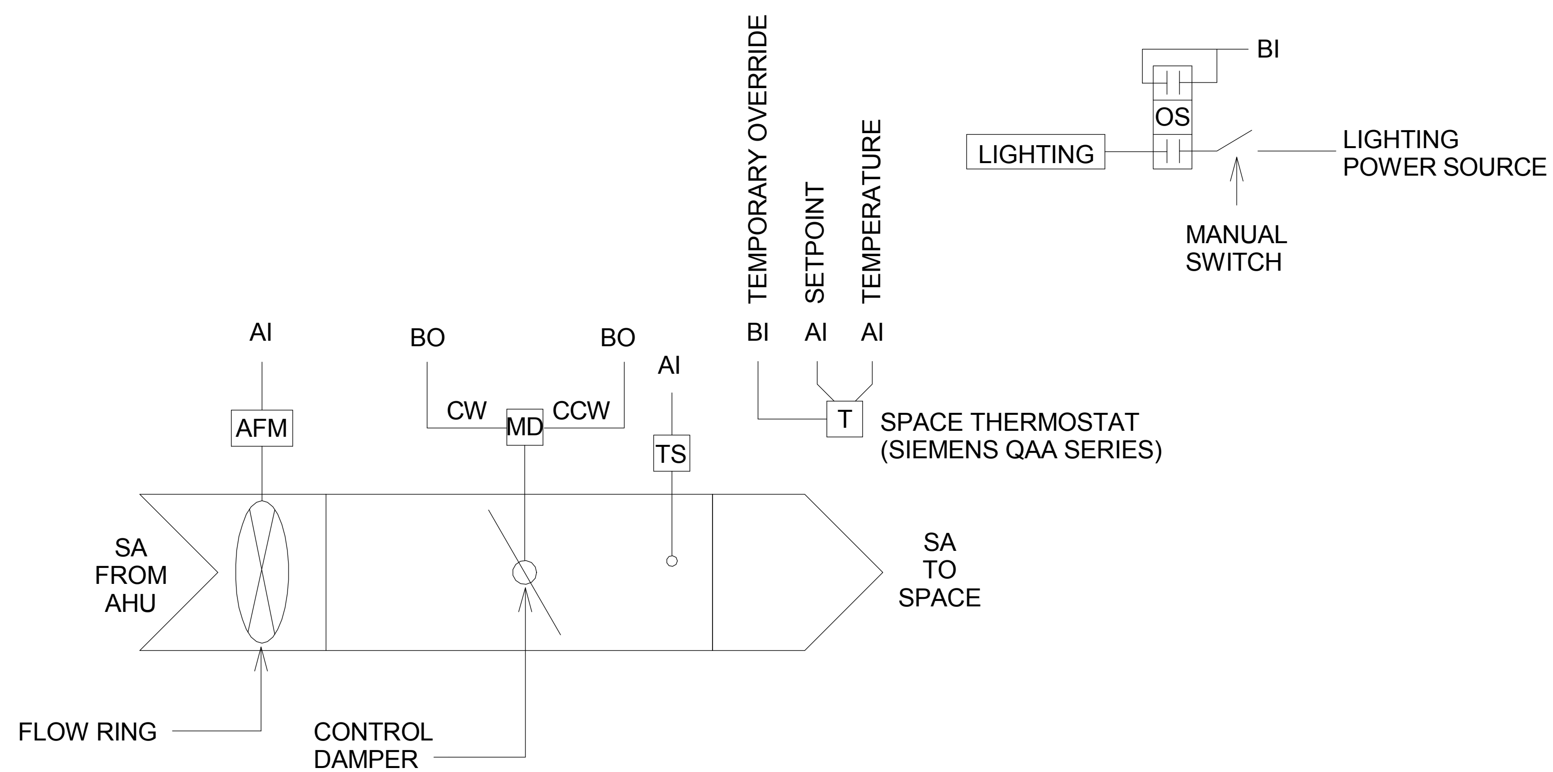
FSU CONTROL STANDARDS
LABORATORY - SUPPLY / FUME / EXHAUST / TRACKING

DATE

DESIGNED BY

11034

IC-14



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TITLE

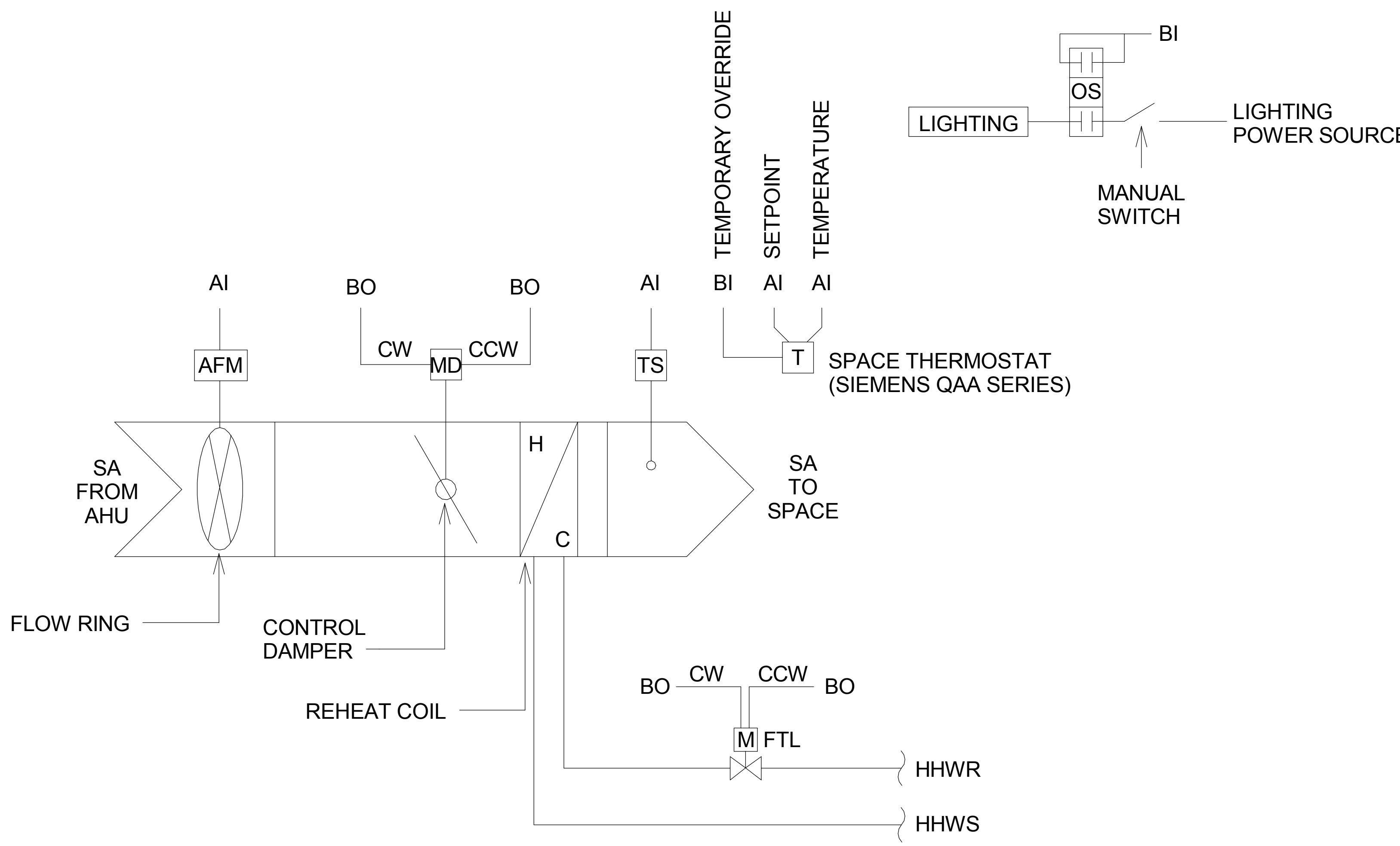
FSU CONTROL STANDARDS
VAV TERMINAL UNIT - COOLING ONLY

DATE

DESIGNED BY

11034

IC-15



TITLE

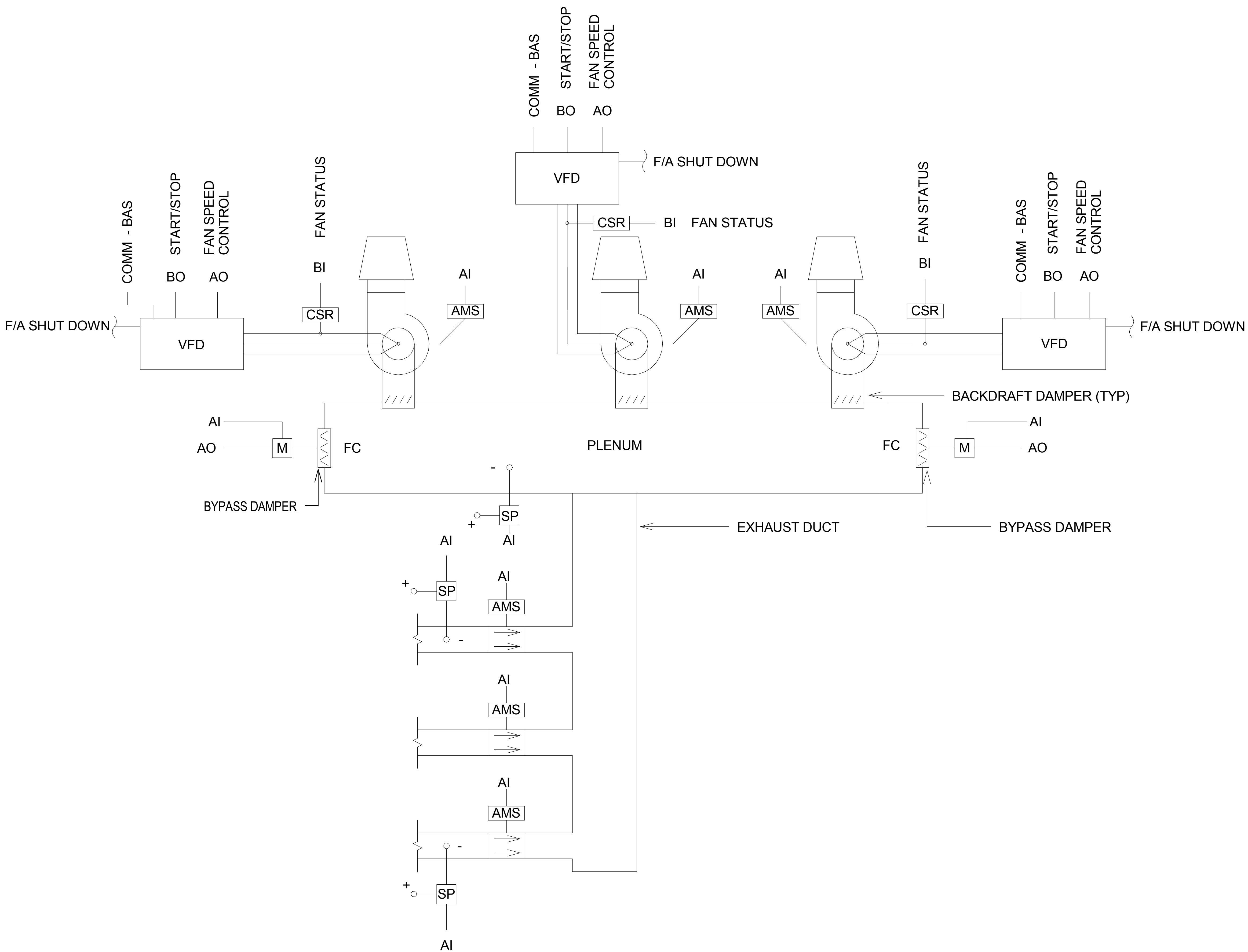
FSU CONTROL STANDARDS
VAV TERMINAL UNIT - WITH REHEAT

DATE

DESIGNED BY

11034

IC-16



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TITLE

FSU CONTROL STANDARDS
EXHAUST SYSTEM - 3 FAN MANIFOLD

DATE

DESIGNED BY

11034

IC-17

SEQUENCE OF OPERATION GUIDELINE

100% OA VAV PREHEAT-COOLING-HUM-SINGLE FAN

Document: 100% OA VAV Htg-Clg-Hum-Single Fan
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL 100% OA AHU WITH A PREHEAT COIL, COOLING COIL, HUMIDIFIER AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-1

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. HEATING AND COOLING COIL CONTROL
2. HUMIDIFIER CONTROL WITH SPACE SENSORS AND HIGH LIMIT DEVICES
3. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
4. ISOLATION DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. LOW STATIC PRESSURE LIMIT: PROVIDE A SEPARATE LOW STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE DROPS BELOW [###] IN W.G. WITH MANUAL RESET.
3. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
4. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
5. OUTSIDE AIR ISOLATION DAMPER: PROVIDE OUTSIDE AIR CONTROL DAMPERS IN THE OUTSIDE AIR SECTION WHERE SHOWN ON THE DRAWINGS. HARDWIRE OA CONTROL DAMPER TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. OA CONTROL DAMPER SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
6. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET
7. HIGH HUMIDITY LIMIT: PROVIDE HIGH HUMIDITY LIMITING DEVICE TO CLAMP THE CONTROL SIGNAL UPON REACHING THE HIGH LIMIT THRESHOLD.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND SUPPLY AIR DAMPERS: OPEN OA AND SMOKE DAMPERS TO 100% UPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE DAMPERS AND SIGNAL FAN FAILURE ALARM.
2. COOLING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. PRE-HEATING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
4. HUMIDIFIER: ENABLE HUMIDIFIER CONTROL UPON PROOF OF FAN ARRAY START. DISABLE HUMIDIFIER UPON PROOF OF FAN ARRAY STOP.

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

COOLING COIL CONTROL: BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN) SET-POINT OF 55°F (ADJ).

PREHEAT COIL CONTROL: BAS SHALL MODULATE THE PREHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN PREHEAT AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL) SET-POINT OF 50°F (ADJ).

HUMIDIFIER CONTROL: BAS SHALL MODULATE THE HUMIDIFIER CONTROL VALVE AS NEEDED TO MAINTAIN THE CALCULATED SUPPLY AIR HUMIDITY SETPOINT (AS SENSED DOWNSTREAM OF HUMIDIFIER). MONITOR THE SPACE HUMIDITY SENSORS AND DETERMINE THE HIGHEST AVERAGE HUMIDITY VALUE. THE SUPPLY AIR HUMIDITY SETPOINT SHALL BE RESET ACCORDING TO THE FOLLOWING RESET SCHEDULE.

1. SUPPLY HUMIDITY SETPOINT = 60%RH (ADJ) WHEN THE SPACE HUMIDITY IS 45%RH (ADJ);

2. SUPPLY AIR HUMIDITY SETPOINT =85%RH WHEN THE SPACE HUMIDITY IS 30%RH (ADJ). EVALUATE EVERY 10 MINUTES (ADJ)
3. DISABLE HUMIDIFIER CONTROL WHEN THE COOLING VALVE EXCEEDS 25% (ADJ).

AHU # TYPE: IC-1			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AhxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxPT	PREHEAT AIR TEMPERATURE								
bbb_AHxxPT_SP	PREHEAT AIR TEMPERATURE SETPOINT	DEG F	X			X	X		
bbb_AHxxPHV	PREHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSH	SUPPLY AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxHV	HUMIDIFIER VALVE OUTPUT	%OPEN	X						
bbb_AHxxFZ	FREEZE SAFETY	NML/ALM		X	X				
bbb_AHxxSAFETY_	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxSAFETY_	AIR HANDLER LOW PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxODS	OUTSIDE AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X			X	X		
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
bbb_Ahxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_Ahxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

100% OA VAV PREHEAT-COOLING-HUMIDIFIER-FAN ARRAY

Document: **100% OA VAV Htg-Clg-hum-Fan array**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL 100% OA AHU WITH A PREHEAT COIL, COOLING COIL, HUMIDIFIER AND FAN ARRAY. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-2

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. HEATING AND COOLING COIL CONTROL
2. HUMIDIFIER CONTROL WITH SPACE SENSORS AND HIGH LIMIT DEVICES
3. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
4. ISOLATION DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN ARRAY WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. LOW STATIC PRESSURE LIMIT: PROVIDE A SEPARATE LOW STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN ARRAY WHEN STATIC PRESSURE DROPS BELOW [###] IN W.G. WITH MANUAL RESET.
3. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN ARRAY AND SIGNAL THE FIRE ALARM.
4. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN ARRAY START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
5. OUTSIDE AIR ISOLATION DAMPER: PROVIDE OUTSIDE AIR CONTROL DAMPERS IN THE OUTSIDE AIR SECTION WHERE SHOWN ON THE DRAWINGS. HARDWIRE OA CONTROL DAMPER TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN ARRAY START UP. OA CONTROL DAMPER SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
6. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN ARRAY WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET
7. HIGH HUMIDITY LIMIT: PROVIDE HIGH HUMIDITY LIMITING DEVICE TO CLAMP THE CONTROL SIGNAL UPON REACHING THE HIGH LIMIT THRESHOLD.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN ARRAY IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN ARRAY STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND SUPPLY AIR DAMPERS: OPEN OA AND SMOKE DAMPERS TO 100% UPON FAN ARRAY SIGNAL TO START. IF FAN ARRAY FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE DAMPERS AND SIGNAL FAN ARRAY FAILURE ALARM.
2. COOLING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN ARRAY START. CLOSE VALVE TO COIL UPON PROOF OF FAN ARRAY STOP.
3. PRE-HEATING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN ARRAY START. CLOSE VALVE TO COIL UPON PROOF OF FAN ARRAY STOP.
4. HUMIDIFIER: ENABLE HUMIDIFIER CONTROL UPON PROOF OF FAN ARRAY START. DISABLE HUMIDIFIER UPON PROOF OF FAN ARRAY STOP.

FAN ARRAY SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

COOLING COIL CONTROL: BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN ARRAY) SET-POINT OF 55°F (ADJ).

PREHEAT COIL CONTROL: BAS SHALL MODULATE THE PREHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN PREHEAT AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL) SET-POINT OF 50°F (ADJ).

HUMIDIFIER CONTROL: BAS SHALL MODULATE THE HUMIDIFIER CONTROL VALVE AS NEEDED TO MAINTAIN THE CALCULATED SUPPLY AIR HUMIDITY SETPOINT (AS SENSED DOWNSTREAM OF HUMIDIFIER). MONITOR THE SPACE HUMIDITY SENSORS AND DETERMINE THE HIGHEST AVERAGE HUMIDITY VALUE. THE SUPPLY AIR HUMIDITY SETPOINT SHALL BE RESET ACCORDING TO THE FOLLOWING RESET SCHEDULE.

1. SUPPLY HUMIDITY SETPOINT = 60%RH (ADJ) WHEN THE SPACE HUMIDITY IS 45%RH (ADJ);

2. SUPPLY AIR HUMIDITY SETPOINT =85%RH WHEN THE SPACE HUMIDITY IS 30%RH (ADJ). EVALUATE EVERY 10 MINUTES (ADJ)
3. DISABLE HUMIDIFIER CONTROL WHEN THE COOLING VALVE EXCEEDS 25% (ADJ).

AHU # TYPE: IC-2			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxFW1S	AIR HANDLER FAN WALL #1 STATUS	ON/OFF		X	X				
bbb_AHxxFW2S	AIR HANDLER FAN WALL #2 STATUS	ON/OFF		X	X				
bbb_AHxxFW3S	AIR HANDLER FAN WALL #3 STATUS	ON/OFF		X	X				
bbb_AHxxFW4S	AIR HANDLER FAN WALL #4 STATUS	ON/OFF		X	X				
bbb_AHxxFW5S	AIR HANDLER FAN WALL #5 STATUS	ON/OFF		X	X				
bbb_AHxxFW6S	AIR HANDLER FAN WALL #6 STATUS	ON/OFF		X	X				
bbb_AHxxFW7S	AIR HANDLER FAN WALL #7 STATUS	ON/OFF		X	X				
bbb_AHxxFW8S	AIR HANDLER FAN WALL #8 STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxPT	PREHEAT AIR TEMPERATURE					X	X		
bbb_AHxxPT_SP	PREHEAT AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxPHV	PREHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSH	SUPPLY AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxHV	HUMIDIFIER VALVE OUTPUT	%OPEN	X						
bbb_AHxxFZ	FREEZE SAFETY	NML/ALM		X	X				
bbb_AHxxSAFETY	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxSAFETY	AIR HANDLER LOW PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxODS	OUTSIDE AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
bbb_AHxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_AHxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

100% OA VAV PREHEAT-COOLING-ER-SINGLE FAN

Document: 100% OA VAV Htg-Clg-ER-Single Fan
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL 100% OA AHU WITH A PREHEAT COIL, COOLING COIL, ENERGY RECOVERY UNIT AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-3

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. HEATING AND COOLING COIL CONTROL
2. ENERGY RECOVERY SYSTEM CONTROL
3. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
4. ISOLATION DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. LOW STATIC PRESSURE LIMIT: PROVIDE A SEPARATE LOW STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE DROPS BELOW [###] IN W.G. WITH MANUAL RESET.
3. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
4. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
5. OUTSIDE AIR ISOLATION DAMPER: PROVIDE OUTSIDE AIR CONTROL DAMPERS IN THE OUTSIDE AIR SECTION WHERE SHOWN ON THE DRAWINGS. HARDWIRE OA CONTROL DAMPER TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. OA CONTROL DAMPER SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
6. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET
7.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND SUPPLY AIR DAMPERS: OPEN OA AND SMOKE DAMPERS TO 100% UPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE DAMPERS AND SIGNAL FAN FAILURE ALARM.
2. COOLING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. PRE-HEATING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
4. PRE-HEATING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

COOLING COIL CONTROL: BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN) SET-POINT OF 55°F (ADJ).

PREHEAT COIL CONTROL: BAS SHALL MODULATE THE PREHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN PREHEAT AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL) SET-POINT OF 50°F (ADJ).

ENERGY RECOVERY CONTROL: BAS SHALL ENABLE THE ENERGY RECOVERY WHEEL WHEN THE OUTDOOR AIR TEMPERATURES ARE BELOW 48 DEGF (ADJ) AND ABOVE 75 DEGF (ADJ). THE ENERGY RECOVERY WHEEL SHALL REMAIN OFF AT ALL OTHER CONDITIONS.

EXHAUST FAN CONTROL: INTERLOCK THE EXHAUST FAN TO RUN WHENEVER THE SUPPLY FAN IS RUNNING. THE EXHAUST FAN SPEED SHALL RUN IN PARALLEL WITH THE SUPPLY FAN SPEED BUT AT A PREDEFINED OFFSET ESTABLISHED THROUGH THE TEST ADJUST AND BALANCE PROCESS PROCEDURE.

AHU # TYPE: IC-3			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxPT	PREHEAT AIR TEMPERATURE					X	X		
bbb_AHxxPT_SP	PREHEAT AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxPHV	PREHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSH	SUPPLY AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxHV	HUMIDIFIER VALVE OUTPUT	%OPEN	X						
bbb_AHxxFZ	FREEZE SAFETY	NML/ALM		X	X				
bbb_AHxxSAFETY_HI	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxSAFETY_LO	AIR HANDLER LOW PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxODS	OUTSIDE AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_EFxxSS	EXHAUST FAN START/STOP	ON/OFF		X	X				
bbb_EFxxS	EXHAUST FAN STATUS	ON/OFF		X	X				
bbb_EFxxSF_VFD	EXHAUST FAN VFD OUTPUT	%	X						
bbb_HWxxSS	HEAT WHEEL START/STOP	ON/OFF		X	X				
bbb_HWxxS	HEAT WHEEL STATUS	ON/OFF		X	X				
bbb_HWxxSF_VFD	HEAT WHEEL VFD OUTPUT	%	X						
bbb_HWxx_EAH	EXHAUST AIR TEMPERATURE ENTERING HW	DEG F	X			X	X		
bbb_HWxx_EAT	EXHAUST AIR RELATIVE HUMIDITY ENTERING HW	%RH	X						

bbb_EFxxEAFLW	EXHAUST AIR FLOW	CFM	X						
bbb_EFxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X						
bbb_HWxx_LAH	EXHAUST AIR TEMPERATURE LEAVING HW	DEG F	X			X	X		
bbb_HWxx_LAT	EXHAUST AIR RELATIVE HUMIDITY LEAVING HW	%RH	X						
bbb_AHxx_EAH	SUPPLY AIR TEMPERATURE ENTERING HW	DEG F	X			X	X		
bbb_AHxx_EAT	SUPPLY AIR RELATIVE HUMIDITY ENTERING HW	%RH	X						
bbb_AHxx_LAH	SUPPLY AIR TEMPERATURE LEAVING HW	DEG F	X			X	X		
bbb_AHxx_LAT	SUPPLY AIR RELATIVE HUMIDITY LEAVING HW	%RH	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	NML/ALM		X	X			X	
bbb_EFxxHZ	EXHAUST FAN VFD HERTZ	HZ	X					X	
bbb_EFxxKW	EXHAUST FANVFD KW DEMAND	KW	X					X	
bbb_Efxx_A	EXHAUST FAN VFD ALARM	NML/ALM		X	X			X	
bbb_HWxxHZ	HEAT WHEEL FAN VFD HERTZ	HZ	X					X	
bbb_HWxxKW	HEAT WHEEL FANVFD KW DEMAND	KW	X					X	
bbb_HWxx_A	HEAT WHEEL FAN VFD ALARM	NML/ALM		X	X			X	
bbb_Ahxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_Ahxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

100% OA VAV PREHEAT-COOLING-HUM-HEATPIPE-SINGLE FAN

Document: 100% OA VAV Htg-Clg-Hum-HP-Single Fan
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL 100% OA AHU WITH A PREHEAT COIL, COOLING COIL, HUMIDIFIER, HEATPIPE AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-4

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. HEATING AND COOLING COIL CONTROL
2. HUMIDIFIER CONTROL WITH SPACE SENSORS AND HIGH LIMIT DEVICES
3. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
4. ISOLATION DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. LOW STATIC PRESSURE LIMIT: PROVIDE A SEPARATE LOW STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE DROPS BELOW [###] IN W.G. WITH MANUAL RESET.
3. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
4. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
5. OUTSIDE AIR ISOLATION DAMPER: PROVIDE OUTSIDE AIR CONTROL DAMPERS IN THE OUTSIDE AIR SECTION WHERE SHOWN ON THE DRAWINGS. HARDWIRE OA CONTROL DAMPER TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. OA CONTROL DAMPER SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
6. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET
7. HIGH HUMIDITY LIMIT: PROVIDE HIGH HUMIDITY LIMITING DEVICE TO CLAMP THE CONTROL SIGNAL UPON REACHING THE HIGH LIMIT THRESHOLD.

<u>START-STOP SEQUENCES</u>: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. <u>OUTSIDE AIR AND SUPPLY AIR DAMPERS</u>: OPEN OA AND SMOKE DAMPERS TO 100% UPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE DAMPERS AND SIGNAL FAN FAILURE ALARM.
2. <u>COOLING COIL CONTROL VALVE</u>: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. <u>PRE-HEATING COIL CONTROL VALVE</u>: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
4. <u>HUMIDIFIER</u>: ENABLE HUMIDIFIER CONTROL UPON PROOF OF FAN ARRAY START. DISABLE HUMIDIFIER UPON PROOF OF FAN ARRAY STOP.
5. <u>HEAT PIPE VALVE</u>: ENABLE HEAT PIPE CONTROL UPON PROOF OF FAN START. CLOSE HEAT PIPE VALVE UPON PROOF OF FAN STOP

<u>FAN SPEED CONTROL</u>: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

<u>STATIC PRESSURE RESET CONTROL</u>: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

<u>COOLING COIL CONTROL</u>: BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN A COOLING COIL AIR DISCHARGE AIR TEMPERATURE SET-POINT OF 53°F (ADJ).

<u>PREHEAT COIL CONTROL</u>: BAS SHALL MODULATE THE PREHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN PREHEAT AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL) SET-POINT OF 50°F (ADJ).

<u>HUMIDIFIER CONTROL</u>: BAS SHALL MODULATE THE HUMIDIFIER CONTROL VALVE AS NEEDED TO MAINTAIN THE CALCULATED SUPPLY AIR HUMIDITY SETPOINT (AS SENSED DOWNSTREAM OF HUMIDIFIER). MONITOR THE SPACE HUMIDITY SENSORS AND DETERMINE THE HIGHEST AVERAGE HUMIDITY VALUE. THE SUPPLY AIR HUMIDITY SETPOINT SHALL BE RESET ACCORDING TO THE FOLLOWING RESET SCHEDULE:

1. SUPPLY HUMIDITY SETPOINT = 60%RH (ADJ) WHEN THE SPACE HUMIDITY IS 45%RH (ADJ);

2. SUPPLY AIR HUMIDITY SETPOINT =85%RH WHEN THE SPACE HUMIDITY IS 30%RH (ADJ). EVALUATE EVERY 10 MINUTES (ADJ)
3. DISABLE HUMIDIFIER CONTROL WHEN THE COOLING VALVE EXCEEDS 25% (ADJ).

HEAT PIPE COIL CONTROL: THE BAS SHALL MODULATE THE HEAT PIPE COIL CONTROL VALVE AS REQUIRED TO MAINTAIN A CALCULATED SUPPLY AIR TEMPERATURE (AS SENSED DOWNSTREAM OF PREHEAT COIL). THE SUPPLY AIR SETPOINT SHALL BE ESTABLISHED USING THE FOLLOWING RESET STRATEGY:

1. START THE SUPPLY AIR SETPOINT AT 55 DEGF (ADJ).
2. POLL ALL DOWN STREAM REHEAT COILS EVERY 10 MINUTES.
3. ADJUST THE SUPPLY AIR SETPOINT UP BY 1 DEGF (ADJ) IF ALL REHEAT COILS ARE COMMANDED TO 25% OR GREATER.
4. ADJUST THE SUPPLY AIR SETPOINT DOWN BY 1 DEGF (ADJ) IF ANY REHEAT COIL IS AT 0% AND ANY AIR TERMINAL IS GREATER THAN 90%.
5. LIMIT THE RESET TO RANGE TO A MINIMUM OF 55 DEGF (ADJ) AND A MAXIMUM OF 62 DEGF (ADJ)
6. IN THE EVENT ANY SPACE HUMIDITY SENSOR EXCEEDS THE HIGH LIMIT SETPOINT OF 58% (ADJ), RESET THE SUPPLY AIR SETPOINT TO THE MINIMUM SETPOINT UNTIL THE HUMIDITY LEVELS DROP BELOW 50%RH (ADJ) IN THE SPACE. THIS HUMIDITY OVERRIDE MODE SHALL REMAIN IN EFFECT FOR NO LESS THAN 1 HR (ADJ).
7. UPON RE-ESTABLISHMENT OF THE SUPPLY AIR RESET SEQUENCE, START THE SUPPLY AIR SETPOINT AT THE MINIMUM VALUE AND ALLOW THE RESET STRATEGY TO RESET THE SUPPLY AIR TEMPERATURE UP ACCORDING TO THE RESET SEQUENCE DESCRIBED ABOVE.

AHU # TYPE: IC-4			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxPT	PREHEAT AIR TEMPERATURE	DEG F				X	X		
bbb_AHxxPT_SP	PREHEAT AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxPHV	PREHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxHP1T	HEAT PIPE-1 LEAVING AIR TEMPERATURE (precool)	DEG F				X	X		
bbb_AHxxHP2T	HEAT PIPE-2 LEAVING AIR TEMPERATURE (reheat)	DEG F				X	X		
bbb_AHxxPT_SP	HEAT PIPE TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxHPV	HEAT PIPE VALVE OUTPUT	%OPEN	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSH	SUPPLY AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxHV	HUMIDIFIER VALVE OUTPUT	%OPEN	X						
bbb_AHxxFZ	FREEZE SAFETY	NML/ALM		X	X				
bbb_AHxxSAFETY_	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxSAFETY_	AIR HANDLER LOW PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxODS	OUTSIDE AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
						X	X		
bbb_AHxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_AHxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

MIXED AIR VAV-COOLING-REHEAT-SINGLE FAN

Document: **Mixed Air VAV Clg-Rht-Single Fan**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL MIXED AIR SINGLE ZONE PATH AHU WITH A COOLING COIL, REHEAT COIL AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-5

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. HEATING AND COOLING COIL CONTROL
2. VARIABLE FREQUENCY DRIVE WITH SINGLE ZONE CONTROL
3. ISOLATION DAMPER CONTROL
4. MIXED AIR DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
3. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND RETURN AIR DAMPERS: OPEN RETURN DAMPERS AND ENABLE OA AIRFLOW CONTROLUPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE RETURN AIR DAMPER AND SIGNAL FAN FAILURE ALARM.

2. COOLING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. REHEAT COIL CONTROL VALVE: ENABLE REHEAT COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.

FAN SPEED CONTROL: MODULATE FAN SPEED AS NEEDED TO MAINTAIN THE COOLING SETPOINT OF 74 DEGF (ADJ). UPON A CALL FOR MORE COOLING, INCREASE FAN SPEED AND ON A CALL FOR LESS COOLING, REDUCE FAN SPEED. THE MINIMUM AND MAXIMUM FAN SPEED SHALL BE ESTABLISHED BY TAB IN ACCORDANCE WITH THE MINIMUM AND MAXIMUM FLOW DESCRIBED IN THE FAN SCHEDULE.

REHEAT COIL CONTROL: THE BAS SHALL MODULATE THE REHEAT COIL CONTROL VALVE AS REQUIRED TO MAINTAIN THE SPACE HEATING SETPOINT OF 70 DEGF (ADJ). THE REHAT VALVE SHALL ONLY OPEN WHEN THEFAN IS RUNNING AT ITS MINIMUM SPEED.

OUTSIDE AIR CONTROL: PROVIDE AIRFLOW MONITORING STATION OUTSIDE AIR DUCT TO MODULATE OUTSIDE AIR DAMPER AND RETURN AIR DAMPER IN SEQUENCE TO MAINTAIN THE OUTSIDE AIRFLOW SET-POINT REGARDLESS OF FAN SPEED OR FILTER LOADING. WITH THE RETURN AIR DAMPER OPEN, MODULATE THE OUTSIDE AIR DAMPER OPEN/CLOSED AS REQUIRED TO MAINTAIN THE CALCULATED AIR FLOW SETPOINT. IN THE EVENT THE OUTSIDE AIR DAMPER IS FULLY OPEN (100%) AND THE OUTSIDE AIR VOLUME IS BELOW SET-POINT, BEGIN MODULATING THE RETURN AIR DAMPER TOWARDS ITS CLOSED POSITION BUT NOT LESS THAN 50% (ADJ).

OUTDOOR AIR FLOW RESET CONTROL: BAS SHALL CONTINUOUSLY POLL ALL CO2 SENSORS, AND PERFORM A HIGH SELECT FUNCTION TO DETERMINE A VIRTUAL CO2 CONTROL POINT USED IN THE RESET CONTROL. IF THE CO2 CONTROL POINT IS LOWER THAN 700 PPM THE BAS SHALL BEGIN RESETTING THE OUTDOOR AIRFLOW SET-POINT DOWN AT A RATE OF -100 CFM EVERY 5 MINUTES UNTIL THE CO2 LEVELS RISE ABOVE 900 PPM OR OUTDOOR AIRFLOW REACHES THE LOW LIMIT OF [###] CFM. IF THE CO2 CONTROL POINT IS HIGHER THAN 1000 PPM THE BAS SHALL RESET THE OUTDOOR AIRFLOW SET-POINT UP AT A RATE OF +250 CFM EVERY 5 MINUTES UNTIL THE CONTROL POINT FALLS BELOW 900 PPM OR THE OUTDOOR AIRFLOW SET-POINT REACHES THE HIGH LIMIT OF [###] CFM.

AHU # TYPE: IC-5			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxRA	RETURN AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxRH	RETURN AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxRD	MODULATING RETURN AIR DAMPER	%OPEN	X						
bbb_AHxxMA	MIXED AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxOD	MODULATING OUTDOOR AIR DAMPER	%OPEN	X						
bbb_AHxxOAFLW	FRESH AIR FLOW	CFM	X						
bbb_AHxxOAFLW_SP	FRESH AIR FLOW SETPOINT	CFM	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxRT	REHEAT AIR TEMPERATURE					X	X		
bbb_AHxxRT_SP	REHEAT AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxRHV	REHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSH	SUPPLY AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxxSAFETY_HI	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxRDS	RETURN AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
bbb_AHxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_AHxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		
bbb_AHxx_CO2	SPACE CO2 SENSOR-1	PPM	X			X			
bbb_AHxx_CO2	SPACE CO2 SENSOR-2	PPM	X			X			

SEQUENCE OF OPERATION GUIDELINE

MIXED AIR VAV-PREHEAT-COOLING-SINGLE FAN

Document: **Mixed Air VAV-Prht-Clg-Single Fan**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL MIXED AIR SINGLE PATH AHU WITH A PREHEAT COIL, COOLING COIL AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-7

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. PREHEAT COIL CONTROL
2. COOLING COIL CONTROL
3. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
4. ISOLATION DAMPER CONTROL
5. MIXED AIR DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
3. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.
4. FREEZSTAT: PROVIDE LOW TEMPERATURE SAFETY SWITCH DOWNSTREAM OF PRE-HEAT COIL TO STOP THE FAN WHEN PRE-HEAT COIL DISCHARGE TEMPERATURE DROPS BELOW 38°F (ADJ). MANUAL RESET

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND RETURN AIR DAMPERS: OPEN RETURN DAMPERS AND ENABLE OA AIRFLOW CONTROLUPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE RETURN AIR DAMPER AND SIGNAL FAN FAILURE ALARM.
2. COOLING COIL CONTROL VALVE: ENABLE COOLING COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. PREHEAT COIL CONTROL VALVE: ENABLE PREHEAT COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

COOLING COIL CONTROL: THE BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN) SET-POINT OF 55°F (ADJ).

PREHEAT COIL CONTROL: THE BAS SHALL MODULATE THE PREHEAT COIL CONTOL VALVE AS REQUIRED TO MAINTAIN PREHEAT SUPPLY TEMPERATURE AT 52 DEGF (ADJ).

OUTSIDE AIR CONTROL: PROVIDE AIRFLOW MONITORING STATION OUTSIDE AIR DUCT TO MODULATE OUTSIDE AIR DAMPER AND RETURN AIR DAMPER IN SEQUENCE TO MAINTAIN THE OUTSIDE AIRFLOW SET-POINT REGARDLESS OF FAN SPEED OR FILTER LOADING. WITH THE RETURN AIR DAMPER OPEN, MODULATE THE OUTSIDE AIR DAMPER OPEN/CLOSED AS REQUIRED TO MAINTAIN THE CALCULATED AIR FLOW SETPOINT. IN THE EVENT THE OUTSIDE AIR DAMPER IS FULLY OPEN (100%) AND THE OUTSIDE AIR VOLUME IS BELOW SET-POINT, BEGIN MODULATING THE RETURN AIR DAMPER TOWARDS ITS CLOSED POSITION BUT NOT LESS THAN 50% (ADJ).

OUTDOOR AIR FLOW RESET CONTROL: BAS SHALL CONTINUOUSLY POLL ALL CO2 SENSORS, AND PERFORM A HIGH SELECT FUNCTION TO DETERMINE A VIRTUAL CO2 CONTROL POINT USED IN THE RESET CONTROL. IF THE CO2 CONTROL POINT IS LOWER THAN 700 PPM THE BAS SHALL BEGIN RESETTING THE OUTDOOR AIRFLOW SET-POINT DOWN AT A RATE OF -100 CFM EVERY 5 MINUTES UNTIL THE CO2 LEVELS RISE ABOVE 900 PPM OR OUTDOOR AIRFLOW REACHES THE LOW LIMIT OF [###] CFM. IF THE CO2 CONTROL POINT IS HIGHER THAN 1000 PPM THE BAS SHALL RESET THE OUTDOOR AIRFLOW SET-POINT UP AT A RATE OF +250 CFM EVERY 5 MINUTES UNTIL THE CONTROL

POINT FALLS BELOW 900 PPM OR THE OUTDOOR AIRFLOW SET-POINT REACHES THE HIGH LIMIT OF [###] CFM.

AHU #			POINT TYPE		ALARM			INTEGRATED POINT	NOTES
TYPE: IC-7					CONDITION				
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxRA	RETURN AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxRH	RETURN AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxx_CO2	RETURN AIR CO2 SENSOR	PPM	X			X			
bbb_AHxxRD	MODULATING RETURN AIR DAMPER	%OPEN	X						
bbb_AHxxMA	MIXED AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxOD	MODULATING OUTDOOR AIR DAMPER	%OPEN	X						
bbb_AHxxOAFLW	FRESH AIR FLOW	CFM	X						
bbb_AHxxOAFLW_SP	FRESH AIR FLOW SETPOINT	CFM	X						
bbb_AHxxOAFLTDP	STATIC PRESSURE ACROSS OA FILTERS	INWG	X			X			
bbb_AHxxPT	PREHEAT AIR TEMPERATURE	DEG F				X	X		
bbb_AHxxPT_SP	PREHEAT AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxPHV	PREHEAT VALVE OUTPUT	%OPEN	X						
bbb_AHxxHWR	HOT WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSAFETY_HI	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxRDS	RETURN AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
bbb_AHxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_AHxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		
bbb_AHxx_CO2	SPACE CO2 SENSOR-1	PPM	X			X			
bbb_AHxx_CO2	SPACE CO2 SENSOR-2	PPM	X			X			

SEQUENCE OF OPERATION GUIDELINE

MIXED AIR VAV-COOLING-SINGLE FAN

Document: **Mixed Air VAV Clg-Single Fan**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL MIXED AIR SINGLE PATH AHU WITH A COOLING COIL AND SINGLE FAN. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-6

PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT.

1. COOLING COIL CONTROL
2. VARIABLE FREQUENCY DRIVE WITH STATIC PRESSURE CONTROL
3. ISOLATION DAMPER CONTROL
4. MIXED AIR DAMPER CONTROL

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

1. HIGH STATIC PRESSURE LIMIT: PROVIDE A SEPARATE HIGH STATIC PRESSURE SWITCH (ADJ) TO STOP THE FAN WHEN STATIC PRESSURE RISES TO [###] IN W.G. WITH MANUAL RESET.
2. SMOKE DETECTORS: SMOKE DETECTORS SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL THE FIRE ALARM.
3. SMOKE DAMPER: PROVIDE SMOKE DAMPERS IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS. HARDWIRE SMOKE DAMPERS TO CLOSE UPON UNIT SHUTDOWN AND OPEN ON FAN START UP. SMOKE DAMPERS SHALL OPEN/CLOSE WITHOUT BAS SUPPORT.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AIR HANDLING UNIT FAN IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTSIDE AIR AND RETURN AIR DAMPERS: OPEN RETURN DAMPERS AND ENABLE OA AIRFLOW CONTROLUPON FAN SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE RETURN AIR DAMPER AND SIGNAL FAN FAILURE ALARM.

2. COOLING COIL CONTROL VALVE: ENABLE COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED ON SUPPLY AIR DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE TO MAINTAIN THE CALCULATED STATIC PRESSURE SET-POINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE AHU AND INITIATE AN ALARM.

STATIC PRESSURE RESET CONTROL: BAS SHALL POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 60% AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1" WG. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 90%, THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25" WG. THE BAS SHALL POLL ALL AIR TERMINALS CONTINUOUSLY AND LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES. LIMIT THE RESET TO A MINIMUM STATIC OF [###] INWG AND A MAXIMUM OF [###] AS SETERMINED BY THE TEST, ADJUST AND BALANCE PROCEDURE.

COOLING COIL CONTROL: THE BAS SHALL MODULATE THE COOLING COIL CONTROL VALVE AS REQUIRED TO MAINTAIN SUPPLY AIR DISCHARGE AIR TEMPERATURE (AS SENSED DOWNSTREAM OF FAN) SET-POINT OF 55°F (ADJ).

OUTSIDE AIR CONTROL: PROVIDE AIRFLOW MONITORING STATION OUTSIDE AIR DUCT TO MODULATE OUTSIDE AIR DAMPER AND RETURN AIR DAMPER IN SEQUENCE TO MAINTAIN THE OUTSIDE AIRFLOW SET-POINT REGARDLESS OF FAN SPEED OR FILTER LOADING. WITH THE RETURN AIR DAMPER OPEN, MODULATE THE OUTSIDE AIR DAMPER OPEN/CLOSED AS REQUIRED TO MAINTAIN THE CALCULATED AIR FLOW SETPOINT. IN THE EVENT THE OUTSIDE AIR DAMPER IS FULLY OPEN (100%) AND THE OUTSIDE AIR VOLUME IS BELOW SET-POINT, BEGIN MODULATING THE RETURN AIR DAMPER TOWARDS ITS CLOSED POSITION BUT NOT LESS THAN 50% (ADJ).

OUTDOOR AIR FLOW RESET CONTROL: BAS SHALL CONTINUOUSLY POLL ALL CO2 SENSORS, AND PERFORM A HIGH SELECT FUNCTION TO DETERMINE A VIRTUAL CO2 CONTROL POINT USED IN THE RESET CONTROL. IF THE CO2 CONTROL POINT IS LOWER THAN 700 PPM THE BAS SHALL BEGIN RESETTING THE OUTDOOR AIRFLOW SET-POINT DOWN AT A RATE OF -100 CFM EVERY 5 MINUTES UNTIL THE CO2 LEVELS RISE ABOVE 900 PPM OR OUTDOOR AIRFLOW REACHES THE LOW LIMIT OF [###] CFM. IF THE CO2 CONTROL POINT IS HIGHER THAN 1000 PPM THE BAS SHALL RESET THE OUTDOOR AIRFLOW SET-POINT UP AT A RATE OF +250 CFM EVERY 5 MINUTES UNTIL THE CONTROL POINT FALLS BELOW 900 PPM OR THE OUTDOOR AIRFLOW SET-POINT REACHES THE HIGH LIMIT OF [###] CFM.

AHU # TYPE: IC-6			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_AHxxSS	AIR HANDLER START/STOP	ON/OFF		X	X				
bbb_AHxxS	AIR HANDLER STATUS	ON/OFF		X	X				
bbb_AHxxSF_VFD	SUPPLY FAN VFD OUTPUT	%	X						
bbb_AHxxUV_SS	UV LIGHT START/STOP	ON/OFF		X	X				
bbb_AHxxUV_S	UV LIGHT STATUS	ON/OFF		X	X				
bbb_AHxxRA	RETURN AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxRH	RETURN AIR RELATIVE HUMIDITY	%RH	X						
bbb_AHxx_CO2	RETURN AIR CO2 SENSOR	PPM	X			X			
bbb_AHxxRD	MODULATING RETURN AIR DAMPER	%OPEN	X						
bbb_AHxxMA	MIXED AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxOD	MODULATING OUTDOOR AIR DAMPER	%OPEN	X						
bbb_AHxxOAFLW	FRESH AIR FLOW	CFM	X						
bbb_AHxxOAFLW_SP	FRESH AIR FLOW SETPOINT	CFM	X						
bbb_AHxxCT	COOLING COIL AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxCT_SP	COOLING COIL AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_AHxxCHWR	CHILLED WATER RETURN TEMPERATURE	DEG F	X						
bbb_AHxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_AHxxSA_SP	SUPPLY AIR TEMPERATURE SETPOINT	DEG F	X						
bbb_AHxxSAFETY_HI	AIR HANDLER HIGH PRESSURE SAFETY SHUTDOWN STATUS	NML/ALM		X	X				
bbb_AHxxRDS	RETURN AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxSDS	SUPPLY AIR SMOKE DAMPER STATUS	OPN/CLO		X	X				
bbb_AHxxFLTDP	COMPOUND STATIC PRESSURE ACROSS FILTERS	INWG	X			X			
bbb_AHxxSP1	SUPPLY STATIC AFTER FAN	INWG	X			X	X		
bbb_AHxxSP2	STATIC 2/3 IN DUCT	INWG	X			X	X		
bbb_AHxxSP2_SP	STATIC 2/3 IN DUCT SETPOINT	INWG	X						
bbb_AHxxSAFLW	SUPPLY AIR FLOW	CFM	X						
bbb_AHxxSHZ	SUPPLY FAN VFD HERTZ	HZ	X					X	
bbb_AHxxSKW	SUPPLY FANVFD KW DEMAND	KW	X					X	
bbb_AHxxSA	SUPPLY FAN VFD ALARM	KW		X	X			X	
bbb_AHxx_RH1	SPACE HUMIDITY SENSOR-1	%RH	X			X	X		
bbb_AHxx_RH2	SPACE HUMIDITY SENSOR-2	%RH	X			X	X		
bbb_AHxx_CO2	SPACE CO2 SENSOR-1	PPM	X			X			
bbb_AHxx_CO2	SPACE CO2 SENSOR-2	PPM	X			X			

SEQUENCE OF OPERATION GUIDELINE

CHILLED WATER PUMPING

Document: **CHW-1-rev1**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL BUILDING CHILLED WATER PUMPING SYSTEM. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. THE PUMP CONTROL SEQUENCE HAS BEEN WRITTEN TO ACCOMODATE A TWO PUMP DESIGN. TWO DIFFERENT PUMP CONTROL SEQUENCES ARE SHOWN TO ACCOUNT FOR BOTH THE 100% REDUNDANT CONDITION AND THE CONDITION IN WHICH EACH PUMP IS SIZED FOR 50% OF THE TOTAL LOAD. SELECT THE APPROPRIATE SEQUENCE ACCORDING TO THE SPECIFIC APPLICATION.

4. REFERENCE STANDARD CONTROL DIAGRAM IC-8.

CHILLED WATER PUMPING

PROVIDE THE FOLLOWING FOR CHILLED WATER PUMPING SYSTEMS.

1. APPROPRIATE TEMPERATURE, FLOW AND PRESSURE SENSORS.
2. BTU METERS
3. DIFFERENTIAL PRESSURE SENSORS FOR PUMP CONTROL
4. CONTROL VALVES
5. SYSTEM ENABLE/DISABLE SHALL BE DETERMINED BY BUILDING OCCUPANCY SCHEDULE AND AHU STATUS.

ENABLE MODE

1. THE BAS SHALL ENABLE THE CHILLED WATER PUMPING SYSTEM WHEN ANY AHU IS PROVEN ON.
2. ONCE THE SYSTEM IS ENABLED, THE PUMP BYPASS VALVE SEQUENCE SHALL BE THE PRIMARY MEANS OF CONTROLLING DIFFERENTIAL PRESSURE.
3. IN THE EVENT THE MAIN BUILDING RETURN CONTROL VALVE REMAINS AT 100% AND THE REMOTE DIFFERENTIAL PRESSURE IS 2 PSID (ADJ) BELOW THE CALCULATED SETPOINT FOR MORE THAN 15 MINUTES (ADJ), CLOSE THE BYPASS VALVE, OPEN THE MAIN BUILDING RETURN CONTROL VALVE TO 100%, AND ENABLE THE PUMP CONTROL SEQUENCE. THIS IS AN INDICATION THAT THE

PLANT PRESSURE IS NO LONGER SUFFICIENT TO SATISFY THE BUILDING CHILLED WATER DEMAND.

4. VERIFY PUMPS ARE RUNNING BY WAY OF PUMP STATUS AND WATER FLOW METER.
5. UPON VERIFICATION THAT PUMP(S) ARE ON AND WATER IS FLOWING, ENABLE THE PUMP CONTROL SEQUENCE
6. MONITOR PUMP COMMAND AND IF THE % SPEED DROPS TO MINIMUM SPEED FOR A SINGLE PUMP FOR MORE THAN 15 MINUTES (ADJ), SHUTDOWN THE PUMPING SYSTEM AND RE-ESTABLISH PUMP BYPASS VALVE CONTROL SEQUENCE.

BYPASS VALVE CONTROL

1. ONCE ENABLED, OPEN THE BYPASS VALVE AND MODULATE THE MAN BUILDING RETURN VALVE TO MAINTAIN CALCULATED DIFFERENTIAL PRESSURE SETPOINT.
2. OPEN THE RETURN VALVE ON A DROP IN DIFFERENTIAL PRESSURE AND CLOSE THE RETURN VALVE ON A RISE IN DIFFERENTIAL PRESSURE.

PUMP CONTROL (LEAD/LAG EACH PUMP SIZED AT 50%)

1. ONCE ENABLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.
2. SOFTWARE LEAD/LAG FUNCTION SHALL ALLOW EITHER OF THE CHILLED WATER PUMPS TO ACT AS THE LEAD PUMP.
3. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE COOLING CONTROL VALVE 80% OPEN SO THE PUMPS OPERATE AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE COOLING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL COOLING CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.
4. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL COOLING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMPS TO THEIR MINIMUMS.
5. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
6. PUMP STAGING: WITH ONE PUMP RUNNING, WHEN THE PUMP COMMAND REACHES 100% AND THE DIFFERENTIAL PRESSURE DROPS MORE THAN 2 PSI BELOW THE SETPOINT FOR 10 MINUTES (ALL ADJUSTABLE), START THE LAG PUMP. BOTH PUMPS SHALL CONVERGE AND RUN IN PARALLEL TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT AND THE REMOTE DP SETPOINTS.
7. DURING REDUCING LOAD AS THE DP INCREASES: WHEN THE TWO PUMPS DROP BELOW 20% FOR 10 MINUTES (ADJUSTABLE), THE LAG PUMP SHUTS OFF AND THE LEAD PUMP RESUMES CONTROL.

1. ALARM ON PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE LEAD PUMP, THE LAG PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE LEAD PUMP AND RESUME CONTROL WITH THE LEAD PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE LAG PUMP SHALL BE DISABLED IF THE LOAD ONLY REQUIRES A SINGLE PUMP TO RUN..
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

PUMP CONTROL (PRIMARY/STANDBY EACH PUMP SIZED AT 100%)

2. ONCE ENALBLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.
3. SOFTWARE PRIMARY/STANDBY FUNCTION SHALL ALLOW EITHER OF THE CHILLED WATER PUMPS TO ACT AS THE PRIMARY PUMP.
4. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE HEATING CONTROL VALVE 80% OPEN SO THE PUMP OPERATES AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE HEATING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL HEATING CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.
5. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL HEATING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMP TO ITS MINIMUM.
6. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
7. ALARM ON PRIMARY PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE PRIMARY PUMP, THE STANDBY PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE PRIMARY PUMP AND RESUME CONTROL WITH THE PRIMARY PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE STANDBY PUMP SHALL BE DISABLED ONCE THE PRIMARY PUMP RESTARTS.
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

CHILLED WATER - BUILDING PUMPING TYPE: IC-8			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_CHWP1_SS	CHILLED WATER PUMP-1 START/STOP	ON/OFF		X	X				
bbb_CHWP1_S	CHILLED WATER PUMP-1 STATUS	ON/OFF		X	X				
bbb_CHWP1_VFD	CHILLED WATER PUMP-1 VFD	%	X						
bbb_CHWP2_SS	CHILLED WATER PUMP-2 START/STOP	ON/OFF		X	X				
bbb_CHWP2_S	CHILLED WATER PUMP-2 STATUS	ON/OFF		X	X				
bbb_CHWP2_VFD	CHILLED WATER PUMP-2 VFD	%	X						
bbb_BLGD_CHWS	BUILDING ENTERING CHILL WATER SUPPLY	DEG F	X			X	X		
bbb_BLDG_CHWR	BUILDING EXITING CHILL WATER RETURN	DEG F	X						
bbb_BLDG_DP	CAMPUS CHILLED WATER DIFFERENTIAL PRESSURE	PSID	X						
bbb_BLDG_DP1	BUILDING CHILLED WATER DIFFERENTIAL PRESSURE-1	PSID	X						
bbb_BLDG_DP2	BUILDING CHILLED WATER DIFFERENTIAL PRESSURE-2	PSID	X						
bbb_CHWS_V	CAMPUS CHILLED WATER SUPPLY ISOLATION VALVE	OPN/CLO		X	X				
bbb_CHWS_VS	CAMPUS CHILLED WATER SUPPLY ISOLATION VALVE STATUS	OPN/CLO		X	X				
bbb_CHWR_V	CAMPUS CHILLED WATER RETURN ISOLATION VALVE	OPN/CLO		X	X				
bbb_CHWR_VS	CAMPUS CHILLED WATER RETURN ISOLATION VALVE STATUS	OPN/CLO		X	X				
bbb_CHWS_BYPV	CAMPUS CHILLED WATER SUPPLY BYPASS VALVE	OPN/CLO		X	X				
bbb_CHWS_BYPVS	CAMPUS CHILLED WATER SUPPLY BYPASS VALVE STATUS	OPN/CLO		X	X				
bbb_CHWP1_HZ	CHILLED WATER PUMP-1 VFD HERTZ	HZ	X					X	
bbb_CHWP1_KW	CHILLED WATER PUMP-1VFD KW DEMAND	KW	X					X	
bbb_CHWP1_A	CHILLED WATER PUMP-1 VFD ALARM	KW		X	X			X	
bbb_CHWP2_HZ	CHILLED WATER PUMP-2 VFD HERTZ	HZ	X					X	
bbb_CHWP2_KW	CHILLED WATER PUMP-2VFD KW DEMAND	KW	X					X	
bbb_CHWP2_A	CHILLED WATER PUMP-2 VFD ALARM	KW		X	X			X	
bbb_BLDG_CHWS	BUILDING ENTERING CHILL WATER SUPPLY	DEG F	X					X	
bbb_BLDG_CHWR	BUILDING EXITING CHILL WATER RETURN	DEG F	X					X	
bbb_BLDG_CHWDP	BUILDING CHILL WATER DIFFERENTIAL PRESSURE	PSID	X			X	X	X	
bbb_BLDG_FLW	BUILDING CHILL WATER FLOW	GPM	X			X	X	X	

SEQUENCE OF OPERATION GUIDELINE

FAN COIL UNITS - HEATING AND COOLING

Document: FCU-Htg-Clg-rev1
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR TYPICAL HEATING/COOLING FAN COIL UNITS. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. REFERENCE STANDARD CONTROL DIAGRAMS IC-9.

FAN COIL UNITS WITH COOLING AND HEATING COILS:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. HEATING AND COOLING CONTROL
3. FAN CONTROL

OCCUPIED MODE (AS SCHEDULED BY BAS)

1. START THE FCU FAN AND PROVE FAN ON PRIOR TO TEMPERATURE CONTROL
2. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND MAINTAIN A HEATING AND COOLING SETPOINT.
3. MODULATE THE COOLING COIL TO MAINTAIN THE CLG SETPOINT
4. MODULATE THE HEATING COIL TO MAINTAIN THE HTG SETPOINT.
5. SHUT DOWN THE FAN AND GENERATE AN ALARM WHEN EITHER FLOAT SWITCH INDICATES AN OVER FLOW CONDITION WITHIN THE CONDENSATE PAN.
6. WHEN THE ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, BOTH HTG AND COOLING VALVES SHALL BE CLOSED.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)
OCCUPIED HTG SETPOINT 70 F (ADJUSTABLE)
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)
UNOCCUPIED HTG SETPOINT 68 F (ADJUSTABLE)

FCU # TYPE: IC-9			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_FCUxxSS	FAN COIL UNIT START/STOP	ON/OFF		X	X				
bbb_FCUxxS	FAN COIL UNIT STATUS	ON/OFF		X	X				
bbb_FCUxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_FCUxxRHV	REHEAT VALVE OUTPUT	%OPEN	X						
bbb_FCUxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_FCUxxFS	FAN COIL UNIT DRAIN PAN FLOAT SWITCH	ALM/NML		X	X				
bbb_FCUxx_T	SPACE TEMPERATURE	DEG F	X			X	X		
bbb_FCUxx_SP	SPACE TEMPERATURE SETPOINT	DEG F	X						

SEQUENCE OF OPERATION GUIDELINE

FAN COIL UNITS - COOLING

Document: **FCU-Clg-rev1**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR TYPICAL COOLING ONLY FAN COIL UNITS. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. REFERENCE STANDARD CONTROL DIAGRAMS IC-9.

FAN COIL UNITS WITH COOLING COILS:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. COOLING CONTROL
3. FAN CONTROL

OCCUPIED MODE (AS SCHEDULED BY BAS)

1. START THE FCU FAN AND PROVE FAN ON PRIOR TO TEMPERATURE CONTROL
2. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND MAINTAIN A COOLING SETPOINT.
3. MODULATE THE COOLING COIL TO MAINTAIN THE CLG SETPOINT
4. SHUT DOWN THE FAN AND GENERATE AN ALARM WHEN EITHER FLOAT SWITCH INDICATES AN OVER FLOW CONDITION WITHIN THE CONDENSATE PAN.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)

FCU # TYPE: IC-10			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_FCUxxSS	FAN COIL UNIT START/STOP	ON/OFF		X	X				
bbb_FCUxxS	FAN COIL UNIT STATUS	ON/OFF		X	X				
bbb_FCUxxCV	COOLING VALVE OUTPUT	%OPEN	X						
bbb_FCUxxSA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_FCUxxFS	FAN COIL UNIT DRAIN PAN FLOAT SWITCH	ALM/NML		X	X				
bbb_FCUxx_T	SPACE TEMPERATURE	DEG F	X			X	X		
bbb_FCUxx_SP	SPACE TEMPERATURE SETPOINT	DEG F	X						

SEQUENCE OF OPERATION GUIDELINE

STEAM – HOT WATER HEAT EXCHANGER – SINGLE

Document: Hx-1-rev1
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL STEAM TO HOT WATER CONVERTOR SYSYEM. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. THE PUMP CONTROL SEQUENCE HAS BEEN WRITTEN TO ACCOMODATE A TWO PUMP DESIGN. TWO DIFFERENT PUMP CONTROL SEQUENCES ARE SHOWN TO ACCOUNT FOR BOTH THE 100% REDUNDANT CONDITION AND THE CONDITION IN WHICH EACH PUMP IS SIZED FOR 50% OF THE TOTAL LOAD. SELECT THE APPROPRIATE SEQUENCE ACCORDING TO THE SPECIFIC APPLICATION.

4. REFERENCE STANDARD CONTROL DIAGRAM IC-11.

STEAM TO HOT WATER HEAT EXCHANGER - SINGLE:

PROVIDE THE FOLLOWING FOR HEAT EXCHANGER SYSTEMS.

1. APPROPRIATE TEMPERATURE, FLOW AND PRESSURE SENSORS.
2. BTU AND STEAM METERS
3. DIFFERENTIAL PRESSURE SENSORS FOR PUMP CONTROL
4. NORMALLY CLOSED- SPRING RETURN STEAM CONTROL VALVES
5. CONDENSATE CONDUCTIVITY METER
6. DOMESTIV HOT WATER MAKEUP FLOW METER
7. SYSTEM ENABLE/DISABLE SHALL BE DETERMINED BY BUILDING OCCUPANCY SCHEDULE AND AHU STATUS.

ENABLE MODE

1. THE BAS SHALL ENABLE THE HOT WATER HEAT EXCHANGER SYSTEM WHEN ANY AHU IS PROVEN ON.
2. ONCE THE SYSTEM IS ENABLED, START THE HOT WATER PUMPS AND ENABLE DIFFERENTIAL PRESSURE CONTROL.
3. VERIFY PUMPS ARE RUNNING BY WAY OF PUMP STATUS AND WATER FLOW METER.

4. UPON VERIFICATION THAT PUMP(S) ARE ON AND WATER IS FLOWING THROUGH THE HEAT EXCHANGER, ENABLE THE HEAT EXCHANGER TEMPERATURE CONTROL SEQUENCE, PUMP CONTROL SEQUENCE AND PRESSURE REDUCING VALVE (PRV) CONTROL SEQUENCE. NOTE: MAINTAIN PRV CONTROL IF OTHER BUILDING SYSTEMS REQUIRE CONTINUOUS STEAM SERVICE.

PRV PRESSURE CONTROL

1. ONCE THE PRV SYSTEM IS ENABLED, BEGIN MODULATING THE 1/3 AND 2/3 PRESSURE REDUCING VALVES IN SEQUENCE TO MAINTAIN A CONSTANT STEAM PRESSURE INITIALLY SET AT 75 PSIG (ADJ).
2. THE 1/3 VALVE SHALL MODULATE FIRST LEAVING THE 2/3 VALVE CLOSED. OPEN THE 1/3 PRV AS THE PRESSURE DECREASES AND MODULATE CLOSED AS THE PRESSURE INCREASES.
3. ONCE THE 1/3 VALVE HAS REACHED 100%, BEGING MODULATING OPEN THE 2/3 PRV UNTIL THE SETPOINT HAS BEEN ACHIVEDED.

HEAT EXCHANGER TEMPERATURE CONTROL

1. PROVIDE TEMPERATURE SENSOR IN THE HEATING HOT WATER SUPPLY PIPING AND OUTDOOR AIR. RESET THE HEATING HOT WATER SUPPLY TEMPERATURE FROM [180°F] AT [30°F] OUTDOOR AIR TEMPERATURE TO [140°F] HEATING HOT WATER SUPPLY TEMPERATURE AT [90°F] OUTDOOR AIR TEMPERATURE. ALL SETPOINTS SHALL BE ADJUSTABLE. LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES (ADJ)
2. ONCE THE TEMPERATURE SETPOINT HAS BEEN ESTABLISHED BEGIN MODULATING THE 1/3 STEAM CONTROL VALVE TO MAINTAIN HOT WATER SUPPLY SETPOINT. OPEN THE 1/3 VALVE AS THE TEMPERATURE DECREASES AND MODULATE CLOSED AS THE TEMPERATURE INCREASES.
3. ONCE THE 1/3 VALVE HAS REACHED 100%, AND REMAINS THERE FOR AT LEAST 5 MINUTES, ENABLE THE 2/3 VALVE. ONCE THE 2/3 VALVE HAS BEEN ENABLED, REVERT PRIMARY CONTROL OVER TO THE 2/3 VALVE AND CLOSE THE 1/3 VALVE.
4. ONCE THE 2/3 VALVE HAS REACHED 100%, BEGIN MODULATING THE 1/3 VALVE OPEN TO MAINTAIN SUPPLY WATER TEMPERATURE SETPOINT.
5. REVERSE THE SEQUENCE AS THE DEMAND DECREASES. RE-ESTABLISH PRIMARY CONTROL OF THE 1/3 VALVE, ONCE THE 2/3 VALVE COMMAND HAS REACHED 15% (ADJ) OR LESS FOR MORE THAN 5 MINUTES (ADJ).

PUMP CONTROL (LEAD/LAG EACH PUMP SIZED AT 50%)

1. ONCE ENABLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.
2. SOFTWARE LEAD/LAG FUNCTION SHALL ALLOW EITHER OF THE HOT WATER PUMPS TO ACT AS THE LEAD PUMP.
3. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE HEATING CONTROL VALVE 80% OPEN SO THE PUMPS OPERATE AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE HEATING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL HEATING

CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.

4. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL HEATING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMPS TO THEIR MINIMUMS.
5. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
6. PUMP STAGING: WITH ONE PUMP RUNNING, WHEN THE PUMP COMMAND REACHES 100% AND THE DIFFERENTIAL PRESSURE DROPS MORE THAN 2 PSI BELOW THE SETPOINT FOR 10 MINUTES (ALL ADJUSTABLE), START THE LAG PUMP. BOTH PUMPS SHALL CONVERGE AND RUN IN PARALLEL TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT AND THE REMOTE DP SETPOINTS.
7. DURING REDUCING LOAD AS THE DP INCREASES: WHEN THE TWO PUMPS DROP BELOW 20% FOR 10 MINUTES (ADJUSTABLE), THE LAG PUMP SHUTS OFF AND THE LEAD PUMP RESUMES CONTROL.
1. ALARM ON PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE LEAD PUMP, THE LAG PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE LEAD PUMP AND RESUME CONTROL WITH THE LEAD PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE LAG PUMP SHALL BE DISABLED IF THE LOAD ONLY REQUIRES A SINGLE PUMP TO RUN..
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

PUMP CONTROL (PRIMARY/STANDBY EACH PUMP SIZED AT 100%)

2. ONCE ENALBLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.
3. SOFTWARE PRIMARY/STANDBY FUNCTION SHALL ALLOW EITHER OF THE HOT WATER PUMPS TO ACT AS THE PRIMARY PUMP.
4. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE HEATING CONTROL VALVE 80% OPEN SO THE PUMP OPERATES AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE HEATING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL HEATING CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.
5. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL HEATING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE

LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMP TO ITS MINIMUM.

6. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
7. ALARM ON PRIMARY PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE PRIMARY PUMP, THE STANDBY PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE PRIMARY PUMP AND RESUME CONTROL WITH THE PRIMARY PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE STANDBY PUMP SHALL BE DISABLED ONCE THE PRIMARY PUMP RESTARTS.
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

HOT WATER HEAT EXCHANGER - SINGLE TYPE: IC-11			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_HWP1_SS	HOT WATER PUMP-1 START/STOP	ON/OFF		X	X				
bbb_HWP1_S	HOT WATER PUMP-1 STATUS	ON/OFF		X	X				
bbb_HWP1_VFD	HOT WATER PUMP-1 VFD	%	X						
bbb_HWP2_SS	HOT WATER PUMP-2 START/STOP	ON/OFF		X	X				
bbb_HWP2_S	HOT WATER PUMP-2 STATUS	ON/OFF		X	X				
bbb_HWP2_VFD	HOT WATER PUMP-2 VFD	%	X						
bbb_MAIN_STM_T	CAMPUS STEAM TEMPERATURE	DEG F	X			X	X		
bbb_MAIN_STM_P	CAMPUS STEAM PRESSURE	PSI	X			X	X		
bbb_MAIN_STM_FLW	CAMPUS STEAM FLOW	GPM	X			X	X		
bbb_BLDG_DP1	BUILDING HOT WATER DIFFERENTIAL PRESSURE-1	PSID	X						
bbb_BLDG_DP2	BUILDING HOT WATER DIFFERENTIAL PRESSURE-2	PSID	X						
bbb_PRV_1/3_VLV	STEAM 1/3 PRV VALVE	%OPEN	X						
bbb_PRV_1/3_VLV_FBK	STEAM 1/3 PRV VALVE FEEDBACK	%OPEN	X						
bbb_PRV_2/3_VLV	STEAM 2/3 PRV VALVE	%OPEN	X						
bbb_PRV_2/3_VLV_FBK	STEAM 2/3 PRV VALVE FEEDBACK	%OPEN	X						
bbb_PRV_STM_P	STEAM PRESSURE AFTER PRV	PSI	X			X	X		
bbb_HX_1/3_VLV	1/3 HX VALVE	%OPEN	X						
bbb_HX_1/3_VLV_FBK	1/3 HX VALVE FEEDBACK	%OPEN	X						
bbb_HX_2/3_VLV	2/3 HX VALVE	%OPEN	X						
bbb_HX_2/3_VLV_FBK	2/3 HX VALVE FEEDBACK	%OPEN	X						
bbb_HX_HWS	HX HOT WATER SUPPLY TEMPERATURE	DEG F	X						
bbb_COND_T	CONDENSATE TEMPERATURE FROM HX	DEG F	X			X			
bbb_COND_P1	CONDENSATE PUMP-1 CURRENT	%	X						
bbb_COND_P2	CONDENSATE PUMP-2 CURRENT	%	X						
bbb_COND_R	CONDENSATE RETURN TEMPERATURE	DEG F	X			X			
bbb_COND_A	CONDENSATE HIGH LEVEL ALARM	NML/ALM		X	X				
bbb_COND_CM	CONDENSATE CONDUCTIVITY LEVEL	PPM	X			X	X		
bbb_MUW_FLW	MAKE UP WATER FLOW	GPM	X						
bbb_MUW_P	MAKE UP WATER PRESSURE	PSI	X						
bbb_HWP1_HZ	HOT WATER PUMP-1 VFD HERTZ	HZ	X					X	
bbb_HWP1_KW	HOT WATER PUMP-1VFD KW DEMAND	KW	X					X	
bbb_HWP1_A	HOT WATER PUMP-1 VFD ALARM	KW		X	X			X	
bbb_HWP2_HZ	HOT WATER PUMP-2 VFD HERTZ	HZ	X					X	
bbb_HWP2_KW	HOT WATER PUMP-2VFD KW DEMAND	KW	X					X	
bbb_HWP2_A	HOT WATER PUMP-2 VFD ALARM	KW		X	X			X	
bbb_BLDG_HWS	BUILDING HOT WATER SUPPLY	DEG F	X					X	
bbb_BLDG_HWR	BUILDING HOT WATER RETURN	DEG F	X					X	
bbb_BLDG_FLW	BUILDING HOT WATER FLOW	GPM	X			X	X	X	
bbb_MER_T	MER SPACE TEMPERATURE	DEG F	X			X	X		
bbb_MER_RH	MER SPACE HUMIDITY SENSOR	%RH	X			X	X		
bbb_MER_DC	MER DOOR CONTACT STATUS	OPN/CLO		X					

SEQUENCE OF OPERATION GUIDELINE

STEAM – HOT WATER HEAT EXCHANGER – DUAL

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NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL STEAM TO HOT WATER CONVERTOR SYSYEM (DUAL EXCHANGERS). THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. THE PUMP CONTROL SEQUENCE HAS BEEN WRITTEN TO ACCOMODATE A TWO PUMP DESIGN. TWO DIFFERENT PUMP CONTROL SEQUENCES ARE SHOWN TO ACCOUNT FOR BOTH THE 100% REDUNDANT CONDITION AND THE CONDITION IN WHICH EACH PUMP IS SIZED FOR 50% OF THE TOTAL LOAD. SELECT THE APPROPRIATE SEQUENCE ACCORDING TO THE SPECIFIC APPLICATION.

4. THE HEAT EXCHANGER CONTROL SEQUENCE HAS BEEN WRITTEN TO ACCOMODATE A DUAL HEAT EXCHANGER DESIGN. TWO DIFFERENT HEAT EXCHANGER CONTROL SEQUENCES ARE SHOWN TO ACCOUNT FOR BOTH THE 100% REDUNDANT CONDITION AND THE CONDITION IN WHICH EACH EXCHANGER IS SIZED FOR 50% OF THE TOTAL LOAD. SELECT THE APPROPRIATE SEQUENCE ACCORDING TO THE SPECIFIC APPLICATION.

5. REFERENCE STANDARD CONTROL DIAGRAM IC-12.

STEAM TO HOT WATER HEAT EXCHANGER - DUAL:

PROVIDE THE FOLLOWING FOR HEAT EXCHANGER SYSTEMS.

1. APPROPRIATE TEMPERATURE, FLOW AND PRESSURE SENSORS.
2. HEAT EXCHANGER ISOLATION VALVES
3. BTU AND STEAM METERS
4. DIFFERENTIAL PRESSURE SENSORS FOR PUMP CONTROL
5. NORMALLY CLOSED- SPRING RETURN STEAM CONTROL VALVES
6. CONDENSATE CONDUCTIVITY METER
7. DOMESTIV HOT WATER MAKEUP FLOW METER
8. SYSTEM ENABLE/DISABLE SHALL BE DETERMINED BY BUILDING OCCUPANCY SCHEDULE AND AHU STATUS.

ENABLE MODE

1. THE BAS SHALL ENABLE THE HOT WATER HEAT EXCHANGER SYSTEM WHEN ANY AHU IS PROVEN ON.
2. ONCE THE SYSTEM IS ENABLED, OPEN THE LEAD/PRIMARY EXCHANGER ISOLATION VALVE, START THE HOT WATER PUMPS AND ENABLE DIFFERENTIAL PRESSURE CONTROL.
3. VERIFY PUMPS ARE RUNNING BY WAY OF PUMP STATUS AND WATER FLOW METER.
4. UPON VERIFICATION THAT PUMP(S) ARE ON AND WATER IS FLOWING THROUGH THE HEAT EXCHANGER, ENABLE THE HEAT EXCHANGER TEMPERATURE CONTROL SEQUENCE, PUMP CONTROL SEQUENCE AND PRESSURE REDUCING VALVE (PRV) CONTROL SEQUENCE. NOTE: MAINTAIN PRV CONTROL IF OTHER BUILDING SYSTEMS REQUIRE CONTINUOUS STEAM SERVICE.

PRV PRESSURE CONTROL

1. ONCE THE PRV SYSTEM IS ENABLED, BEGIN MODULATING THE 1/3 AND 2/3 PRESSURE REDUCING VALVES IN SEQUENCE TO MAINTAIN A CONSTANT STEAM PRESSURE INITIALLY SET AT 75 PSIG (ADJ).
2. THE 1/3 VALVE SHALL MODULATE FIRST LEAVING THE 2/3 VALVE CLOSED. OPEN THE 1/3 PRV AS THE PRESSURE DECREASES AND MODULATE CLOSED AS THE PRESSURE INCREASES.
3. ONCE THE 1/3 VALVE HAS REACHED 100%, BEGING MODULATING OPEN THE 2/3 PRV UNTIL THE SETPOINT HAS BEEN ACHIVEDED.

HEAT EXCHANGER TEMPERATURE CONTROL (LEAD/LAG EACH HEAT EXCHANGER SIZED AT 50%)

1. SOFTWARE LEAD/LAG FUNCTION SHALL ALLOW EITHER OF THE HEAT EXCHANGERS TO ACT AS THE LEAD EXCHANGER.
2. PROVIDE TEMPERATURE SENSORS IN THE HEATING HOT WATER SUPPLY PIPING (EACH HEAT EXCHANGER) AND OUTDOOR AIR. RESET THE HEATING HOT WATER SUPPLY TEMPERATURE FROM [180˚F] AT [30˚F] OUTDOOR AIR TEMPERATURE TO [140˚F] HEATING HOT WATER SUPPLY TEMPERATURE AT [90˚F] OUTDOOR AIR TEMPERATURE. ALL SETPOINTS SHALL BE ADJUSTABLE. LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES (ADJ)
3. ONCE THE TEMPERATURE SETPOINT HAS BEEN ESTABLISHED BEGIN MODULATING THE LEAD EXCHANGER STEAM CONTROL VALVES AS FOLLOWS: MODULATE THE 1/3 STEAM CONTROL VALVE TO MAINTAIN HOT WATER SUPPLY SETPOINT. OPEN THE 1/3 VALVE AS THE TEMPERATURE DECREASES AND MODULATE CLOSED AS THE TEMPERATURE INCREASES.
4. ONCE THE 1/3 VALVE HAS REACHED 100%, AND REMAINS THERE FOR AT LEAST 5 MINUTES, ENABLE THE 2/3 VALVE. ONCE THE 2/3 VALVE HAS BEEN ENABLED, REVERT PRIMARY CONTROL OVER TO THE 2/3 VALVE AND CLOSE THE 1/3 VALVE.
5. ONCE THE 2/3 VALVE HAS REACHED 100%, BEGIN MODULATING THE 1/3 VALVE OPEN TO MAINTAIN SUPPLY WATER TEMPERATURE SETPOINT.
6. REVERSE THE SEQUENCE AS THE DEMAND DECREASES. RE-ESTABLISH PRIMARY CONTROL OF THE 1/3 VALVE, ONCE THE 2/3 VALVE COMMAND HAS REACHED 15% (ADJ) OR LESS FOR MORE THAN 5 MINUTES (ADJ).

7. IN THE EVENT THE LEAD HEAT EXCHANGER HAS REACHED ITS MAXIMUM CAPACITY (AS INDICATED BY A 100% COMMAND TO BOTH THE 1/3 AND 2/3 VALVES) FOR MORE THAN 15 MINUTES (ADJ), ENABLE THE LAG HEAT EXCHANGER.
8. ONCE ENABLED, THE LAG HEAT EXCHANGER ISOLATION VALVE SHALL OPEN.
9. THE LAG SUPPLY SETPOINT SHALL MATCH THE LEAD HEAT EXCHANGER SETPOINT. TEMPERATURE CONTROL SHALL BE AS DESCRIBED ABOVE.
10. DISABLE THE LAG HEAT EXCHANGER WHEN BOTH THE LEAD AND LAG HEAT EXCHANGER 1/3 VALVE IS COMMANDED TO LESS THAN 50% AND THE 2/3 VALVES ARE 0% FOR MORE THAN 15 MINUTES (ADJ).
11. CLOSE THE LAG HEAT EXCHANGER ISOLATION VALVE AND CLOSE THE LAG STEAM CONTROL VALVES.
12. LEAD HEAT EXCHANGER DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

HEAT EXCHANGER TEMPERATURE CONTROL (PRIMARY/STANDBY EACH HEAT EXCHANGER SIZED AT 100%)

1. SOFTWARE PRIMARY/STANDBY FUNCTION SHALL ALLOW EITHER OF THE HEAT EXCHANGERS TO ACT AS THE PRIMARY EXCHANGER.
2. PROVIDE TEMPERATURE SENSORS IN THE HEATING HOT WATER SUPPLY PIPING (EACH HEAT EXCHANGER) AND OUTDOOR AIR. RESET THE HEATING HOT WATER SUPPLY TEMPERATURE FROM [180°F] AT [30°F] OUTDOOR AIR TEMPERATURE TO [140°F] HEATING HOT WATER SUPPLY TEMPERATURE AT [90°F] OUTDOOR AIR TEMPERATURE. ALL SETPOINTS SHALL BE ADJUSTABLE. LIMIT RESET FREQUENCY TO NO MORE THAN ONCE EVERY 15 MINUTES (ADJ)
3. ONCE THE TEMPERATURE SETPOINT HAS BEEN ESTABLISHED BEGIN MODULATING THE PRIMARY EXCHANGER STEAM CONTROL VALVES AS FOLLOWS: MODULATE THE 1/3 STEAM CONTROL VALVE TO MAINTAIN HOT WATER SUPPLY SETPOINT. OPEN THE 1/3 VALVE AS THE TEMPERATURE DECREASES AND MODULATE CLOSED AS THE TEMPERATURE INCREASES.
4. ONCE THE 1/3 VALVE HAS REACHED 100%, AND REMAINS THERE FOR AT LEAST 5 MINUTES, ENABLE THE 2/3 VALVE. ONCE THE 2/3 VALVE HAS BEEN ENABLED, REVERT PRIMARY CONTROL OVER TO THE 2/3 VALVE AND CLOSE THE 1/3 VALVE.
5. ONCE THE 2/3 VALVE HAS REACHED 100%, BEGIN MODULATING THE 1/3 VALVE OPEN TO MAINTAIN SUPPLY WATER TEMPERATURE SETPOINT.
6. REVERSE THE SEQUENCE AS THE DEMAND DECREASES. RE-ESTABLISH PRIMARY CONTROL OF THE 1/3 VALVE, ONCE THE 2/3 VALVE COMMAND HAS REACHED 15% (ADJ) OR LESS FOR MORE THAN 5 MINUTES (ADJ).
7. CLOSE THE LAG HEAT EXCHANGER ISOLATION VALVE AND CLOSE THE LAG STEAM CONTROL VALVES.
8. THE BAS SHALL CONTINUE MONITORING THE SUPPLY WATER TEMPERATURE AND SETPOINT AT THE PRIMARY HEAT EXCHANGER. IN THE EVENT THE SUPPLY WATER TEMPERATURE DIFFERS FROM THE SUPPLY SETPOINT BY MORE THAN 10 DEGF (ADJ) FOR MORE THAN 5 MINUTES (ADJ), ALARM THE PRIMARY HEAT EXCHANGER AND CLOSE THE PRIMARY STEAM CONTROL VALVES. OPEN THE STANDBY EXCHANGER ISOLATION VALVE AND RE-ESTABLISH TEMPERATURE CONTROL USING THE STANDBY HEAT EXCHANGER STEAM CONTROL VALVES.
9. THE BAS SHALL LOCKOUT THE PRIMARY HEAT EXCHANGER UNTIL A MANUAL RESET IS INITIATED BY AN OPERATOR.

10. PRIMARY HEAT EXCHANGER DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

PUMP CONTROL (LEAD/LAG EACH PUMP SIZED AT 50%)

1. ONCE ENABLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.
2. SOFTWARE LEAD/LAG FUNCTION SHALL ALLOW EITHER OF THE HOT WATER PUMPS TO ACT AS THE LEAD PUMP.
3. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE HEATING CONTROL VALVE 80% OPEN SO THE PUMPS OPERATE AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE HEATING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL HEATING CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.
4. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL HEATING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMPS TO THEIR MINIMUMS.
5. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
6. PUMP STAGING: WITH ONE PUMP RUNNING, WHEN THE PUMP COMMAND REACHES 100% AND THE DIFFERENTIAL PRESSURE DROPS MORE THAN 2 PSI BELOW THE SETPOINT FOR 10 MINUTES (ALL ADJUSTABLE), START THE LAG PUMP. BOTH PUMPS SHALL CONVERGE AND RUN IN PARALLEL TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT AND THE REMOTE DP SETPOINTS.
7. DURING REDUCING LOAD AS THE DP INCREASES: WHEN THE TWO PUMPS DROP BELOW 20% FOR 10 MINUTES (ADJUSTABLE), THE LAG PUMP SHUTS OFF AND THE LEAD PUMP RESUMES CONTROL.
1. ALARM ON PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE LEAD PUMP, THE LAG PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE LEAD PUMP AND RESUME CONTROL WITH THE LEAD PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE LAG PUMP SHALL BE DISABLED IF THE LOAD ONLY REQUIRES A SINGLE PUMP TO RUN..
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

PUMP CONTROL (PRIMARY/STANDBY EACH PUMP SIZED AT 100%)

2. ONCE ENALBLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL SETPOINT.

3. SOFTWARE PRIMARY/STANDBY FUNCTION SHALL ALLOW EITHER OF THE HOT WATER PUMPS TO ACT AS THE PRIMARY PUMP.
4. DIFFERENTIAL PRESSURE CONTROL. THE OBJECTIVE IS TO ALWAYS HAVE ONE HEATING CONTROL VALVE 80% OPEN SO THE PUMP OPERATES AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. EVERY 5 MINUTES THE HEATING VALVES SHALL BE POLLED. WHEN THE MOST OPEN HEATING VALVE IS MORE THAN 80% OPEN, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT UP BY .50 PSID (ADJ). WHEN ALL HEATING CONTROL VALVES ARE 60% (ADJ) OR BELOW, THE BAS SHALL RESET THE DIFFERENTIAL PRESSURE SETPOINT DOWN BY .25 PSID.
5. THE REMOTE DP SETPOINT SHALL BE MAINTAINED BETWEEN MAXIMUM AND MINIMUM PRESSURES. THE MAXIMUM PRESSURE LIMIT IS THE PRESSURE REQUIRED TO PROVIDE FULL FLOW TO ALL HEATING CONTROL VALVES SIMULTANEOUSLY (PER TAB). THE MINIMUM PRESSURE LIMIT IS THE PRESSURE CORRELATING TO THE LOWEST SPEED THE PUMP MOTOR IS ALLOWED TO BE OPERATED AT (PER MOTOR MANUF. AND TAB). MAXIMUM PRESSURE LIMIT:__________PSI. MININUM PRESSURE LIMIT:__________PSI. THE VFD INTERNAL SETTINGS WILL ALLOW THE VFD TO RUN THE PUMP TO ITS MINIMUM.
6. WHEN TWO REMOTE DIFFERENTIAL PRESSURE SENSORS ARE USED, CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT.
7. ALARM ON PRIMARY PUMP FAILURE DETECTED VIA CURRENT SENSING SWITCH. UPON FAILURE OF THE PRIMARY PUMP, THE STANDBY PUMP SHALL START AUTOMATICALLY. THE BAS SHALL MAINTAIN A START COMMAND AT THE PRIMARY PUMP AND RESUME CONTROL WITH THE PRIMARY PUMP UPON CONFIRMATION THAT THE LEAD PUMP HAS RETURNED TO NORMAL OPERATION. THE STANDBY PUMP SHALL BE DISABLED ONCE THE PRIMARY PUMP RESTARTS.
8. LEAD PUMP DESIGNATION SHALL BE ROTATED WEEKLY (ADJ) IN ACCORDANCE WITH THE BAS SCHEDULE.

HOT WATER HEAT EXCHANGER - DUAL TYPE: IC-12			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_HWP1_SS	HOT WATER PUMP-1 START/STOP	ON/OFF		X	X				
bbb_HWP1_S	HOT WATER PUMP-1 STATUS	ON/OFF		X	X				
bbb_HWP1_VFD	HOT WATER PUMP-1 VFD	%	X						
bbb_HWP2_SS	HOT WATER PUMP-2 START/STOP	ON/OFF		X	X				
bbb_HWP2_S	HOT WATER PUMP-2 STATUS	ON/OFF		X	X				
bbb_HWP2_VFD	HOT WATER PUMP-2 VFD	%	X						
bbb_MAIN_STM_T	CAMPUS STEAM TEMPERATURE	DEG F	X			X	X		
bbb_MAIN_STM_P	CAMPUS STEAM PRESSURE	PSI	X			X	X		
bbb_MAIN_STM_FLW	CAMPUS STEAM FLOW	GPM	X			X	X		
bbb_BLDG_DP1	BUILDING HOT WATER DIFFERENTIAL PRESSURE-1	PSID	X						
bbb_BLDG_DP2	BUILDING HOT WATER DIFFERENTIAL PRESSURE-2	PSID	X						
bbb_PRV_1/3_VLV	STEAM 1/3 PRV VALVE	%OPEN	X						
bbb_PRV_1/3_VLV_FBK	STEAM 1/3 PRV VALVE FEEDBACK	%OPEN	X						
bbb_PRV_2/3_VLV	STEAM 2/3 PRV VALVE	%OPEN	X						
bbb_PRV_2/3_VLV_FBK	STEAM 2/3 PRV VALVE FEEDBACK	%OPEN	X						
bbb_PRV_STM_P	STEAM PRESSURE AFTER PRV	PSI	X			X	X		
bbb_HX1_1/3_VLV	1/3 HX1 VALVE	%OPEN	X						
bbb_HX1_1/3_VLV_FBK	1/3 HX1 VALVE FEEDBACK	%OPEN	X						
bbb_HX1_2/3_VLV	2/3 HX1 VALVE	%OPEN	X						
bbb_HX1_2/3_VLV_FBK	2/3 HX1 VALVE FEEDBACK	%OPEN	X						
bbb_HX1_HWS	HX1 HOT WATER SUPPLY TEMPERATURE	DEG F	X						
bbb_HX2_1/3_VLV	1/3 HX2 VALVE	%OPEN	X						
bbb_HX2_1/3_VLV_FBK	1/3 HX2 VALVE FEEDBACK	%OPEN	X						
bbb_HX2_2/3_VLV	2/3 HX2 VALVE	%OPEN	X						
bbb_HX2_2/3_VLV_FBK	2/3 HX2 VALVE FEEDBACK	%OPEN	X						
bbb_HX2_HWS	HX2 HOT WATER SUPPLY TEMPERATURE	DEG F	X						
bbb_COND_T	CONDENSATE TEMPERATURE FROM HX	DEG F	X			X			
bbb_COND_P1	CONDENSATE PUMP-1 CURRENT	%	X						
bbb_COND_P2	CONDENSATE PUMP-2 CURRENT	%	X						
bbb_COND_R	CONDENSATE RETURN TEMPERATURE	DEG F	X			X			
bbb_COND_A	CONDENSATE HIGH LEVEL ALARM	NML/ALM		X	X				
bbb_COND_CM	CONDENSATE CONDUCTIVITY LEVEL	PPM	X			X	X		
bbb_MUW_FLW	MAKE UP WATER FLOW	GPM	X						
bbb_MUW_P	MAKE UP WATER PRESSURE	PSI	X						
bbb_HWP1_HZ	HOT WATER PUMP-1 VFD HERTZ	HZ	X					X	
bbb_HWP1_KW	HOT WATER PUMP-1VFD KW DEMAND	KW	X					X	
bbb_HWP1_A	HOT WATER PUMP-1 VFD ALARM	KW		X	X			X	
bbb_HWP2_HZ	HOT WATER PUMP-2 VFD HERTZ	HZ	X					X	
bbb_HWP2_KW	HOT WATER PUMP-2VFD KW DEMAND	KW	X					X	
bbb_HWP2_A	HOT WATER PUMP-2 VFD ALARM	KW		X	X			X	
bbb_BLDG_HWS	BUILDING HOT WATER SUPPLY	DEG F	X					X	
bbb_BLDG_HWR	BUILDING HOT WATER RETURN	DEG F	X					X	
bbb_BLDG_FLW	BUILDING HOT WATER FLOW	GPM	X			X	X	X	
bbb_MER_T	MER SPACE TEMPERATURE	DEG F	X			X	X		
bbb_MER_RH	MER SPACE HUMIDITY SENSOR	%RH	X			X	X		
bbb_MER_DC	MER DOOR CONTACT STATUS	OPN/CLO		X					

SEQUENCE OF OPERATION GUIDELINE

LABORATORY CONTROL – SUPPLY AND GENERAL

Document: lab-s-g-rev1
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL LABORATORY WITH SUPPLY TERMINAL AND GENERAL EXHAUST TERMINAL. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. USE ZONE OCCUPANCY SENSORS FOR "UNOCCUPIED" MODE WHENEVER POSSIBLE. COORDINATE WITH ELECTRICAL/LIGHTING DESIGN FOR DUAL USE.

4. REFERENCE STANDARD CONTROL DIAGRAMS IC-13.

LABORATORY, SUPPLY AND GENERAL EXHAUST:

PROVIDE THE FOLLOWING FOR ALL LABORATORIES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. THE LABORATORY ENVELOPE CONSISTS OF SUPPLY VAV BOX WITH REHEAT COIL AND 1 GENERAL EXHAUST VAV BOX.
3. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE SUPPLY TERMINAL REHEAT COIL FOR USE IN MONITORING OVERALL TERMINAL UNIT PERFORMANCE.
4. CALCULATE TOTAL EXHAUST AIR VOLUME AND TOTAL SUPPLY AIR VOLUME FOR THE LAB TO MONITOR AND MAINTAIN A SCHEDULED AIRFLOW OFFSET
5. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

OCCUPIED MODE

1. THE LAB CONTROLLER SHALL MAINTAIN OCCUPIED TEMPERATURE SETPOINTS AND MINIMUM VENTILATION RATES. REFER TO SCHEDULE FOR MINIMUM OCCUPIED CFM SETPOINTS TO ESTABLISH MINIMUM VENTILATION RATES DURING OCCUPIED MODE.

UNOCCUPIED MODE

1. THE LAB CONTROLLER SHALL MAINTAIN UNOCCUPIED TEMPERATURE SETPOINTS AND MINIMUM VENTILATION RATES. REFER TO SCHEDULE FOR MINIMUM UNOCCUPIED CFM SETPOINTS TO ESTABLISH MINIMUM VENTILATION RATES DURING UNOCCUPIED MODE.

ROOM VENTILATION CONTROL

1. THE LAB CONTROLLER CALCULATES TOTAL ROOM EXHAUST CFM BY ADDING THE ROOM GENERAL EXHAUST CFM TOGETHER.
2. THE LAB CONTROLLER SHALL THEN MODULATE THE ROOM GENERAL EXHAUST FROM ITS SCHEDULED MINIMUM TO MAXIMUM FLOW SETPOINT TO ENSURE THAT A MINIMUM TOTAL ROOM EXHAUST NECESSARY TO MEET THE REQUIRED ROOM VENTILATION RATE IS CONTINUOUSLY MAINTAINED.

ROOM PRESSURIZATION CONTROL

1. THE LAB CONTROLLER SHALL UTILIZE AN AIRFLOW SENSOR IN THE ROOM SUPPLY AIR TERMINAL TO CONTINUOUSLY MEASURE THE ACTUAL ROOM SUPPLY AIR CFM.
2. THE LAB CONTROLLER CALCULATES THE REQUIRED ROOM SUPPLY AIR CFM NECESSARY TO MAINTAIN THE PREDETERMINED FLOW TRACKING DIFFERENTIAL BY SUBTRACTING THE FLOW TRACKING DIFFERENTIAL CFM SET POINT FROM THE TOTAL ROOM EXHAUST CFM.
3. THE LAB CONTROLLER SHALL MODULATE THE ROOM SUPPLY AIR CFM TO ENSURE THAT THE FLOW TRACKING DIFFERENTIAL CFM IS ALWAYS MAINTAINED.

ROOM TEMPERATURE CONTROL

1. WHEN THE ROOM AIRFLOWS ARE NOT CHANGING, THE LAB CONTROLLER MAINTAINS THE ROOM AT THE AMBIENT TEMPERATURE SET POINT BY MODULATING THE HEATING VALVE.
2. THE LAB CONTROLLER SHALL CONTINUOUSLY CALCULATE THE ROOM COOLING LOAD AS A FUNCTION OF THE SUPPLY AIRFLOW AND THE TEMPERATURE DIFFERENCE BETWEEN THE ROOM TEMPERATURE SENSOR AND THE SUPPLY AIR TEMPERATURE SENSOR.
3. UPON A CHANGE IN ROOM AIRFLOW (I.E. GENERAL EXHAUST IS RE-POSITIONED), THE LAB CONTROLLER SHALL CALCULATE THE NEW REQUIRED SUPPLY AIR TEMPERATURE REQUIRED TO HANDLE THE SAME ROOM COOLING LOAD BUT AT THE NEW SUPPLY AIRFLOW NEEDED TO MAINTAIN ROOM PRESSURIZATION.
4. IF THE CALCULATED SUPPLY AIR TEMPERATURE IS OUTSIDE OF THE PRESET SUPPLY AIR TEMPERATURE DISCHARGE LIMITS, THE SEQUENCE MAINTAINS THE SUPPLY DISCHARGE TEMPERATURE AT THE LIMIT AND INCREASES THE SUPPLY AIRFLOW TO HANDLE THE COOLING LOAD WHILE ALSO INCREASING THE ROOM GENERAL EXHAUST AIRFLOW TO MAINTAIN ROOM PRESSURIZATION.

OCCUPIED SETPOINT 74 F (ADJUSTABLE)
UNOCCUPIED SETPOINT 78 F (ADJUSTABLE)

LAB# TYPE: IC-13			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_LAB_RMxxx_SUP_FLW	SUPPLY AIR FLOW	CFM	X			X	X		
bbb_LAB_RMxxx_SUP_DMP	SUPPLY AIR DAMPER	%OPEN	X						
bbb_LAB_RMxxx_SUP_RHV	REHEAT VALVE OUTPUT	%OPEN	X						
bbb_LAB_RMxxx_SUP_SA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_LAB_RMxxx_SUP_OS	OCCUPANCY STATUS	OCC/UNOCC		X					
bbb_LAB_RMxxx_GEX_FLW	GENERAL EXHAUST AIR FLOW	CFM	X			X	X		
bbb_LAB_RMxxx_GEX_DMP	EXHAUST AIR DAMPER	%OPEN	X						
bbb_LAB_RMxxx_ZT	LAB TEMPERATURE	DEG F	X			X	X		
bbb_LAB_RMxxx_SP	LAB TEMPERATURE SETPOINT	DEG F	X						
bbb_LAB_RMxxx_OR	LAB TEMPORARY OCCUPANCY OVERRIDE	OCC/UNOCC		X					
bbb_LAB_RMxxx_H	LAB HUMIDITY	%RH	X						
bbb_LAB_RMxxx_DP	LAB DIFFERENTIAL PRESSURE	INWC	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

LABORATORY CONTROL – SUPPLY, GENERAL AND FUME

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Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL LABORATORY WITH SUPPLY TERMINAL, GENERAL EXHAUST TERMINAL AND FUME EXHAUST TERMINAL. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. USE ZONE OCCUPANCY SENSORS FOR “UNOCCUPIED” MODE WHENEVER POSSIBLE. COORDINATE WITH ELECTRICAL/LIGHTING DESIGN FOR DUAL USE.

4. REFERENCE STANDARD CONTROL DIAGRAMS IC-14.

LABORATORY, SUPPLY, GENERAL EXHAUST AND FUME EXHAUST:

PROVIDE THE FOLLOWING FOR ALL LABORATORIES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. THE LABORATORY ENVELOPE CONSISTS OF 1 FUME HOOD WITH INDIVIDUAL VAV FACE VELOCITY CONTROLLER, 1 SUPPLY VAV BOX WITH REHEAT COIL AND 1 GENERAL EXHAUST VAV BOX.
3. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE SUPPLY TERMINAL REHEAT COIL FOR USE IN MONITORING OVERALL TERMINAL UNIT PERFORMANCE.
4. CALCULATE TOTAL EXHAUST AIR VOLUME AND TOTAL SUPPLY AIR VOLUME FOR THE LAB TO MONITOR AND MAINTAIN A SCHEDULED AIRFLOW OFFSET
5. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

OCCUPIED MODE

1. THE LAB CONTROLLER SHALL MAINTAIN OCCUPIED TEMPERATURE SETPOINTS AND MINIMUM VENTILATION RATES. REFER TO SCHEDULE FOR MINIMUM OCCUPIED CFM SETPOINTS TO ESTABLISH MINIMUM VENTILATION RATES DURING OCCUPIED MODE.

UNOCCUPIED MODE

1. THE LAB CONTROLLER SHALL MAINTAIN UNOCCUPIED TEMPERATURE SETPOINTS AND MINIMUM VENTILATION RATES. REFER TO SCHEDULE FOR MINIMUM UNOCCUPIED CFM SETPOINTS TO ESTABLISH MINIMUM VENTILATION RATES DURING UNOCCUPIED MODE.

FUME HOOD CONTROL

1. THE FUME HOOD CONTROLLER SHALL CALCULATE THE TOTAL FUME HOOD OPEN AREA BASED ON THE FUME HOOD'S FIXED OPENINGS, BYPASS OPENING, LEAKAGE AREA AND SASH POSITION AS INDICATED BY THE SASH SENSOR(S).
2. THE FUME HOOD CONTROLLER SHALL CONTINUOUSLY CALCULATE THE FUME HOOD EXHAUST CFM REQUIRED TO MAINTAIN THE AVERAGE FACE VELOCITY SET POINT BASED ON THE TOTAL OPEN AREA OF THE FUME HOOD AND THE AVERAGE FACE VELOCITY SET POINT.
3. THE FUME HOOD CONTROLLER SHALL UTILIZE A FUME HOOD EXHAUST TERMINAL TO MEASURE ACTUAL FUME HOOD EXHAUST CFM AND MODULATE THE FUME HOOD EXHAUST TO CONTROL AND MAINTAIN THE REQUIRED FUME HOOD AVERAGE FACE VELOCITY.
4. THE FUME HOOD CONTROLLER SHALL MAINTAIN THE FUME HOOD EXHAUST CFM AT THE SCHEDULED MINIMUM SET POINT WHEN THE SASH IS AT ITS MINIMUM POSITION.

ROOM VENTILATION CONTROL

1. THE LAB CONTROLLER SHALL RECEIVE THE FUME HOOD EXHAUST CFM SET POINT VALUE FROM EACH FUME HOOD CONTROLLER IN THE ROOM AND MEASURES THE ACTUAL ROOM GENERAL EXHAUST CFM.
2. THE LAB CONTROLLER CALCULATES TOTAL ROOM EXHAUST CFM BY ADDING THE ROOM GENERAL EXHAUST CFM AND ALL FUME HOOD EXHAUST SET POINTS TOGETHER.
3. THE LAB CONTROLLER SHALL THEN MODULATE THE ROOM GENERAL EXHAUST FROM ITS SCHEDULED MINIMUM TO MAXIMUM FLOW SETPOINT TO ENSURE THAT A MINIMUM TOTAL ROOM EXHAUST NECESSARY TO MEET THE REQUIRED ROOM VENTILATION RATE IS CONTINUOUSLY MAINTAINED.

ROOM PRESSURIZATION CONTROL

1. THE LAB CONTROLLER SHALL UTILIZE AN AIRFLOW SENSOR IN THE ROOM SUPPLY AIR TERMINAL TO CONTINUOUSLY MEASURE THE ACTUAL ROOM SUPPLY AIR CFM.
2. THE LAB CONTROLLER CALCULATES THE REQUIRED ROOM SUPPLY AIR CFM NECESSARY TO MAINTAIN THE PREDETERMINED FLOW TRACKING DIFFERENTIAL BY SUBTRACTING THE FLOW TRACKING DIFFERENTIAL CFM SET POINT FROM THE TOTAL ROOM EXHAUST CFM.
3. THE LAB CONTROLLER SHALL MODULATE THE ROOM SUPPLY AIR CFM TO ENSURE THAT THE FLOW TRACKING DIFFERENTIAL CFM IS ALWAYS MAINTAINED.

ROOM TEMPERATURE CONTROL

1. WHEN THE ROOM AIRFLOWS ARE NOT CHANGING, THE LAB CONTROLLER MAINTAINS THE ROOM AT THE AMBIENT TEMPERATURE SET POINT BY MODULATING THE HEATING VALVE.
2. THE LAB CONTROLLER SHALL CONTINUOUSLY CALCULATE THE ROOM COOLING LOAD AS A FUNCTION OF THE SUPPLY AIRFLOW AND THE TEMPERATURE DIFFERENCE BETWEEN THE ROOM TEMPERATURE SENSOR AND THE SUPPLY AIRTEMPERATURE SENSOR.
3. UPON A CHANGE IN ROOM AIRFLOW (I.E. FUME HOOD SASH IS REPOSITIONED), THE LAB CONTROLLER SHALL CALCULATE THE NEW REQUIRED SUPPLY AIR TEMPERATURE REQUIRED TO HANDLE THE SAME ROOM COOLING LOAD BUT AT THE NEW SUPPLY AIRFLOW NEEDED TO MAINTAIN ROOM PRESSURIZATION.
4. IF THE CALCULATED SUPPLY AIR TEMPERATURE IS OUTSIDE OF THE PRESET SUPPLY AIR TEMPERATURE DISCHARGE LIMITS, THE SEQUENCE MAINTAINS THE SUPPLY DISCHARGE TEMPERATURE AT THE LIMIT AND INCREASES THE SUPPLY AIRFLOW TO HANDLE THE COOLING LOAD WHILE ALSO INCREASING THE ROOM GENERAL EXHAUST AIRFLOW TO MAINTAIN ROOM PRESSURIZATION.

OCCUPIED SETPOINT 74 F (ADJUSTABLE)
UNOCCUPIED SETPOINT 78 F (ADJUSTABLE)

LAB TYPE: IC-14 LABORATORY - SUPPLY / FUME / EXHAUST / TRACKING			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_LAB_RMxxx_SUP_FLW	SUPPLY AIR FLOW	CFM	X			X	X		
bbb_LAB_RMxxx_SUP_DMP	SUPPLY AIR DAMPER	%OPEN	X						
bbb_LAB_RMxxx_SUP_RHV	REHEAT VALVE OUTPUT	%OPEN	X						
bbb_LAB_RMxxx_SUP_SA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_LAB_RMxxx_SUP_OS	OCCUPANCY STATUS	OCC/UNOCC		X					
bbb_LAB_RMxxx_GEX_FLW	GENERAL EXHAUST AIR FLOW	CFM	X			X	X		
bbb_LAB_RMxxx_GEX_DMP	EXHAUST AIR DAMPER	%OPEN	X						
bbb_LAB_RMxxx_FEX_FLW	FUME HOOD EXHAUST AIR FLOW	CFM	X			X	X		
bbb_LAB_RMxxx_FEX_DMP	FUME HOOD EXHAUST AIR DAMPER	%OPEN	X						
bbb_LAB_RMxxx_FH_OCC	FUME HOOD ZONE PRESENCE SENSOR	OCC/UNOCC		X					
bbb_LAB_RMxxx_FH_SASH	FUME HOOD SASH POSITION SENSOR	%	X						
bbb_LAB_RMxxx_ZT	LAB TEMPERATURE	DEG F	X			X	X		
bbb_LAB_RMxxx_SP	LAB TEMPERATURE SETPOINT	DEG F	X						
bbb_LAB_RMxxx_OR	LAB TEMPORARY OCCUPANCY OVERRIDE	OCC/UNOCC		X					
bbb_LAB_RMxxx_H	LAB HUMIDITY	%RH	X						
bbb_LAB_RMxxx_DP	LAB DIFFERENTIAL PRESSURE	INWC	X			X	X		

SEQUENCE OF OPERATION GUIDELINE

AIR TERMINAL UNITS – SINGLE DUCT VARIABLE AIR VOLUME COOLING ONLY

Document: VAV-clg rev1
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR TYPICAL VAV AIR TERMINAL UNITS- COOLING ONLY. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. USE ZONE OCCUPANCY SENSORS FOR "UNOCCUPIED" MODE WHENEVER POSSIBLE. COORDINATE WITH ELECTRICAL/LIGHTING DESIGN FOR DUAL USE.

4. REFERENCE STANDARD CONTROL DIAGRAMS IC-15.

VAV BOXES – COOLING ONLY:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. PRESSURE INDEPENDENT VOLUME CONTROL WITH ADJUSTABLE MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. RETURN THE VOLUME DAMPER TO A MINIMUM POSITION (25 %) WHEN ASSOCIATED AHU IS OFF.
4. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE DAMPER FOR USE IN MONITORING OVERALL VAV BOX PERFORMANCE.
5. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

OCCUPIED MODE

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING DEMAND.
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.

3. ON A DROP IN ROOM TEMPERATURE, MODULATE THE DAMPER TOWARDS ITS MINIMUM CFM SETPOINT
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW.

UNOCCUPIED MODE (BASED ON SCHEDULE OR LOCAL OCCUPANCY SENSOR)

ASSOCIATED AHU IS SCHEDULED OFF

1. THE AIR DAMPER SHALL REMAIN AT ITS MINIMUM 25% POSITION.
2. IN THE EVENT THE AHU IS ENABLED DURING UNOCCUPIED HOURS (DUE TO A NIGHT SETBACK CALL FOR COOLING), THE BOX SHALL CONTROL ACCORDING TO THE OCCUPIED MODE DESCRIBED ABOVE USING THE OCCUPIED SETPOINTS.
3. THE BAS SHALL POLL THE VARIOUS ZONES AND, BASED ON A PRESET REQUEST QUANTITY TARGET (INITIALLY SET AT 2), ACTIVATE THE AHU WHEN THE ASSOCIATED QUANTITY TARGET HAS BEEN REACHED.
4. UPON ACTIVATION OF THE AHU BASED ON OCCUPANCY SENSORS, THE ASSOCIATED AHU SHALL BE TEMPORARILY ACTIVATED AND THE TERMINAL UNIT SHALL RESUME NORMAL OCCUPANCY MODE CONTROL. DEACTIVATION OF ALL LOCAL OCCUPANCY SENSORS SHALL RETURN THE TERMINAL UNIT TO ITS UNOCCUPIED STATE AND CAUSE THE ASSOCIATED AHU TO SHUT DOWN.
5. TERMINAL UNIT AND ASSOCIATED AHU SHALL REMAIN OCCUPIED AND ACTIVE FOR A MINIMUM OF 1 HR (ADJUSTABLE).

ASSOCIATED AHU RUNS CONTINUOUSLY

.

1. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARD ITS MAXIMUM CFM SETPOINT UNTIL THE UNOCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.
2. ON A FALL IN ROOM TEMPERATURE MODULATE THE AIR TOWARDS ITS UNOCCUPIED MINIMUM CFM SETPOINT.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)

VAV# TYPE: IC-15			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_RMxxxx_AHxxx_BOXxx_FLW	SUPPLY AIR FLOW	CFM	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_DMP	SUPPLY AIR DAMPER	%OPEN		X					
bbb_RMxxxx_AHxxx_BOXxx_SA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_OS	OCCUPANCY STATUS	OCC/UNOCC		X					
bbb_RMxxxx_AHxxx_BOXxx_ZT	ZONE TEMPERATURE	DEG F	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_SP	ZONE TEMPERATURE SETPOINT	DEG F	X						
bbb_RMxxxx_AHxxx_BOXxx_OR	TEMPORARY OCCUPANCY OVERRIDE	OCC/UNOCC		X					

SEQUENCE OF OPERATION GUIDELINE

AIR TERMINAL UNITS – SINGLE DUCT VARIABLE AIR VOLUME with HOT WATER REHEAT or ELECTRIC HEAT

Document: VAV-HTG rev1
Revision: 1.0
Rev. Date: July 22, 2011

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR TYPICAL VAV AIR TERMINAL UNITS. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.

2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.

3. USE ZONE OCCUPANCY SENSORS FOR “UNOCCUPIED” MODE WHENEVER POSSIBLE. COORDINATE WITH ELECTRICAL/LIGHTING DESIGN FOR DUAL USE.

4. REFERENCE STANDARD CONTROL DIAGRAMS IC-16.

VAV BOXES WITH HOT WATER REHEAT:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. PRESSURE INDEPENDENT VOLUME CONTROL WITH ADJUSTABLE MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. CLOSE HOT WATER REHEAT AND RETURN THE VOLUME DAMPER TO A MINIMUM POSITION (25 %) WHEN ASSOCIATED AHU IS OFF.
4. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE HEATING COIL FOR USE IN MONITORING OVERALL VAV BOX PERFORMANCE.
5. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

OCCUPIED MODE

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING/HEATING DEMAND
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.

3. WHEN THE ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE ZONE DAMPER SHALL CONTROL TO ITS MINIMUM OCCUPIED AIRFLOW (ADJ.). HOT WATER REHEAT REMAINS CLOSED.
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW AND, INCREASE THE HOT WATER REHEAT OUTPUT PROPORTIONALLY UNTIL THE OCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

UNOCCUPIED MODE (BASED ON SCHEDULE OR LOCAL OCCUPANCY SENSOR)

ASSOCIATED AHU IS SCHEDULED OFF

1. THE AIR DAMPER SHALL REMAIN AT ITS MINIMUM 25% POSITION AND THE ELECTRIC HEAT SHALL REMAIN OFF.
2. IN THE EVENT THE AHU IS ENABLED DURING UNOCCUPIED HOURS (DUE TO A NIGHT SETBACK CALL FOR COOLING OR HEATING), THE BOX SHALL CONTROL ACCORDING TO THE OCCUPIED MODE DESCRIBED ABOVE USING THE OCCUPIED SETPOINTS.
3. THE BAS SHALL POLL THE VARIOUS ZONES AND, BASED ON A PRESET REQUEST QUANTITY TARGET (INITIALLY SET AT 2), ACTIVATE THE AHU WHEN THE ASSOCIATED QUANTITY TARGET HAS BEEN REACHED.
4. UPON ACTIVATION OF THE AHU BASED ON OCCUPANCY SENSORS, THE ASSOCIATED AHU SHALL BE TEMPORARILY ACTIVATED AND THE TERMINAL UNIT SHALL RESUME NORMAL OCCUPANCY MODE CONTROL. DEACTIVATION OF ALL LOCAL OCCUPANCY SENSORS SHALL RETURN THE TERMINAL UNIT TO ITS UNOCCUPIED STATE AND CAUSE THE ASSOCIATED AHU TO SHUT DOWN.
5. TERMINAL UNIT AND ASSOCIATED AHU SHALL REMAIN OCCUPIED AND ACTIVE FOR A MINIMUM OF 1 HR (ADJUSTABLE).

ASSOCIATED AHU RUNS CONTINUOUSLY

.

1. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARD ITS MAXIMUM CFM SETPOINT UNTIL THE UNOCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.
2. ON A FALL IN ROOM TEMPERATURE MODULATE THE AIR TOWARDS ITS UNOCCUPIED MINIMUM CFM SETPOINT. ON A CONTINUED FALL IN ROOM TEMPERATURE, INCREASE THE HOT WATER REHEAT OUTPUT PROPORTIONALLY UNTIL THE UNOCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)
OCCUPIED HTG SETPOINT 70 F (ADJUSTABLE)
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)
UNOCCUPIED HTG SETPOINT 68 F (ADJUSTABLE)

<u>VAV BOXES WITH ELECTRIC REHEAT</u>:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.

2. PRESSURE INDEPENDENT VOLUME CONTROL WITH ADJUSTABLE MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. PROVIDE SCR VARIABLE CONTROL OF ELECTRIC HEAT STRIP.
4. DISABLE ELECTRIC HEAT AND RETURN THE VOLUME DAMPER TO A MINIMUM POSITION (25 %) WHEN ASSOCIATED AHU IS OFF.
5. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE HEATING COIL FOR USE IN MONITORING OVERALL VAV BOX PERFORMANCE.
6. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

OCCUPIED MODE

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING/HEATING DEMAND
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.
3. WHEN THE ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE ZONE DAMPER SHALL CONTROL TO ITS MINIMUM OCCUPIED AIRFLOW (ADJ.). ELECTRIC HEAT IS DISABLED.
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW AND, INCREASE THE ELECTRIC HEATER OUTPUT PROPORTIONALLY UNTIL THE OCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

UNOCCUPIED MODE (BASED ON SCHEDULE OR LOCAL OCCUPANCY SENSOR)

ASSOCIATED AHU IS SCHEDULED OFF

1. THE AIR DAMPER SHALL REMAIN AT ITS MINIMUM 25% POSITION AND THE ELECTRIC HEAT SHALL REMAIN OFF.
2. IN THE EVENT THE AHU IS ENABLED DURING UNOCCUPIED HOURS (DUE TO A NIGHT SETBACK CALL FOR COOLING OR HEATING), THE BOX SHALL CONTROL ACCORDING TO THE OCCUPIED MODE DESCRIBED ABOVE USING THE OCCUPIED SETPOINTS.
3. THE BAS SHALL POLL THE VARIOUS ZONES AND, BASED ON A PRESET REQUEST QUANTITY TARGET (INITIALLY SET AT 2), ACTIVATE THE AHU WHEN THE ASSOCIATED QUANTITY TARGET HAS BEEN REACHED.
4. UPON ACTIVATION OF THE AHU BASED ON OCCUPANCY SENSORS, THE ASSOCIATED AHU SHALL BE TEMPORARILY ACTIVATED AND THE TERMINAL UNIT SHALL RESUME NORMAL OCCUPANCY MODE CONTROL. DEACTIVATION OF ALL LOCAL OCCUPANCY SENSORS SHALL RETURN THE TERMINAL UNIT TO ITS UNOCCUPIED STATE AND CAUSE THE ASSOCIATED AHU TO SHUT DOWN.
5. TERMINAL UNIT AND ASSOCIATED AHU SHALL REMAIN OCCUPIED AND ACTIVE FOR A MINIMUM OF 1 HR (ADJUSTABLE).

ASSOCIATED AHU RUNS CONTINUOUSLY

.

1. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARD ITS MAXIMUM CFM SETPOINT UNTIL THE UNOCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.

2. ON A FALL IN ROOM TEMPERATURE MODULATE THE AIR TOWARDS ITS UNOCCUPIED MINIMUM CFM SETPOINT. ON A CONTINUED FALL IN ROOM TEMPERATURE, ENERGIZE THE ELECTRIC HEATER IN STAGES UNTIL THE UNOCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)
OCCUPIED HTG SETPOINT 70 F (ADJUSTABLE)
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)
UNOCCUPIED HTG SETPOINT 68 F (ADJUSTABLE)

VAV # TYPE: IC-16			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_RMxxxx_AHxxx_BOXxx_FLW	SUPPLY AIR FLOW	CFM	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_DMP	SUPPLY AIR DAMPER	%OPEN		X					
bbb_RMxxxx_AHxxx_BOXxx_RHV	REHEAT VALVE OUTPUT	%OPEN	X						
bbb_RMxxxx_AHxxx_BOXxx_SA	SUPPLY AIR TEMPERATURE	DEG F	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_OS	OCCUPANCY STATUS	OCC/UNOCC		X					
bbb_RMxxxx_AHxxx_BOXxx_ZT	ZONE TEMPERATURE	DEG F	X			X	X		
bbb_RMxxxx_AHxxx_BOXxx_SP	ZONE TEMPERATURE SETPOINT	DEG F	X						
bbb_RMxxxx_AHxxx_BOXxx_OR	TEMPORARY OCCUPANCY OVERRIDE	OCC/UNOCC		X					

SEQUENCE OF OPERATION GUIDELINE

EXHAUST FAN SYSTEM-MULTIPLE FANS

Document: **Exhaust-Multiple Fan**
Revision: **1.0**
Rev. Date: **July 22, 2011**

NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR A TYPICAL MUTLI FAN EXHAUST SYSTEM. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. REFERENCE STANDARD CONTROL DIAGRAMS IC-17

PROVIDE THE FOLLOWING FOR EXHAUST FAN SYSTEMS.

1. VARIABLE FREQUENCY DRIVE AND BYPASS DAMPERS WITH STATIC PRESSURE CONTROL.
2. AUTOMATIC FAN ROTATION AND FAN FAILURE STANDBY CONTROL.
3. NORMAL TWO FAN OPERATION WITH A DESIGNATED STANDBY FAN OPERATION.

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE EXHAUST SYSTEM IS STARTED OR STOPPED, UNLESS OTHERWISE NOTED. THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE EXHAUST SYSTEM STARTS-STOPS IN ANY MODE OF OPERATION (ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. BYPASS DAMPERS: OPEN BYPASS DAMPERS TO THEIR MINIMUM 25% POSITION UPON INITIAL STARTUP. CLOSE DAMPERS UPON EXHAUST SYSTEM STOP.
2. FANS: RAMP FAN UP TO MINIMUM SPEED AND ENABLE STATIC PRESSURE CONTROL. SHUT DOWN FANS UPON EXHAUST SYSTEM SHUTDOWN.

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED IN EXHAUST DUCTS AS INDICATED ON FLOOR PLAN. CONTROL THE VARIABLE SPEED DRIVE FROM MINIMUM TO MAXIMUM SPEED TO MAINTAIN THE STAITC PRESSURE SETPOINT. IN THE EVENT THE REMOTE STATIC PRESSURE BECOMES UNRELIABLE, REVERT CONTROL TO THE STATIC PRESSURE SENSOR LOCATED AT THE EXHAUST PLENUM AND INITIATE AN ALARM. IN THE EVENT MORE THAN ONE STATIC PRESSURE IS SHOWN, THE BAS SHALL CONTROL TO THE SENSOR THAT IS FARTHEST FROM SETPOINT

BYPASS DAMPER CONTROL: IN THE EVENT THE FANS HAVE REACHED THEIR MINIMUM SPEED AND THE STATIC PRESSURE REMAINS HIGH, BEGIN MODULATING THE BYPASS

DAMPERS BETWEEN THEIR MINIMUM AND MAXIMUM OPEN POSITION. CONTINUE MODULATING THE BYPASS DAMPERS UNTIL THEY REACH THEIR MINIMUM SETTING 25% (ADJ) AT WHICH TIME THE FANS WILL BEGIN RAMPING UP TOWARDS THEIR MAXIMUM SPEED.

SINGLE EXHAUST FAN FAILURE: IN THE EVENT ONE OF THE EXHAUST FANS FAIL, IMMEDIATELY START THE STANDBY EXHAUST FAN. THE STANDBY FAN WILL REMAIN ON AND BE RE-DESIGNATED AS THE NEW PRIMARY FAN. THE FAILED FAN SHALL MAINTAIN ITS ALARM CONDITION UNTIL A BAS RESET IS INITIATED TO BRING THE FAILED FAN OUT OF ITS ALARM CONDITION. NOTE: REGARDLESS OF STANDBY FAN ALARM STATE THE BAS SHALL MAKE AN ATTEMPT TO START THE STANDBY FAN IN THE EVENT OF A LEAD FAN FAILURE.

EXHAUST SYSTEM ROTATION SEQUENCE: UPON SIGNAL FROM THE BAS TO ROTATE THE EXHAUST FANS, EXECUTE THE FOLLOWING SEQUENCE.

1. WHILE THE CURRENT LEAD FANS ARE STILL ACTIVE, RUN THE FANS DOWN TO 50% (ADJ).
2. OVERRIDE THE EXHAUST BYPASS DAMPER TO 50%
3. START THE NEW LEAD FAN
4. STOP THE OLD LEAD FAN AND DESIGNATE IT AS THE NEW STANDBY FAN
5. RELEASE FANS AND BYPASS DAMPER TO MAINTAIN STATIC PRESSURE SETPOINT
6. DELAY 10 SECODNS (ADJUSTABLE)
7. INITIATE ROTATION IN ACCORDANCE WITH A BAS SCHEDULE OR BY MANUAL INITIATION.

EXH # TYPE: IC-17			POINT TYPE		ALARM CONDITION			INTEGRATED POINT	NOTES
SHORT NAME	POINT DESCRIPTION	UNITS	ANALOG	DIGITAL	EQUIP ALARM	HIGH LIMIT	LOW LIMIT		
bbb_EXHxxA_SS	EXHAUST FAN-A START/STOP	ON/OFF		X	X				
bbb_EXHxxA_S	EXHAUST FAN-A STATUS	ON/OFF		X	X				
bbb_EXHxxA_VFD	EXHAUST FAN-A VFD OUTPUT	%	X						
bbb_EXHxxA_FLW	EXHAUST FAN-A AIR FLOW	CFM	X						
bbb_EXHxxB_SS	EXHAUST FAN-B START/STOP	ON/OFF		X	X				
bbb_EXHxxB_S	EXHAUST FAN-B STATUS	ON/OFF		X	X				
bbb_EXHxxB_VFD	EXHAUST FAN-B VFD OUTPUT	%	X						
bbb_EXHxxB_FLW	EXHAUST FAN-B AIR FLOW	CFM	X						
bbb_EXHxxC_SS	EXHAUST FAN-C START/STOP	ON/OFF		X	X				
bbb_EXHxxC_S	EXHAUST FAN-C STATUS	ON/OFF		X	X				
bbb_EXHxxC_VFD	EXHAUST FAN-C VFD OUTPUT	%	X						
bbb_EXHxxC_FLW	EXHAUST FAN-C AIR FLOW	CFM	X						
bbb_EXHxxSP1	STATIC IN DUCT-1	INWG	X			X	X		
bbb_EXHxxSP2	STATIC IN DUCT-2	INWG	X			X	X		
bbb_EXHxxSP_SP	STATIC IN DUCT SETPOINT	INWG	X						
bbb_EXHxx1_FLW	EXHAUST AIR FLOW DUCT-1	CFM	X			X	X		
bbb_EXHxx2_FLW	EXHAUST AIR FLOW DUCT-2	CFM	X			X	X		
bbb_EXHxx3_FLW	EXHAUST AIR FLOW DUCT-3	CFM	X			X	X		
bbb_EXHxx_BYPD1	EXHAUST FAN OA BYPASS DAMPER OUTPUT-1	% OPEN	X						
bbb_EXHxx_BYPD2	EXHAUST FAN OA BYPASS DAMPER OUTPUT-2	% OPEN	X						
bbb_EXHxxA_HZ	EXHAUST FAN-A VFD HERTZ	HZ	X					X	
bbb_EXHxxA_KW	EXHAUST FAN-A VFD KW DEMAND	KW	X					X	
bbb_EXHxxA_A	EXHAUST FAN-A VFD ALARM	KW		X	X			X	
bbb_EXHxxB_HZ	EXHAUST FAN-B VFD HERTZ	HZ	X					X	
bbb_EXHxxB_KW	EXHAUST FAN-B VFD KW DEMAND	KW	X					X	
bbb_EXHxxB_A	EXHAUST FAN-B VFD ALARM	KW		X	X			X	
bbb_EXHxxC_HZ	EXHAUST FAN-C VFD HERTZ	HZ	X					X	
bbb_EXHxxC_KW	EXHAUST FAN-C VFD KW DEMAND	KW	X					X	
bbb_EXHxxC_A	EXHAUST FAN-C VFD ALARM	KW		X	X			X	

Florida State University
BAS Point Naming Standard

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter desigination) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
AIR HANDLERS	WES_AHxxOA (xx=Air Handler #)	fresh air temperature	0.5 Deg	AI
	WES_AHxxMA	mix air temperature	0.5 Deg	AI
	WES_AHxxPT	preheat air temperature	0.5 Deg	AI
	WES_AHxxCT	cooling coil air temperature	0.5 Deg	AI
	WES_AHxxSA	supply air temperature	0.5 Deg	AI
	WES_AHxxRT	reheat air temperature	0.5 Deg	AI
	WES_AHxxRA	return air temperature	0.5 Deg	AI
	WES_AHxxRACO2	return air CO2 sensor	10 units	AI
	WES_AHxxRAH	return air humidity	1 rh	AI
	WES_AHxxSAH	supply air humidity	1 rh	AI
	WES_AHxxRAFLW	return air flow	10-20 cfm	AI
	WES_AHxxSAFLW	supply air flow	10-20 cfm	AI
	WES_AHxxOAFLW	fresh air flow	10-20 cfm	AI
	WES_AHxxSP1	supply static after fan	0.1 inches	AI
	WES_AHxxSP2	static 2/3 in duct	0.1 inches	AI
	WES_AHxxFLT1DP	compound static pressure across pre-filter	0.1 inches	AI
	WES_AHxxFLT2DP	compound static pressure across final-filter	0.1 inches	AI
AIR HANDLERS	WES_AHxxPHV	preheat valve	1%	AO
(water side)	WES_AHxxPCV	fresh air precool valve	1%	AO
	WES_AHxxCV	cooling valve	1%	AO
	WES_AHxxRHV	reheat valve	1%	AO
	WES_AHxxCHWF	chill water flow	1 gpm	AI
	WES_AHxxHWF	hot water flow	1 gpm	AI
	WES_AHxxCHWR	chill water return temp (rap around sensor)	0.5 Deg	AI
	WES_AHxxHWR	hot water return temp (rap around sensor)	0.5 Deg	AI
	WES_AHxxHUMV	humidifier valve	1%	AI

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter desigination) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
AIR HANDLERS	WES_AHxxFLT1	pre filter pressure drop	0.1 "	AI
	WES_AHxxFLT2	final filter pressure drop	0.1"	AI
	WES-AHxxFZ	obtain status from freeze safety		BI
	WES_AHxxDDS	duct detector status		BI
	WES_AHxxFDS	fire damper status		BI
	WES_AHxxS	air handler status		BI
	WES_AHxxSAFETY	air handler high pressure safety shutdown status		BI
AIR HANDLERS	WES_AHxxSS	air handler start/stop		BO
(output)	WES_AHxxOD	modulating outdoor damper	1%	AO
	WES_AHxxRD	modulating return air damper	1%	AO
	WES_AHxxRFAN	return air fan start/stop		BO
	WES_AHxxOAFAN	fresh air fan start/stop		BO
HVAC HEATING	WES_HPS	high pressure steam	1 psi	AI
(Steam side AI)	WES_LPS	low pressure steam	1 psi	AI
	WES_MPS	medium pressure steam	1 psi	AI
	WES_SFLO	steam flow lbm/hr	5 lbm/hr	AI
	WES_SFLW	corrected steam flow lbm/hr	5 lbm/hr	AI
HVAC HEATING	WES_PRV1	low pressure steam prv valve 1/3	1%	AO
(Steam side AO)	WES_PRV2	low pressure steam prv valve 2/3	1%	AO
	WES_PRV3	medium pressure steam prv valve 1/3	1%	AO
	WES_PRV4	medium pressure steam prv valve 2/3	1%	AO
	WES_DSTV	steam control valve for dometic hw	1%	AO

Florida State University
BAS Point Naming Standard

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter desigination) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
	WES_HX1_SV1	heat exchanger # 1 steam valve 1/3	1%	AO
	WES_HX1_SV2	heat exchanger # 1 steam valve 2/3	1%	AO
	WES_HX2_SV1	heat exchanger # 2 steam valve 1/3	1%	AO
	WES_HX2_SV2	heat exchanger # 2 steam valve 2/3	1%	AO
HVAC HEATING	WES_HX1_ISO	heat exchanger # 1 two position isolation vlv		BO
(water side)	WES_HX2_ISO	heat exchanger # 2 two position isolation vlv		BO
	WES_HX1_HWS	heat exchanger # 1 hot water supply temp	1 Deg	AI
	WES_HX2_HWS	heat exchanger # 2 hot water supply temp	1 Deg	AI
	WES_HWS	common hot water supply temperature	1 Deg	AI
	WES_HWR	common hot water return temperature	1 Deg	AI
	WES_HWF	hot water return flow	2 gpm	AI
	WES_HWDP	hw differential for variable volume sys	1 psid	AI
	WES_HP1	hot water pump # 1 start/stop		BO
	WES_HP2	hot water pump # 2 start/stop		BO
	WES_VFD_HP1	hot water pump # 1 VFD	1%	AO
	WES_VFD_HP2	hot water pump # 2 VFD	1%	AO
HVAC HEATING	WES_CNP1	condensate pump # 1 status		BI
(Steam cond.)	WES_CNP2	condensate pump # 2 status		BI
	WES_CNT	condensate water temperature	2 Deg	AI
	WES_CNFLW	condensate flow	1 gpm	AI
	WES_COND	condensate conductivity	10 mho	AI
HVAC COOLING	WES_CHWP1	chill water pump # 1 start/stop		BO

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter desigination) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
(bldg cooling)	WES_CHWP2	chill water pump # 2 start/stop		BO
	WES_CHWP1_SC	chill water pump # 1 speed control	1%	AI
	WES_CHWP2_SC	chill water pump # 2 speed control	1%	AI
	WES_CHWP_BYP	two position chill water pumps bypass		BO
	WES_CHWDP	chill water differential pressure	1 psid	AI
	WES_BLDG_CHWS	building entering chill water supply	0.5 Deg	AI
	WES_BLDG_CHWR	building exiting chill water return	0.5 Deg	AI
	WES_BLDG_CHWDP	building chill water differential pressure	0.2 psid	AI
	WES_CHW_FLW	building chill water flow	5 gpm	AI
DEDICATED BLDG	WES_CHWS	chill water supply temperature	0.2 Deg	AI
CHILLER	WES_CHWR	chill water return temperature	0.2 Deg	AI
	WES_CHWF	chill water flow	5 gpm	AI
	WES_CWS	cooling tower or well water supply temp.	1 Deg	AI
	WES_CWR	cooling tower or well water return temp.	1 Deg	AI
	WES_CWF	cooling tower or well water flow	5 gpm	AI
	WES_CHILL_SS	chiller start/stop		BO
	WES_CHWP1	chill water pump # 1 start/stop		BO
	WES_CHWP2	chill water pump # 2 start/stop		BO
	WES_EVP_DP	differential pressure across evaporator barrel	0.1 psid	AI
	WES_CON_DP	differential pressure across condensor barrel	0.1 psid	AI
	WES_COND_FANS	total amps for all the air cooled condensor fans	1 amp	AI
	WES_WELL_PMP	well pump start/stop		BO
	WES_WELL_PMP_LOAD	total amps for well pump	1 amp	AI
	WES_CW_FR	freon head pressue on condensor side	0.1 psia	AI
	WES_CH_GATEWAY	connect to gateway to import all data to Apogee		AI/AO/BO/BI

Florida State University
BAS Point Naming Standard

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter desigination) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
	WES_CHWRP	chill water return pressure (to detect sys leaks)	1 psig	AI
	WES_CHW_MKUP	chill water make up flow (Pulse type meter)	10gal/pulse	BI
	WES_CHILLER _LOAD	chiller load using DEM-2000 electrical meter	1 kw	AI
DEDICATED BLDG	WES_BOIL_SS	boiler start/stop		BO
BOILER	WES_HWP	hot water pump start/stop		BO
	WES_HWS	boiler hot water supply	1 Deg	AI
	WES_HWR	boiler hot water return	1 Deg	AI
	WES_HWF	boiler hw flow	5 gpm	AI
	WES_HWSP	boiler hw set point	1 Deg	AI
	WES_HWRP	hot water return pressure	1 psig	AI
	WES_HW_MKUP	hot water make up flow (pulse type meter)	10gal/pulse	BI
BLDG GENERATOR	WES_GENS	Generator status		BI
	WES_GEN_LOAD	monitor load side of transfer switch (DEM-2000)	1 kw	AI
	WES_GEN_GATEWAY	connect to gateway to import all data to Apogee		AI/AO/BO/BI
	WES_GEN_TRANSFER	generator transfer switch status		AI
	WES_GEN_ALM	generator alarm		BI
ROOM SENSORS	WES_RMxxxx (xxxx = room #)	logical name must be identified as WES_RMxxxx		P1 lan
		descriptor must be AH#_BOX#(eg AH01_VAV1-1)		
		wher AH= Air Handler		
		BOX # = actual vav box number as appearing on		
		100% asbuilt drawings		

EQUIPMENT	SHORT LOGICAL NAMES (all bldg names should use three letter designation) examples: Westcott-WES; Diffenbaugh-DIF, Fine arts-FAB; (confer bldg names with FSU/CUP)	DESCRIPTION	APOGEE VALUE CHANGE UPDATE	INPUT/ OUTPUT TYPE
LAB UNITS	WES_LAB_RMxxxx	lab unit connected to Apogee P1		AI/AO/BO/BI
	WES_LAB_RMxxxx_FH1	lab fume hood on P1 lan		AI/AO/BO/BI
LAB EXHAUST	WES_EXHxx (where xx = exhaust #)	lab exhaust fan start/stop		BO
	WES_EXHxx_FLW	exhaust air flow	10 cfm	AI
	WES_EXHxx_VEL	exhaust air velocity	10 fpm	AI
	WES_EXHxx_SP	exhaust static pressure (negative value)	0.1"	AI
	WES_EXHxx_DMP	exhaust inlet damper (two position)		BO
	WES_EXHxx_RLF_DMP	exhaust relief damper	1%	AO
	WES_EXHxx_VFD	exhaust fan VFD	1%	AO
	WES_EXHxx_VFD_LAN	exhaust fan VFD on P1 lan		AI/AO/BO/BI

Control System Integration Requirements for connection to the Siemens Building Automation System at Florida State University

PART 1 – GENERAL

1.01 All non Siemens Building Systems that communicate with the Campus BAS shall conform to the standard for communication for the University as stated herein. Proof of compliance will be required prior to listing in project specifications as an approved vendor. Listing as an approved vendor shall not reduce the requirements of this specification to be met.

1.02 Communication protocols to the BAS shall be fully described in the project specifications. The required communication method for all devices shall be via the *Secondary Network (FLN)* (See PART 2 – PROTOCOLS).

1.03 If there is no solution available utilizing a device that is native to the *Secondary Network*, devices that utilize a *Gateway* to translate to the *Secondary Network (FLN)* protocol may be considered. Vendors requiring the use of *Gateway* devices require pre-approval by the University and Siemens prior to being listed in project specifications as an approved vendor.

1.04 Vendor shall certify, via the *Systems Integration Certification form*, that their system fully integrates with the Siemens BAS for all agreed upon points. The form shall be signed off by both the vendor and Siemens.

1.05 Submittals including PICS statements shall be required prior to design development of projects for review and approval by the University. Equipment samples may be required for consideration and testing by the University and Siemens prior to review and approval.

1.06 Non Siemens Building Systems (Devices) is defined as equipment utilized at Florida State University within facilities for HVAC, Lighting, Power, etc to operate the facilities that this University intends to connect to the Campus Building Automation System of Siemens Field Panels and Servers. The connection shall allow the communication (bi-directionally) for building control, monitoring, alarming, scheduling, occupancy status, etc.

1.07 The Control Systems Integration Requirements document has attempted to minimize all potential integration issues. There shall be no variances to this standard granted without written approval of the Florida State University Central Utilities Department and Siemens.

PART 2 – PROTOCOLS

2.01 Accepted Protocols for Direct Connection to the BAS *Secondary Network (FLN)*

The project specifications will determine the protocol(s) available for connection to the BAS *Secondary Network (FLN)*. Since each project has specific requirements, the vendor should not assume that all of the protocols listed below are available for each project. Each Siemens field panel has a limited number of *Secondary Networks (FLN)* available and the protocols selected for each project are based on the systems architecture required to meet the overall design goals.

Accepted Protocols

A. Siemens P1
B. BACNet MS/TP
C. MODBUS RTU

2.02 Communication:

A. The required communication method for all devices shall be via the *Secondary Network (FLN)*

B. Primary Network – Campus APOGEE VPN Ethernet Communication:

Control System Integration Requirements for connection to the Siemens Building Automation System at Florida State University

1. All Siemens Building Controllers and Servers shall directly reside on the *Primary Ethernet Network* (ALN) such that communications may be executed directly between Building Controllers, or directly between server and Building Controllers on a peer-to-peer basis.

2. Non Siemens Building Controllers shall not connect to the Siemens Campus VPN Network except through the *Secondary Network (FLN)* as described below.

A. *Secondary Network (FLN)*: P1

1. Devices shall communicate directly via EIA-485 Twisted cabling to a Siemens Field Panel.

2. Devices covered under this section shall be currently listed in the Siemens *"APOGEE Integration Compatible Products Guide"* .

3. A maximum of (99) Devices may be configured on individual secondary networks to ensure adequate global data and alarm response times.

B. *Secondary Network (FLN)* : BACNet MS/TP

1. Devices shall communicate directly via EIA-485 Twisted cabling to a Siemens Field Panel.

2. Communication over the secondary network shall be BACnet MS/TP data layer protocol and MS/TP physical layer as is defined in ASHRAE 135-2004.

3. Devices covered under this section must meet BTL (BACnet Testing Laboratories) standards and shall be listed by BTL.

4. A maximum of (50) Devices may be configured on individual *Secondary Network*s *(FLN)* to ensure adequate global data and alarm response times.

C. *Secondary Network (FLN)*: MODBUS RTU

1. Siemens Field Panel shall operate as Modbus Master.

2. Slave Devices shall communicate directly via EIA-485 Twisted cabling to a Siemens Field Panel.

3. Communication over the secondary network shall be Modbus RTU data layer protocol via RS-485.

4. A maximum of (31) Slave Devices may be configured on individual secondary networks without repeaters to ensure adequate global data and alarm response times. Additional addressing up to a total of (247) may be allowed subject to prior approval by FSU and Siemens.

2.03 Gateways

Some systems do not have a native communications protocol suitable for connection to the Siemens *Secondary Network (FLN)*. If no other equipment is available that will fulfill the requirements of the design, upon special approval, equipment may be connected to the *Secondary Network (FLN)* via a *Gateway* Device that has been approved by FSU and Siemens.

Control System Integration Requirements
for connection to the Siemens Building Automation System at
Florida State University

Approved Devices

A. ICC ETH-1000
B. ICC XLTR-1000

Gateway Devices shall not be used without approval by the University and Siemens. In addition, the devices must conform to the requirements described in the Database section of this document.

2.04 Database

BACNet

A. All database and system network layouts including items described below shall be submitted for review and shall be approved by Siemens prior to allowance of equipment release.
   1. BTL Listing and Product Datasheets
   2. BACnet Instance Numbers conforming to University allocations
   3. Object Naming conforming to University standards
   4. System Riser and Layout shop drawings (project specific)
   5. Database settings for data communications variables
   6. Ability of all requested points to be polled without additional front end programming to allow intermittent switching between monitoring of points on the system connected to the *Secondary Network (FLN).*
   7. Signed *Systems Integration Certification Form*

B. Verification that all approved requirements have been met shall be required prior to connection to the Campus BAS and acceptance of the device.

MODBUS

A. All database and system network layouts including items described below shall be submitted for review and shall be approved by Siemens prior to allowance of equipment release.
   1. MODBUS Listing and Product Datasheets
   2. MODBUS Metadrops conforming to University allocations
   3. MODBUS Integrated Systems Binary (ISB) files conforming to University allocations
   4. Object Naming conforming to University standards
   5. System Riser and Layout shop drawings (project specific)
   6. Database settings for data communications variables
   7. Ability of all requested points to be polled without additional front end programming to allow intermittent switching between monitoring of points on the system connected to the *Secondary Network (FLN).*
   8. Signed *Systems Integration Certification Form*
B. Verification that all approved requirements have been met shall be required prior to connection to the Campus BAS and acceptance of the device.

PART 3 – PRODUCTS

3.01 Products

A. Devices defined include but are not limited to:

   1. Variable Frequency Drives, Motor Controllers
   2. Generators, ATS, Switchgear, Power Meters, Lighting Control.

Control System Integration Requirements for connection to the Siemens Building Automation System at Florida State University

3. Unitary HVAC Equipment (Chillers, Boilers, Roof top Units, DX Split Systems, DX Variable Refrigerant Flow Systems, PTAC, Computer Room AC Units, Process Coolers, Ductless Split Systems.
4. Individual classroom or small group of rooms lighting controls.

All Devices require prior written approval before being added to design documents for inclusion on a project or the campus

B. Devices that are native to the *Secondary Network (FLN)* AND are listed in the *"APOGEE Integration Compatible Products Guide"* for the *Secondary Network (FLN)* chosen in project design documents will be given preference over products requiring a 3rd party *gateway* device.

C. The Siemens APOGEE system functions as the primary building control system. In addition to providing the HMI function, the system also allows remote programming, program restoration functions, and a common PPCL language. The central server also integrates with other BI software systems via OPC and XML and is not addressed in this document. The intent of control systems integration is to provide a means to integrate major pieces of equipment with complex on board controls and field level devices to operate as a extension of the APOGEE system. Listed below are some system types that are excluded for use via a gateway device for connection to the *Secondary Network (FLN):*

1. Building controllers with non-PPCL programming used to manage other sub controllers utilizing DALI or other forms of distributed I/O.
2. Visualization clients or other forms of hardware designed to export information from the APOGEE system.

PART 4 – EXECUTION

4.01 In addition to the project specifications the following shall apply

A. Coordination with Siemens for all requirements is the responsibility of the device vendor and University assigned project/construction manager prior to project pricing and award.

B. All runs of communication wiring shall be un-spliced.

C. All communication wiring shall be labeled to indicate origination and destination data.

D. Communications and Systems wiring unless otherwise approved by the University shall be installed by Siemens or the University directly in accordance with all applicable Florida Codes and standards.

E. The contractor shall be responsible to install all required raceway(s), including pull string, for all involved components of the control system(s).

*****END OF SECTION*****

SECTION 16000 - Electrical

Part 1 - General:

1.1 Scope of Section

This section contains the requirements relating provision of electrical service, including utility infrastructure, distribution methods, materials and equipment, electrical energy management, emergency power requirements, circuit coordination, transformers, lightning protection systems, and lighting. Protection of existing electrical equipment, utilities procurement, utility disconnects and locates are included in Division 1- General Requirements.

1.2 Overview

A. **Coordination Meeting:** There shall be a utilities connection/coordination meeting during the Design Development process between Campus Utilities and the MEP/Civil Engineers. At the time of the meeting the design team should have documentation prepared to include the anticipated square footage of the facility, anticipated loads and a basic understanding of the existing utility infrastructure around the project location.

B. **Connection to Existing Utilities:** All utility work shall be coordinated with and approved by the Utilities Section through the construction Project Manager. Each drawing that shows a connection to existing utilities shall have a note stating the Contractor shall request permission for all outages a minimum of 5 working days in advance, unless an emergency arises. Explicit details shall be shown for all connections to existing utilities. The Utilities Section must approve both the location and the method of the proposed connection.

C. **Electric Consumption During Construction:** The Contractor, through the Project Manager, shall pay for all electric energy consumed during construction as part of the project General Conditions. The Contractor shall obtain the Utilities Procurement Procedures from the Project Manager. Requirements for establishing service are as detailed. Drawings shall clearly call for the Contractor to take such action.

D. **Dedicated Electrical Rooms:**

1. The project shall have dedicated electric rooms as required to accommodate all major electric equipment including main switchgear, panels, transformers, automatic transfer switch(es), and disconnect devices.
2. The Life Safety emergency switching equipment shall be in a separate room with outside accessibility.
3. No other type utilities that are not specific to the electric system shall be allowed to occupy any space (including ‘pass through’) in the electric rooms.

4. In multiple floor buildings where additional electrical rooms are required for each floor, the electrical rooms shall be 'stacked' to facilitate the installation of conduit and wire required to provide service to the floors.
5. A scaled drawing (minimum of ¼" = 1') of each electric room shall be available during design to insure the room is of adequate size to accommodate all electrical equipment (panels, transformers, switches) and provide NEC mandated clearances for all equipment.

E. Fault Current and Arc Flash Calculations, Phase Overcurrent Coordination Studies and Breaker Settings:

1. The Engineer of Record (EOR) is responsible for preparing fault current and Arc flash calculations, performing the coordination study and establishing settings for all adjustable circuit breakers.
2. Fault current and Arc fault calculations shall be included in the project specifications and submitted with the 100% construction documents. Construction documents will not be approved if the calculations are omitted.
3. The EOR is responsible for insuring the breaker settings are made prior to any equipment being energized. For projects that are renovations only, to the extent new electrical equipment is installed, the settings shall be made prior to energizing the new equipment.
4. **Remodeling:** For projects that are remodeling in nature and do not encompass the whole electric system, only the electric equipment involved in the remodeling will require circuit coordination settings.

F. Arc Flash Boundaries and PPE requirements:

1. Through a prior study, minimum ARC Flash boundaries and PPE requirements have been established as a standard for campus. The minimum ARC Flash boundary for any location on campus (except the Central Utility Plant and Satellite Utility Plants #1 & #2.) has been determined to be 4 feet. The minimum PPE required is Category 2.
2. If the EOR's calculations reveal any particular device(s) that exceed the above minimum requirements, all equipment exceeding the minimum shall be clearly marked with a warning sign as to the Flash Hazard Boundary, Flash Hazard, PPE Category, Shock Hazard, and all Approach Distances. The sign shall conform to the requirements of NFPA 70E 130.3(C).

G. As-Built Drawing Requirement: Record Drawings that accurately reflect the actual installed conditions shall be furnished at the end of the project. Consult with the Project Manager for details of this requirement.

H. Systems Observation/Training: An authorized representative(s) of the Owner shall witness an operational demonstration of completed systems. Representative(s) shall be completely instructed in the operation and maintenance of installed equipment. Representative(s) shall sign and date a statement that confirms they have received proper, comprehensive training.

I. A manufacturer representative shall be required to provide necessary specified training on all equipment supplied by the manufacturer. Construction material described as 'general construction material' such as conduit and wire, shall not require specific training.

Part 2 – Materials:

2.1 General Material Requirements

A. All electrical materials and equipment shall be UL or ETL listed. CSA is not considered equivalent.
B. All materials and types of construction shall meet or exceed the requirements of UL, ANSI, NEMA, IEEE, and the NEC as well as conform to manufacturer's written recommendations.

2.2 Raceway

A. Exterior:
1. Raceway buried below grade shall be a minimum size of 1", unless otherwise noted, buried to a depth called for by the NEC.
2. Use of flames or hairdryers to fabricate bends of PVC conduit is unacceptable.
3. PVC shall be converted to rigid metallic conduit where the raceway transitions from below grade to above grade. Buried metallic raceway must have a minimum of two coats of bitumastic or have factory applied PVC coating.

B. Interior: All EMT connectors and couplings shall be steel, compression. No set-screw or zinc connectors or couplings shall be used.
C. Empty Conduit: All empty conduit shall have a 200-pound test pull cord installed.
D. Conduit shall be manufactured in the United States.

2.3 Wires and Cables

A. Conductors: All conductors shall be copper with insulation Type THHN/THWN.

B. Minimum power conductor size: #12AWG.
1. **Sizing:** Power conductors shall be sized for maximum 5% voltage drop from source to point of utilization.
2. **Wire Type:** In general, conductors #10 and smaller shall be solid, unless the application specifies stranded wire. Conductors larger than #10 shall be stranded.

3. **Neutral Conductors:** All 120 and 277 volt circuits shall have a dedicated neutral conductor. Multi-wire branch circuits, that share a neutral, shall NOT be allowed.

C. Control conductor sizes and color-coding shall be as governed by approved wiring diagrams or schematics.

2.4 Wire and Cable Connections

A. Wire and cable connected to main electric service equipment, utilizing factory or field installed bus bar, sizes 4/0 and larger shall employ copper to copper 2-hole, compression lugs (long barrel only) using ½" bolts, 2 flat washers, and 1 split lock washer. All bolts and hardware shall be grade 5 cadmium plated steel or bronze (equal to Burndy Durium style). Lugs shall be rated for copper only. Copper clad connectors will be acceptable. No all-aluminum connectors shall be used in any application.

B. Wire and cable may be spliced 'in line' to facilitate circuit extensions and/or new installations. Wire sizes 4/0 and larger shall employ in line compression sleeves with appropriate insulated covers. Cold shrink insulation sleeves may be used in lieu of 'heat shrink' insulation.

C. Connections made to breakers that are furnished with factory installed mechanical connectors will be allowed. For mechanical connectors, factory recommended installation procedures shall be employed (connector torque settings, the use of oxide inhibiting compound, etc).

2.5 MC Cable

A. All wire and cable shall be installed in conduit or where applicable, tray-rated cable in cable trays. In lieu of wire in conduit, MC cable may be used in areas allowed by the NEC, but only with the joint approval of the Engineer of Record, the FSU BCA, FSU Utilities Department, and FSU Plan Reviewers

B. In new and remodeling construction, MC cable shall not be used inside new walls.

Part 3 – Equipment:

3.1 Panelboards

A. Identification: Panelboards shall be identified using permanently attached machine engraved phenolic nameplates.

1. Standard color shall be white letters on black background.
2. Emergency panels shall have white letters on a red background.

B. Bussing: Panelboard bussing, including equipment ground bar, shall be copper.

C. Rating: Lighting and receptacle panelboard neutral bus shall be rated 100%.

D. Sizing: Panelboards shall be sized for minimum 25% spare above calculated diversified demand loads.

E. Breakers:

1. Circuit breakers shall be bolt-on construction.
2. Devices shall be rated for the calculated available bolted fault short circuit currents.
3. If breakers are to be used for switching, switching duty breakers shall be used.
4. Breaker handle ties shall not be employed.

F. Acceptable panel manufacturers: Square D, Siemens, and Cutler-Hammer

3.2 Surge Protective Device (SPD)

1. Main Distribution panels shall have metal oxide varistor type surge protection device (SPD). The MOV device shall have a short circuit current rating of 200 kA or greater.

D. Voltage of the facility.

1. MOV(s) shall be installed in the first ‘down line’ panel and other locations deemed necessary by the Engineer of Record. This type MOV shall be sized as appropriate for the installation as determined by the Engineer of Record.

E. Acceptable SPD manufacturers: As specified by the Engineer of Record.

3.3 Switches and Receptacles

A. Switches and receptacles shall be specification grade and rated 20 amperes.

B. Color: Standard shall be ivory with stainless steel plates. Different color devices must be approved by the Engineer of Record and the Project Manager.

C. Emergency receptacles:

1. Devices assigned to the emergency system shall be distinctive in color: red is considered standard unless another color code has already been established in the facility.
2. Cover plates shall be engraved with panel name and circuit number.

D. Receptacle spacing:

1. Vending areas shall have GFI receptacles mounted no greater than 48” on center. Each receptacle shall be on a dedicated branch circuit.
2. Hallways shall have outlets mounted 50 feet on center, maximum.

E. Receptacle mounting height: Device mounting heights shall conform to the latest applicable edition of ADA standards.

1. Floor outlets shall be flush with finished floor or floor covering, as applicable.
2. When required for classrooms, receptacles for overhead LCD projector shall be mounted flush in finished ceiling.

F. **Wet and Damp Locations:** 20 Amp, 125 Volt and 250 Volt non-locking receptacles in wet or damp locations shall be 'Weather-Resistant', GFI receptacles with 'WR' clearly marked on face.

G. **In Use Covers:** 'In Use' covers employed on exterior receptacles shall be 'die-cast' construction. Plastic covers shall not be used.

H. **Building Exterior:** Outlets shall be provided on the exterior of facilities located so that their spacing does not exceed 100 feet on center. If the receptacle is not continually in use, a weather proof cover will be sufficient.

3.4 Motors, Disconnect Switches and Starters

A. **Motors:** Shall be high efficiency and have an operating power factor of 90% or greater. Provide reduced voltage starters or variable speed drives for all motors 15 horsepower, or larger.
   1. Variable speed drives shall be connected to the campus-wide energy management/monitoring system. For detailed requirements for these connections, contact the FSU Utilities Section.
   2. **Acceptable Manufacturers of VFDs and Soft Starts:**
      a. **VFDs:** AC Technologies; Yaskawa; ABB; Danfoss (under 125 HP); Trane.
      b. **Soft Starts:** SAF
   3. **Acceptable manufacturers of disconnect switches:** Square D, Siemens, General Electric and Cutler Hammer (Eaton).

3.5 Dry Type Transformers:

A. **Windings:** Dry type transformers shall be constructed using aluminum windings.
B. **Temperature Rise:** Dry type transformers shall have 80 degree C temperature rise rating.
C. **Acceptable Manufacturers:** Square D, Siemens, General Electric, and Cutler-Hammer (Eaton).

3.6 Power Generation

A. **Emergency Power Source:** Where required for life safety per NFPA-101and/or for continuity of function in certain facilities, provide a standby rated emergency power engine generator set. The addition of battery-powered lighting, instead of providing a generator set, to meet NFPA-101 exit/egress requirements is highly discouraged.

B. Engine Generator Set: Shall be diesel fueled unless so small that diesel prime mover is not commercially available. Natural gas and LP fueled sets are unacceptable. 'Full tank' shall be defined as 7/8 tank capacity and shall provide 36 hours of continuous operation at full load. Larger tanks may be required to serve facilities where continuity of function is mandatory. The operation and fueling requirements for those types of facilities will be handled on a project-by-project basis as design criteria through the Project Manager.

1. **Acceptable Manufacturers:** Engine generator sets shall be Caterpillar, Cummins/Onan. All other manufacturers are unacceptable.

C. Generator Set Location:

1. There are numerous locations on campus where terrain or geometry of adjacent structures may require that the generator set be installed in a sound attenuating enclosure with a rated sound attenuating silencer. This requirement will need to be discussed during initial design meetings and the actual level of attenuation determined early in the design process.
2. Generator sets shall be installed on building exteriors except possibly for locations such as energy/utility plants.
3. The location of the generator set shall be coordinated with the relative location of the fresh air intake for the building to eliminate the intrusion of the generator's exhaust fumes into the building fresh air intake system.
4. Unit shall be located and physically protected in such a manner as to reduce the vulnerability to damage by vehicles, severe storms or hurricanes.

D. Fuel tank location/Platform: Fuel tank shall be above ground and approved by EPA. If fuel tank is of such dimension that the top of the mounting skid is 24" or greater AFG, then a substantial maintenance platform shall be constructed that allows for adequate access to both sides and generator controls (if controls are mounted on the end of the generator). Platform shall be in full accordance with all applicable OSHA safety standards for handrails, etc.

E. Generator Start: Generator set shall be started electrically using its own properly rated and sized batteries. Air start is unacceptable.

F. Connection to Building Power Distribution: Engine generator set shall connect to building power distribution system through coil and contactor operated automatic transfer switch(s) (ATS). "Walking Beam" switches are unacceptable.

G. Automatic Transfer Switch:

1. Transfer switch shall have an integral, field adjustable automatic exerciser clock.
2. If a four pole ATS is employed, the neutral switching operation shall be a 'make before break' on transfer to emergency power and re-transfer to normal power.
3. Acceptable manufacturer: Emerson Network Power ASCO 7000 Series or ASCO 4000 Series

H. Number of Automatic Transfer Switches:
When 'Standby Emergency' power is required, there shall be a minimum of two Automatic Transfer Switches installed. The switches and associated panels shall be labeled and identified as 'Life Safety' (LS) and 'Optional Standby Emergency' (OS). In a facility where a legally required standby system is required then there shall be a minimum of three Automatic Transfer Switches installed. The switch and associated panels for the legally required system shall be labeled and indentified as 'Required Standby Emergency' (RS).

I. Minimum Emergency Services: In addition to other requirements, the generator set shall have the capacity to serve, as a minimum, one elevator, building access control panels, all building data gathering panels used for HVAC control and management systems, steam condensate return pumps, and sump pumps.

J. Generator Sizing: Shall be for minimum 25% spare above calculated diversified demand loads. Greater than 25% spare capacity may be required. Consult with FSU Project Manager for percentage spare capacity.

K. Reference Standard: Generator shall conform to ISO-9001; have Class H insulation, and permanent magnet excitation for production of 300% of rated full load current for ten seconds.

L. Generator Cooling: Generator set shall be cooled with self-contained coolant and radiator system. Remote coolers are unacceptable.

M. Load Bank Testing: Generator set on-site acceptance testing shall be performed in accordance with NFPA-110 at 80% and 100% power factors.

1. The acceptance test shall be a minimum of 4 hours at 80% PF utilizing a resistor/reactive load bank device.
2. Generator Shop Supervisor shall be notified of the test schedule a minimum of 72 hours in advance so that they may attend.

N. Acceptance Testing and Code Conformance: On site testing of the entire emergency power supply system shall be witnessed by the Engineer of Record and a Representative from EH&S for the test to be valid. It is the contractor's responsibility to make arrangements for the test procedure and witnesses. This testing shall include all control systems incorporated in the particular generator/motor installation. A manufacturer's representative shall be available to demonstrate the system's control functions.

O. Fuel: The contractor shall furnish a full tank of fuel at the completion of all testing. Full tank shall be defined as 7/8 tank capacity.

P. Maintenance Manuals: Equipment supplier shall supply two operation and maintenance manuals. Deliver one to the Project Manager and one directly to the Generator Shop Supervisor.

Q. Warranty: All systems shall have a minimum five-year warranty. Additional warranty may be required on a project-by-project basis.

3.7 Service and Distribution

A. Electric Service:

1. **Source:** Electric service to buildings and facilities on campus will normally be served from FSU's 15 KV (12,470V) medium voltage distribution system. If a building is not served from an existing sectionalizing device, a new SF6 gas insulated vacuum fault interrupter device shall be installed. Interrupters shall have 600-ampere separable quick change bushings. G & W is the only acceptable manufacturer. A 35 lb bottle of SF6 gas shall be supplied with all new sectionalizing switch installations.
2. **Demand Capacity:** Service to buildings shall be supplied from pad-mounted transformers as described below. The transformers, service entrance conductors or bus, and main electrical panel or equipment shall be of adequate size for the demand expected in the facility and to allow for future growth of 25% based on calculated diversified demand.
3. **Transformer Location:** Transformers shall be located as close as possible to the main electric service room. Future servicing or replacement of transformers shall be a consideration when selecting a location. The transformer shall be protected from vehicular and pedestrian traffic.
4. **Connections:** Refer to Paragraph 2.4 (A) Wire and Cable Connections to Main Electric Service for allowable types of connections.
5. **Aesthetics:** The location of the building electric service apparatus shall be incorporated in the landscaping as much as possible.

B. Metering: A watt-hour meter with a demand register shall be provided for each building. This shall be coordinated through the University Project Manager with the Campus Utilities.

1. **Meter Location:**
   - **a.** For buildings being served by a pad mounted transformer, the meter location shall be on the transformer. Metering current transformers shall be installed in the secondary compartment of the transformer. A 1" conduit shall be installed from the pad to the nearest Building Automation System (BAS) control panel for connection by others to the campus monitoring system. Approved metering for building service is Siemen's DEM series 2000 meters.
   - **b.** All metering installed on or in switchgear, panels, or transformers shall be interface compatible with the campus BAS. Provide an empty 1" conduit with pull string from the metering location to the nearest BAS control panel.

C. Grounding

1. **Required Resistance:** All grounding for building services, standby generators, and transformers shall achieve a maximum 10-ohms or less as required by specific project criteria, using the three-point test method. Drive multiple rods as necessary to achieve the desired ground resistance.

2. **Connectors:** All grounds shall be connected with a properly sized copper conductor. All grounding electrode conductors shall be connected to ground rods by either (1) an approved exothermic welding process as manufactured by Erico or (2) a compression system as manufactured by Burndy known as 'Hyground'.
3. **Ground Rods:** Each ground installation shall be tested in the presence of the University's representative. A written record of the test results shall be prepared and signed by the contractor and University's representative. This record shall be submitted to the Architect/Engineer and supplied to the University with the "Record Drawings" and reports upon the completion of the project.

D. 15kV Circuit Coordination: It is the responsibility of the Engineer to insure the proper electric circuit coordination.

1. All new circuit and transformer installations shall be properly coordinated with the existing electric distribution on campus. The Engineer shall furnish circuit coordination parameters including relay/fuse settings, time-current characteristic curve plots, and verification that all settings have been made.
2. Existing substation breaker settings and available fault current data (at FSU's substation) will be made available, upon request, from FSU's Utility Department.
3. The Engineer must produce coordinated time current curve characteristic plots of his proposed settings for review and approval by FSU Utilities Section prior to energizing.

E. Pad-Mounted Transformers:

1. **Base Capacity Rating:** In order to provide better circuit coordination in the University's electrical system, a service transformer's base rating shall not exceed 2000 KVA. If additional capacity is required the design professional must consider either multiple transformers or specifying units that are dual temperature rated and equipped with forced air-cooling.
2. The phase overcurrent device simulated in the SF6 switch must be compatible with the campus system's feeder breakers in order to achieve proper circuit coordination. If requested, a copy of the feeder breaker time-current characteristic curves will be furnished by FSU for use by the design professional prior to the time required for the incoming service to be energized.
3. **Basic description, features, accessories:**
    a. **Insulating fluid** – Envirotemp FR3
    b. **Winding Material** – Copper or Aluminum
    c. **Primary Voltage**, 12470 delta – 95 KV BIL
    d. **Taps** – 2 @ 2 ½ % above and 2 @ 2 ½ % below normal
    e. **Configuration** – Dead front, radial feed
    f. **Primary Bushings** – Three Wells, 15 KV, 200-amp
    g. **Inserts** – Feed through
    h. **Secondary Bushings** – Spade Terminals
    i. **Fusing** – Bay-O-Net oil immersed in series with ELS-P

j. **Impedance** – NEMA Standard with standard tolerances
k. **Color** – Bell Green
l. **Standard Features**:
    i. MOV arrestors
    ii. Provisions for bushing mounted CT's
    iii. Stainless steel grounding pads in HV and LV compartments
    iv. Removable neutral ground strap
m. **Standard Accessories**:
    i. 1" fill plug
    ii. 1" drain valve and sampling device in HV compartment
    iii. Dial type thermometer.
    iv. Liquid level gauge
    v. Pressure vacuum gauge
    vi. Pressure relief valve.

4. **Conductor Connections:** All conductor connections to padmounted transformers shall be installed using 2-hole compression lugs, ½" bolts, (2) flat washers and (1) lock washer for wire size 4/0 and larger. All connection hardware shall be grade 5 cadmium plated steel or bronze equal to Burndy Durium type. Lugs shall be rated for copper only.
5. **Acceptable Manufacturers**: Cooper – Waukesha, Wisconsin; Howard– Laurel, Mississippi; or General Electric – Shreveport, Louisiana.

F. Medium Voltage Cable

1. **Specification:** Medium voltage cable shall be copper, 105 degrees C rated, EPR with 133% insulation.
2. **Size**:
    a. Feeders: Cable size shall be 350 KCMIL for feeders.
    b. Transformers: Transformer feeder cable, from switch to transformer, shall be 2/0, 1/0 or #2 (minimum).
3. **Acceptable Manufacturers**: Cable shall be manufactured by The Okonite Company or The Kerite Company.
4. **Proof-testing:** All new 15KV cable shall be proof tested according to manufacturer's recommendations prior to being energized.

G. Duct Bank Systems: All 15 KV cable shall be installed in duct bank system as follows:

1. All ducts shall be encased in at least 3" concrete on all sides, top and bottom.
2. Ducts may be EB-35, or schedule 40 PVC conduit. Conduit shall be parallel and separated by appropriate spacers. Conduit shall be sized as required for the project but not less than 4".
3. Duct banks shall have sufficient number of conduit for the project plus a minimum of two spares. Conduits from 15 KV switches to transformers will require only one spare. If future use may require additional circuit installation, then more spare ways may need to be installed.
4. Duct banks shall be a minimum depth of 36" to the top of concrete. Where duct banks are less that 36" or in locations that require protection, a layer of 'flowable fill' with red dye shall be installed over the duct bank. The

flowable fill layer shall come to within one foot of finished grade or, if under a paved area, to the bottom of the asphalt base or concrete pavement.

5. A #4 Rebar shall be installed in the duct bank on each corner of the flowable fill for all 2-duct wide banks. If deemed necessary by the engineer of record, on wider duct banks, more #4 Rebar shall be installed in the middle of the top and bottom of the duct banks.
6. A 4/0 copper ground loop conductor shall be installed with all duct banks, regardless of number of ways. The ground loop conductor shall be located in the center of the top of the concrete encasement.
7. All duct bank installations shall be inspected by the Engineer of Record, FSU's BCA, and FSU's Utility Department Representative prior to encasing in concrete.
8. If a duct bank is within 8' laterally or crosses a steam line, coordinate with FSU's Utility Department to insure sufficient additional heat barrier insulation is installed to prevent damage to the duct bank and electric cables.

H. Manholes

1. **Characteristics:** Manholes shall have the following basic physical description:
   - **a.** Inside dimensions of 8'-0" octagonal made from minimum 2500 PSI concrete.
   - **b.** Duct entrances supplied with end bells.
   - **c.** Minimum clearance from centerline of lowest duct entrance shall be 2'-0"to floor.
   - **d.** Minimum 8" thick walls, minimum 6" thick floor for sump.
   - **e.** Duct face at corners a minimum of 18" wide.
2. **Cabling Supports:** Cable racks shall be heavy duty, galvanized, with porcelain cable saddles. Pulling irons fabricated from hot-dipped galvanized steel bars shall be provided in walls opposite duct entrances. Cables shall loop manhole prior to exiting on through-pulls and shall pass by two adjacent complete faces, as a minimum, on angle pulls.
3. **Covers:** Conform to Specification RR-F-621 with vent holes and, minimum, two pick holes. Pick holes shall be minimum ¾" diameter. Cover shall be approximately 32-½" diameter. Manufactured by U.S. Foundry, or equal.
4. **Ground Loop Cabling:** Each manhole shall contain a 4/0 ground loop, mounted 18" above the floor, bonded to a ground rod that measures 10 ohms to ground or less. Ground loop shall bond all non-current carrying conductors in each manhole and shall be bonded to the ground loop conductor routed with the duct bank systems. Bond shall be by exothermic means or compression using a Burndy "Hyground" system. No other compression system is acceptable.

Part 4 – Lighting Systems:

4.1 <u>Requirements for Sit Down Review</u>

FSU is evaluating the present lighting guidelines. The revision will not be completed in time for the present edition of the Design Guidelines. Design professionals shall confer with FSU officials prior to doing any design on proposed lighting systems for any new construction.

4.2 Emergency Lighting

A. Shall be provided at all exits and in all stairways, hallways, mechanical rooms and elevators as required by NFPA-101.

B. **Power Source:** Building emergency generator system.
   1. Battery powered emergency lighting shall not be used unless there is no emergency generator associated with the project.
   2. Where emergency lights are required in classrooms, a bypass switch shall be installed to permit the light to be switched off during special presentations. During actual power failures, the bypass shall be rendered inoperative.

C. **Exit lights:** Shall be of the Light Emitting Diode (LED) type. If appropriate to the specific use, LEED compliant fixtures employing sustainable power sources may be considered. Approval by the Project Manager must be obtained prior to inclusion in the project.

4.3 Interior Lighting

A. **General**: Comply with the current edition of the Illuminating Engineers Society (IES) standard, except where specifically directed for different foot candle levels.

B. **Standard:** The standard lighting system shall utilize fluorescent T8 or T5 lamps with instant start electronic ballasts having a total harmonic distortion (THD) of less than 10%.
   1. **Non-dimming Systems:** Interior systems shall employ 25W lamps where ambient temperatures and other conditions are suitable for their application.
   2. **Dimmable Systems:** Use 25W lamps. Wherever possible, four-foot lamps are to be used. T5HO lamps may be used when required by project design.
      a. **Approved dimming system manufacturers**:
         i. Lutron 'Hi-lume' system
         ii. Lutron Eco-10 system with Hi-lume 3D ballast where 1% dimming is required.
         iii. Crestron
      b. Scene Switching: All dimming systems shall employ switching scenes that will return emergency lights to full brightness upon loss of normal electric power.

C. **Fixture Whips:** All fixture whips shall have #12 wire minimum.

D. Automatic light controls shall comply with "Chapter 13, Energy Efficiency", of the Florida Building Code.

E. Stairway Lighting: Shall be above the landings and not above the steps.

F. Re-lamping: No lights shall be installed that require scaffolding for re-lamping. Exceptions include high ceiling auditoriums and gymnasiums.

G. Building Lighting Level requirements: The following recommended maximum lighting levels shall be used as a general guide*:

a.	Hallways, Restrooms	20 Foot Candles (FC)
b.	Classrooms	50 FC
c.	Offices	40 FC
d.	Laboratory	As required
e.	Mechanical/Electrical Rooms	30 FC
f.	All other areas	As required.

*Approval from FSU's Utility Department and Project Manager is required for variations from the above foot candle levels.

H. Classroom Lighting: Classroom lighting shall comply with DOE requirements. Lighting in classrooms and lecture halls with seating capacity greater than 25 people shall be equipped fluorescent dimming systems. For detail requirements for dimming and occupancy sensor systems refer to Appendix E, Design Criteria and Requirements for Classrooms at Florida State University.

4.4 Exterior Lighting

A. General: Outdoor lighting on the FSU campus shall be attractive and in keeping with the standards set forth in this section. The lighting plan shall be energy efficient while maintaining appropriate light level(s) as prescribed in the latest edition of the NFPA codes and IES handbook for high activity facilities. When outdoor lighting is associated with a building project, security lighting and parking lot lighting shall be included in the building design.

B. Lamp Access: No lights are to be installed that require scaffolding for re-lamping. Pole mounted parking lot and walkway lights shall be bucket truck accessible.

C. Lighting Control: Walkway and exterior security lighting shall be controlled by a photoelectric cell and contactor, with a manual override for maintenance.

D. Security of all areas shall be carefully considered when locating outside lights on buildings or on poles.

E. Aesthetics: Outdoor lighting shall be period style fixtures, pole mounted where possible. Poles and fixtures shall be:

F. Fixtures: All fixtures shall use high-pressure sodium lamps.

1. **Ballasts:** All ballasts shall be multi-voltage capable (120, 208, 240, and 277-volt). Tapped ballasts or 'voltage ranged' ballasts are acceptable.
2. **Globes/diffusers** shall be glass. Plastic is unacceptable. Precision injection-molded, UV stabilized; acrylic lens is acceptable for parking deck fixtures.

G. Walkway and roadway type fixtures:

1. **Acceptable Manufacturers:**
   - **a.** Holophane - Utility Series Granville with black finial or
   - **b.** Sternberg - Hometown Series with acorn glass globe.
   - **c.** Fixture trim shall be black.

H. Parking Lot Fixtures:

1. **Acceptable Manufacturers**:
   - **a.** Gardco - Gullwing Series (G18 series) or
   - **b.** Lithonia Lighting – Aeris AS2 Series w/decorative curved arm
   - **c.** Fixtures shall be black.
2. **Poles:**
   - **a. Streets/Walkways:** Poles shall be 12' Holophane Mount Vernon series or Sternberg Somerset (2700-FP) series flute aluminum for streets and walkways.
   - **b. Parking Lot Poles** shall be square aluminum of appropriate height.
   - **c. Pole Color:** All street and walkway poles shall be black. Parking lot poles shall be bronze.
   - **d. Pole Mounts:** Poles shall be mounted on poured concrete bases. Bases shall be installed at grade level on asphalt, concrete or brick paving; at 6" A.F.G. along walkways and streets; at 30" A.F.G. in parking lots.
   - **e.** Light fixtures and poles shall be separate items (no combination units).
   - **f.** All lighting circuits shall employ an appropriate sized Quazite junction box at each pole location. Conduit shall not be run directly from pole to pole.
   - **g.** A minimum size of 1" buried to a depth called for by the NEC. A Quazite junction box shall be installed near a pole location. A ¾" conduit may be used from the junction box to the pole.

4.5 Parking Deck Lighting

A. The consultant shall evaluate the feasibility of installing lighting control systems that monitor and control the "interior" and "exterior" lighting zones according to available ambient levels. The control systems shall be field adjustable to owner's specifications.

B. A control system recommendation shall be presented to the Project Manager no later than the 50% plans submittal.

C. Acceptable Manufacturers:

1. Lithonia – PGR Series with 100-watt HPS lamps. Fixtures shall be dark bronze with offset junction box mounting feature. (QRS is a quartz restrike option where such is desired)
2. Gardco – Quadra Series fixture with 100-watt HPS lamps. Fixtures shall be dark bronze with offset junction box mounting feature. (QRS is a quartz restrike option where such is desired).

D. Due to the ever changing technology in lighting systems, different systems may be employed in new parking garage projects. Any new system design must be evaluated by the design professional (economically and shown to conform to lighting design criteria) and have approval of FSU's Engineering Services.

Part 5 – Miscellaneous Systems

5.1 Lightning Protection Systems

A. New Construction: All buildings/structures shall have appropriate lightning protection systems designed and installed in accordance with NFPA-780.

B. Existing Construction: Expansions and renovations of existing facilities shall upgrade the existing lightning protection system as required to obtain or maintain a Master Label for the envelope.

C. Certifications: Installer shall be LPI certified. Installed system shall bear a Master Label.

5.2 Blue Light Emergency Call Station Poles and Fixtures

A. Blue Light Stations (BLS) manufacturers: Approved vendors: Talk-A-Phone. Design specifications for the BLS are available from the project manager. The design professional shall be responsible for insuring the BL specifications are current with FSU's standards.

B. Campus Police Coordination: Blue Light Station locations shall be coordinated with the FSU Campus Police Department representative. Design professional shall confer with the representative during the design phase of the project.

C. Blue Light Installation:

1. BL stations shall be ADA accessible including wheel chair access. If required install a concrete apron for wheel chair access.
2. The pole foundation shall provide adequate support for the installation. A copy of the foundation detail is available through the Project Manager.
3. When the pole is installed on the foundation, allow a 1/2" air gap between the bottom of the pole and the foundation.

4. Wall mounted units shall be 48” to the red activation button for ADA compliance.
5. **Electrical:** A dedicated emergency circuit (on Life Safety emergency system) shall be installed from the emergency panel to the BLS. The circuit panel and number shall be indicated in the BLS access panel.
6. **Communication:** A 1” conduit (with pull string) shall be installed from the BLS to the communication room specified for each project.

END OF SECTION

Florida State University

Telecommunications Infrastructure Standard

Revision 2.3
June 20, 2012

Document developed by:

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THE FLORIDA STATE UNIVERSITY
INFORMATION TECHNOLOGY SERVICES

INTRODUCTION TO….

ITS' TELECOMMUNICATIONS INFRASTRUCTURE STANDARD

Information Technology Services (ITS) is proud to release the latest update to the FSU Telecommunications Infrastructure Standard. ***Release2.4.*** A Telecommunications Infrastructure Standard for FSU has been in existence for over 19 years, and has undergone 17 revisions. ITS in conjunction with the departments of Network Computing Technology, Network & Communications Technology and Facilities Design and Construction has evolved and developed the Florida State University Telecommunications Infrastructure Standard.

The mission of ITS is "to provide an effective, comprehensive and secure technology infrastructure to deliver the highest quality and sustainable information and technology provider. ITS strives to engage the University Community in support of the University's mission of teaching, research, creative endeavors and service."

Additionally**,** "ITS has the responsibility of design, development, approval, installation, maintenance and management of telecommunications wiring and infrastructure in all FSU owned and leased buildings and properties. This would include but is not limited to voice, video and data infrastructure with fiber, copper or coaxial cabling." **This also includes telecommunication rooms, raceways, conduit systems, duct banks and the campus telecommunications manhole system. Such responsibility implies a first right of refusal by ITS on all wiring design, development, approval, installation, maintenance and management.**

ITS works closely with many departments at FSU to assure that this mandate is carried out. We do this in two main ways.

a. ITS in conjunction with Facilities Planning and Facilities Design and Construction review design documents in several phases of completion to assure their compliance to local and national standards and codes. Typically, schematics, design development, 50% and 100% drawing are all reviewed and input on changes are implemented throughout the process.

b. Design professionals, departments and electrical engineers have ready access to this standard to reference when questions or conflicts should arise in any construction or renovation process. Through close interaction during the design of new projects, the review of renovation projects and future campus planning the entire design team assures that uniform, cost effective and high quality telecommunications infrastructure are consistently installed.

We are pleased to have this valuable tool available to you as you design telecommunications infrastructure here at FSU. Please feel free to contact our office when needs arise. Our goal is to be available to assist you at any time before or during the decision making process.

Thank You

REVISION HISTORY

Subsequent modifications are listed below:

Rev	Date	Change
1.0	6/12/92	-Document created with IRM assistance
1.1	7/15/92	-Minor editorial changes
1.2	8/26/92	-ADA Act added to standard compliance
1.3	9/6/92	-Level 5 wiring added (CDDI)
1.4	9/16/92	-Revision foot note on each page -Special usage room requirements -Table of contents
1.5	10/6/92	-Minor editorial changes and format changes -Clarify high voltage conduit conflicts in relationship to telco conduit -Clarify conduit run lengths vs location of pull boxes -Change 100 m individual conduit length runs to 90 m -Define MDF vs IDF -Redefine equipment room sizes (IDF and MDF) -Clarify contiguous wall space requirements MDF vs IDF -Add information on how to key lockable MDF and IDF panels -Add RFI/EMI electrical, overhead clearances conflicts to equipment room -Remove all 20 mbps references and replace with 100 Mbps -Remove all specific references to vendors in data wiring sections -Add 25 pair level 5 riser to vertical riser section -Add EIA/TIA TSB-36 and TSB-40 to standards -Identify and outline customer premise equipment (CPE) room
1.5 (a)	11/18/92	-Quantify high voltage electric conduits better -Change DRAFT to Draft in Progress -Better define hand hole in B. MANHOLE section -Quantify when the OTC will start record keeping and assignment of any cables within the OSP system -Change qty 5 ea. 1" to qty 3 ea. 1 " in Zoned Conduit System section -Add diagram of ceiling race way and spec out -Add laboratories to special usage areas -Rewrite section, Conduit and Manhole System, F. Conduit Run Length -Change MDF and IDF room dimensions to accommodate a longer single wall -Add table showing linear , contiguous wall space for MDF's -Remove foot note on linear , contiguous wall space for MDF's -Minor editorial changes
1.6	11/30/92	-Change all mbps references to Mbps -All uninterruptible power supply to emergency backup -Minor editorial changes -Place all vertical riser conduit next to wall with plywood -Add open office space/modular furniture to special application areas ......

-Reformat outline in MEDIA section
-Reformat content of MEDIA section to better reflect continuity of specifications
-Change references to level 5 STP to read level 4 STP
-Change reference to vertical rows in TERMINATION section to read vertical columns

1.6 (a) 12/1/92 -Add overhead racking Attachment 6 and reference CONDUIT AND MANHOLE SYSTEM, D, 3.
-Minor editorial changes

1.6 (b) 1/6/93 -Replace attachment # 1,2,3,4,5 with new revision
-Minor editorial changes

1.6 (c) 4/22/93 -Editorial changes
-Cover page changes
-Fiber optic cable optical performance changes

1.6 (d) 6/1/93 -Add homerun conduit from fire and alarm panels to IDF rooms

1.6 (e) 10/25/93 -Deeper gang boxes at termination end of conduit runs (2 1/2" deep)
-Clarify that no obstructions shall go through ceiling raceways
-Clarify that no janitor's rooms shall be placed in IDF or MDF rooms
-Clarify that ceiling raceway shall be used in conjunction with conduits stubbed above ceiling and ran back to the ceiling raceway.
-Conduits run in slabs or other concrete structures shall be PCV Sch 40.

1.6 (f) 6/10/94 -Remove "Draft in Progress" from front title sheet
-Clarify voice cabling specification to state (CAT3)
-Clarify that all cabling installed under grade shall be fill cable
-Change single mode fiber connectors to SC

1.6 (g) 3/13/96 -Ceiling distribution systems design preference rearranged
-Define the physical size of pull boxes in horizontal conduits runs
-Covers for 4" square gang boxes defined
-Replace Newton cable tray with Atlas Center Hung Cable Tray
-Add Telecom Room (TC) terminology to vertical distribution section
-Remove verbiage on painted/sealed floors in MDF/IDF rooms. Replace with VCT covering only.
-Add room layout verbiage to equipment room requirements
-Addition of wireless verbiage in OTHER section of specification
-Added verbiage to INSPECTION AND TESTING INSTALLATION section to assure test results get to OTC
-MASTER PLAN section renamed to CAMPUS MASTER PLAN
-Added more information outlets in classrooms
-Minor editorial changes
-Change AT&T 110 to Krone 66 type terminal devices

2.0 2/1/2000 MAJOR UPDATE

- Addition of underground entrance conduit recommendations.
- Addition of spare conduit to requirement for recommended entrance conduit counts.
- Added references to building entrance buried and aerial cable section.

- Added manhole interior hardware list.
- Added concrete strength for manholes – 3500 psi.
- Added outside plant conduit duct bank requirements.
- Added special outside plant applications.
- Added recommended design guidelines to horizontal pathway /conduit.
- Added design guidelines to horizontal pathway / cable tray.
- Added elevator conduit requirements to horizontal pathway special consideration section.
- Added ADA requirements to horizontal pathway special consideration section.
- Changed Vertical Riser section to Intrabuilding backbone Riser Conduit System.
- Added location, height and installation recommendations for riser sleeves to riser conduit design section.
- Changed section II from Equip rooms to telecom rooms and equip rooms.
- Changed name of main telecom room from MDF to MTC.
- Changed name of telecom rooms from IDF to TC.
- Added serving floor space recommendations for TC's.
- Added restrictions on other utilities and services sharing MTC and TC's.
- Changed wall coverage of plywood in MTC and TC to include all walls.
- Added installation requirements of plywood on walls in MTC and TC.
- Added lighting requirement section for MTC and TC.
- Added power requirements section for MTC and TC.
- Added room size recommendation section for MTC and TC.
- Added work clearance section for MTC and TC.
- Added RFI/EMI section for MTC and TC.
- Added pathway installation section for MTC and TC.
- Added ceiling section for MTC and TC.
- Added location section for MTC and TC.
- Changed door height and optional lock-box to entry section for MTC and TC.
- Added vertical stacking of rooms and conduit/sleeve recommended layout for MTC TC rooms.
- Added Fire Protection section to MTC and TC.
- Added environmental control section to MTC and TC.
- Added wall lining section to CPE rooms.
- Added lighting section to CPE rooms.
- Added power section to CPE rooms.
- Added rooms size section to CPE rooms.
- Added RFI/EMI section to CPE rooms.
- Added pathway section to CPE rooms.
- Added ceiling section to CPE rooms.
- Added locations section to CPE rooms.
- Added entry section to CPE rooms.
- Added conduit alignment to room layout of CPE rooms.
- Added fire protection section to CPE rooms.
- Added environmental section to CPE rooms.
- Added depth and plywood requirement for inside of terminal boxes.
- Added lighting section to CPE rooms.
- Added Power section to CPE rooms.
- Added grounding section to CPE rooms.
- Added configuration of conduits to CPE room section.
- Added outside plant section to media chapter.

- Added topology section to Intrabuilding backbone distribution cabling section.
- Specified data cables are used with special circuits.
- Specified voice backbone riser cable shall be Category 3 or higher.
- Added codes and standards referencing riser cable.
- Added CATV coaxial intrabuilding backbone section.
- Added Optic Fiber backbone riser section.
- Added Special data applications riser section.
- Added code considerations for intrabuilding backbone riser cables.
- Changed Riser Termination Wiring section to Intrabuilding Backbone Cross-connection.
- Added topology information to Intrabuilding backbone cross-connect section.
- Added voice jumper cross-connect guidelines to Intrabuilding backbone cross-connect section.
- Added Fiber Optic Jumper section.
- Added Data circuits cross-connect section.
- Changed "Wiring Distances" section to be "Intrabuilding Backbone cabling lengths".
- Added cable length chart for copper and fiber optics.
- Added cross-connect equipment length.
- Added Fiber maintenance loop section.
- Added Intrabuilding backbone cable bend radius section.
- Added specification for ANSI/TIA/EIA 568A and 568B under Horizontal Cabling section.
- Changed minimum station outlet for voice to be category 3 or higher.
- Added to data outlet configuration performance guidelines for category 5E jacks.
- Changed CATV horizontal cable from RG59 to RG11.
- Added conduit/cable tray requirement for CATV cable installation.
- Added conduit/cable tray requirement for fiber optic multi-mode and single mode horizontal cable.
- Removed section on jumper wires for data.
- Changed "Horizontal lengths" section to "Horizontal cabling system design considerations".
- Added horizontal cabling link and channel lengths section.
- Added cabling practices (installation) section.
- Added horizontal cable slack section.
- Added code requirements to Terminations section.
- Added Wall and relay rack layout considerations section.
- Made changes to cable routing section including layout and use of cable management devices.
- Added voice riser termination device S66M1 blocks.
- Added use of data patch panel as termination device for data copper riser cables.
- Added CATV riser termination section.
- Changed horizontal outlet configuration to single gang faceplate with a minimum of four ports.
- Added removed Ortronics IMO reference from outlet section.
- Added new voice jack insert termination configuration section.
- Added new data jack insert termination configuration section.
- Changed CATV jack insert to include snap in insert.
- Changed "optional outlets" section to "additional jack inserts terminations".

- Added customer option for additional jacks to "additional insert terminations section".
- Added ADA requirements to terminations section.
- Added "horizontal voice cable termination" section.
- Changed termination recommendations for voice station cables.
- Added horizontal data cable termination section.
- Removed Krone 66 type block as termination device for data horizontal cables.
- Added CATV horizontal cable termination section.
- Added fiber horizontal termination section.
- Added drip loops, use of D rings and jumper lengths for voice cross connects in horizontal cross-connect section.
- Added horizontal data circuits cross connects section.
- Added horizontal fiber jumper section.
- Changed cross-connect color coding figure in labeling section.
- Added backbone riser terminal labeling.
- Added labeling guidelines for patch panels and voice, data and catv outlets.
- Changed horizontal outlet numbering scheme.
- Added "handwritten labels are not recommended".
- Added "Telecommunications Grounding and Bonding" section.
- Added OTC "Recognized Hardware, Media and termination Materials" section.
- Added "has developed both a ten year and twenty year plan" to section on campus master plan.
- Added 18 new applicable codes and standards to the "Applicable codes and standards" section. Added "Glossary of terms" section.
- Added Illustrations section.
- Added Illustrations 1 thru 7.

2.1 7/25/00

I.D.1.a.9 - Added 4"W x 16"L x 3"D (Raco 956 or Equiv) to Horizontal pathway.
I.D.1.a.10 - Added flush cover to 4"x4" wall box (Raco 787 or Equiv).
I.D.1.a.11 - Changed wall box for paytelephones, wall phones etc to 4"x4".
- Added B/C grade plywood as an option for backboard material.
I.D.2.f - Added Card security / card swipe conduit requirement.
- Removed Thin and thick wire Ethernet from media section.
- Changed Prestolite to Krone in recommended materials section.
- Changed Siecor to Corning in recommended materials section.

2.1 10/18/00 - Added minimum size opening for access panels below pull boxes in hardcoat ceilings. D.1.a.9

2.1 02/21/01 - Change to define entrance conduit requirements. A total of 2w4 (2-4") conduits as a minimum into any building under 10,000 square ft usable floor space. Conduit duct banks entering buildings of over 10,000 square feet shall be sized with the assistance of the Office of Telecommunications.

2.2 03/30/01 - Changes made to various areas to clarify conduit installation design criteria including the attachment to walls, turning down conduits to TBB, floor height, etc. To eliminate confusion the term closet was replaced with room.

2.2a 07/24/01 - Change Section I.B. MANHOLES from "round lids no less than 32 inches" to read "round lids with a diameter of 32-1/2 inches."

2.2a 08/22/01 - Change Section I.B. MANHOLES from " New manholes shall be 8'x8'x8' deep octagon" to" New manholes shall be 8'x8'x7' deep octagon".

2.2a 10/25/01 - Change Section III.C.4.a.2 (Horizontal cabling practices) to read " Do not cinch cable bundles tightly. Velcro straps should be used on all data cable bundles and not cable ties to avoid overtightening and deformation of the cable jacket. Avoid deforming the jacket.

2.2b	8/24/02	-	Addition to Section I.D.2.g "Floor Outlets – Floor outlets shall be multiservice recessed floor boxes, Wiremold/Walker part number RFB4-SS with RFB-4TKO-SS internal communications brackets. Any equivalent box shall be approved in advance by the FSU Office of Telecommunications."
2.2b	11/5/02	-	Added specifications and restructured Horizontal Pathway Sections D.1.b Secondary Design Choice - Ceiling Raceway and D.1.c.Third Design Choice – Zone Conduit.
2.2b	2/14/03	-	Restructured Horizontal Pathway Sections D.1.b Secondary Design Choice -. Zone Conduit. Third Design Choice –Ceiling Raceway and D.1.c
2.2b	2/14/03	-	Misc corrections. New description of clearances in Communications rooms.
2.2c	7/8/03	-	Sec I.D.1.a Horizontal Pathway, added specifications of catv conduit to be ¾".
2.2c	7/8/03	-	Sec II.B Power, Added A/C outlet to be installed in each comm. Room on end of Relay Rack.
2.2c	7/8/03	-	Sec III Approved Media, changed OSP entrance Fiber to the standard of 12 single mode and 6 multimode 50 micron fibers.
2.2c	7/8/03	-	Added new labeling standard 606A
2.2d	2/5/04	-	Add description of Code Blue installation requirements.
2.2d	4/27/04	-	I.D.2 Added Access / Security Door Raceway requirements
2.2e	6/18/04	-	IV.C.1.b.1a Addition of angled faceplates as a standard in all new residential halls
2.2e	8/3/04	-	Added specification for inside Code Blue Emergency phones.
2.2e	9/30/04	-	II.D.2 Added electrical specifications for Access systems.
2.2e	11/10/04	-	Changed station outlet fiber option standard from 62.5/125 to 50/125 micron SX+.
2.2e	11/10/04	-	Riser standard for fiber riser was changed from 62.5/125 to 50/125 micron SX+.
2.2e	11/10/04	-	Removed MT-RJ jumpers and changed jumper standard to 50/125 micron, SX+.
2.2e	11/10/04	-	Added Standards for fiber connector panels.
2.2e	11/10/04	-	Added fusion splicing as standard for termination of fiber.
2.2e	11/10/04	-	Add Sub-Section B – "OSP Termination" under Termination Section.
2.2e	11/10/04	-	Added new standard Fiber materials and hardware to materials List.
2.2f04/11/05		-	Added New elevator telephone template.

2.2g	07/27/05	-	Changed Sec II Telecom Rooms requirement for 2 – 4" conduits between telecom rooms on same floor to 1 – 4" minimum.
2.2g	05/22/06	-	Changed Emergency Blue Light Phones from Code Blue to Talk-A-Phone
2.3	06/20/12	-	The entire Telecommunications Infrastructure Standard has been restructured and reorganized with this latest revision. The changes are too numerous to list here. Only the major changes will be referenced here for the sake of brevity and clarity.
		-	Cover sheet changed to reflect that the Office of Telecommunications (OTC) is no longer referenced. The department has been re-named and is now referred to as ITS, Network & Communications Technology (NCT)
		-	Table of contents was revised to reflect the revisions
		-	A new section begins the document and is called "Architectural / Engineering Design and Construction Documentation"
		-	The section previously referred to as "Conduit and Manhole System" is now the "Outside Plant & Related Infrastructure" section.
		-	A new section, "Inside Plant & Related Infrastructure" has been included which upgrades the recommendations for horizontal pathway distribution among other revisions. It also includes raceway requirements for wireless access and security systems. It changes the minimum conduit size requirements for telecommunications outlets from 1" to ¾", along with new requirements for cable tray and zoned conduit systems.
		-	Previous sections and paragraphs pertaining to the installation and termination procedures for telecommunications cabling have been eliminated, as have any illustrations pertaining to same.
		-	Illustration # 2 is not used.

NOTE:

1) Versions 1.4, 1.5, 1.5 (a) and 1.6 were made with input from the FSU Networking Committee
2) Revision 1.6 (c) was made with input from the IRM Office at FSU
3) Version 1.7 will include a glossary of terms

I. ARCHITECTURAL / ENGINEERING DESIGN and CONSTRUCTION DOCUMENTATION

A. CAMPUS MASTER PLAN

FSU has developed both a ten year and twenty year campus master plan which will include documentation of telecommunications service infrastructure for existing and future buildings. New construction and renovation projects planners should reference these plans and budget for the costs associated with the installation of new OSP infrastructure to support new facilities. Planners should work closely with ITS and Facilities to determine the best overall OSP design.

B. CONSTRUCTION DOCUMENTS

1. The ITS Network Infrastructure design team has a responsibility to assist in the design for all telecommunications facilities on the FSU campuses. We work closely with Facilities Planning and Facilities Design and Construction as construction documents are developed. The goal is to end up with a design for the building occupants which will meet their current and future infrastructure and networking needs. We ask to be included during all phases of design including schematic, design development, 50% and 100% construction documents. We will also ask that we be consulted during the development of change orders which could conceivably affect telecommunications systems design, as determined by the Facilities project manager in coordination with ITS Network Infrastructure. <u>Prior to the beginning of construction, the A/E along with Facilities Planning – Space Management shall review and confirm that room numbers identified on the construction documents are accurate, approved by Space Management and not subject to wholesale changes during construction.</u>

a) Prior to the beginning of any campus construction project, a complete set of
b) 100% construction documents should be provided to ITS Network Infrastructure for our files.

C. INSPECTION AND TESTING DURING AND AFTER INSTALLATION

Frequent inspections should be conducted during the installation of the new services and wiring. These inspections should be conducted jointly by the Facilities' project manager and the staff person directly responsible for building services. It is important that the design professional work with IT'S, and the University Project Manager to outline the specific tests the contractor must perform to gain acceptance of the new services. All finished test and inspection results should be delivered to ITS.

D. AS-BUILT DOCUMENTATION

A complete set of as-built documents should be submitted to ITS for our files as well. As with Facilities, these documents are critical to the coordination of room numbers, changes in floor plans and other changes that might affect current or future infrastructure and networking needs for the facility and its occupants.

II. OUTSIDE PLANT & RELATED INFRASTRUCTURE

A. MANHOLE SYSTEM

1. FSU has an extensive network of telecommunication manholes throughout campus. The facility design professional should assure all renovations and new construction projects connect to this system where needed. Any new manhole number assignment shall be coordinated through ITS' Network Infrastructure.

2. The strength of concrete used for manholes shall be at least 3,500 PSI

3. New manholes shall be 8'x8'x7' deep octagonal type; lids shall be round with a diameter of 32 1/2 inches. Hand holes (small manholes) are not acceptable unless approved by ITS. Square lids are not permitted. Lids should have pull-slots for easy removal, shall be DOT H20 traffic rated, and labeled "TELECOMMUNICATIONS" or "COMMUNICATIONS." Grounding shall be included in the design of all OSP systems, including manholes. The distance between manholes shall not exceed 300 feet and should be void of 90 deg. bends. However, if 90's are necessary, they shall be sweeping 90's and the distance between manholes shall be reduced by 30 ft. for every 90 deg. bend included in the run. No more than two 90 deg. bends shall be installed between any two pulling points.

   a) Manhole interior hardware must be galvanized. Manholes should be equipped with the following:
   b) Bonding inserts and struts for racking.
   c) Pulling Eyes at least 7/8" in diameter.
   d) An 8 inch floor sump.

B. OUTSIDE PLANT CONDUIT (INTER-BUILDING DUCTBANKS):

The University has a system of underground duct-banks throughout its property used for providing telecommunications services to University buildings. The use of conduit space in the Telecommunications duct-banks shall be managed by ITS' Network Infrastructure department.

1. Outside Plant duct-banks shall meet the following requirements:

   a) The recommended size for conduit used between manholes is 4 inches in diameter. Duct-banks interconnecting manholes shall consist of a minimum of 6 - 4" conduits (6W4); however, 8 – 4" conduits are recommended in most applications. Consult with ITS Network Infrastructure design team during design to determine the best solution for the project.

   b) Conduit should be buried at a minimum depth of 36 inches (or to meet local codes) and encased in concrete rated at a minimum 2,500 psi. Where conduit will be placed in a roadway, 3,500 psi rated concrete should be used in conjunction with a 10 & 1 mixture (concrete and sand) from the top of the duct-bank to the underside of the road base. Special circumstances may require more stringent measures and must be reviewed and approved by ITS design team. To minimize the chance of accidental dig-up, place a plastic warning tape a minimum of 18 inches below the surface and directly above the conduit. It is recommended that Telecommunications conduit not to be placed in joint trenches with other utilities. When this is necessary, the design professional shall contact the ITS project manager for design and coordination. Other utilities shall not be placed in telecommunications ducts.

c) Do not include more than two 90 degree bends. Bends must be long sweeping bends with a minimum radius not less than 10 times the diameter of the four inch conduit. LB's shall not be used.

d) Conduit shall be corrosive – resistant and one of the following type:
- Rigid galvanized conduit
- Plastic polyvinyl chloride (PVC) Schedule 40 or equivalent.

e) A #3/0 AWG copper ground wire shall be placed in the trench above the concrete encased duct bank. Telecommunications conduit shall not be poured and encased in the same concrete as the campus medium voltage (5kv-12kv) electrical conduit system. A minimum or 18" of fill should be placed between the two duct-banks unless an exception is approved in writing by ITS.

f) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

g) Provide a pull cord having a metallic member (tone tape) with a minimum test rating of 200 lbs. pulling strength in each conduit. Reference: Arnco DL WP12LC Tone Tape or equivalent.

2. Hand-holes / Pull-Boxes – Where hand-holes / pull-boxes are used, they shall be installed using a weather-proof door/panel or cover arranged for access from the top. Avoid installation adjacent to sprinkler system discharge. Conduits should be installed with sweeps. Do not use a pull-box in lieu of a bend. Telecom Pull boxes SHALL NOT be used by other utilities.

C. SERVICE ENTRANCE:

The Service entrance is the route by which Telecommunication service cables enter a building. There are three types of service entrances: 1.) Underground Entrance - buried conduit (FSU responsibility); 2) Buried Entrance - cable buried in a trench (Service Provider responsibility); 3.) Aerial Entrance - cable drop from a pole to a building. (Service Provider responsibility)

Service entrances shall terminate at the main telecommunications room / terminal room location of the building; usually on the ground floor or basement of a facility.

1. Underground Entrance – The following recommendations are made for underground entrances:

a) The recommended size for conduit used in an underground entrance is 4 inches in diameter. A spare conduit of equal size is recommended, thus giving a total of 2 - 4" conduits (2W4) as a minimum into any building under 10,000 square ft. usable floor space. Conduit duct-banks entering buildings of over 10,000 square feet shall be sized using Table 1 on Page 7, and/or with the assistance of the ITS Network Infrastructure design team.

b) Conduit should be buried at a minimum depth of 36 inches (or to meet local codes) and encased in concrete rated at a minimum 2,500 psi. Where conduit will be placed in a roadway, 3,500 psi rated concrete should be used in conjunction with a 10 & 1 mixture (concrete and sand) from the top of the duct-bank to the underside of the road base.

Special circumstances may require more stringent measures and must be reviewed and approved by ITS design team. To minimize the chance of accidental dig-up, place a plastic warning tape a minimum of 18 inches below the surface and directly above the conduit. It is recommended that Telecommunications conduit not to be placed in joint trenches with other utilities. When this is necessary, the design professional shall contact the ITS project manager for design and coordination. Other utilities shall not be placed in telecommunications ducts. A #3/0 AWG copper ground wire shall be placed in the trench above the concrete encased duct-bank. Telecommunications conduit shall not be poured and encased in the same concrete as the campus medium voltage (5kv-12kv) electrical conduit system. A minimum or 18" of fill should be placed between the two facilities or as agreed upon during the design phase.

c) Entrance conduit must not include more than two 90 degree bends without a pull box, hand-hole or manhole (as appropriate). Underground 90 deg. ells shall be sweeping and shall transition from PVC to RGC (rigid galvanized conduit) below grade before entering building. Bends must be sweeping bends with a radius not less than 10 times the inside diameter of the four inch conduit. Grounding bushings and connectors are required. NO LBs will be considered.

d) Conduit shall be corrosive – resistant and one of the following type:
- Rigid galvanized conduit
- Plastic polyvinyl chloride (PVC) Schedule 40 or equivalent.

e) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

f) Conduits shall have a pull cord having a metallic member (tone tape) with a minimum test rating of 200 lbs. pulling strength in each conduit. Reference: Arnco DL WP12LC Tone Tape or equivalent.

g) When terminating entrance conduit within a building, design conduits entering from:

- Below grade - to extend 4 inches above the finished floor.
- Through ceiling - to extend to 8 1/2 feet above finished floor.
- Through walls - install with sweeps not less than 10 times the inside diameter of the conduit to turn conduit down on wall to extend to 8 1/2 Feet above finished floor, or at a point above the eight (8) foot tall TBB.

h) Provide and install end bells to seal the inside-the-building and manhole ends of all conduits to prevent rodents, noxious gases and water from entering building and telecom rooms.

i) All entrance conduits shall be securely fastened to the building so they can withstand a typical placing operation.

j) Telecommunications conduits shall be used for telecommunications cables only and shall not be used for joint use with electrical utilities.

Redundant service entrances with diverse routes are recommended for buildings which provide critical services such as research facilities, health care facilities, police stations, fire stations and other similar buildings.

Table 1 - Recommended Quantity of Service Entrance Conduits

Gross Building Floor Area (x 1000 Ft. Sq.)	No. Of Conduits (includes spare)
0 - 10	2 (minimum)
10 - 50	4
50 - 100	6
100 - 200	8
200 - over	size in coordination with ITS

2. Direct Buried Cable Entrance - This method is discouraged and may only be used for temporary service to a building. Design for buried cable should be coordinated with ITS.

3. Aerial Entrance - This method too should only be considered for temporary service, or if an underground or direct buried service cannot be made available to the site. When approved, pole sizes, cable clearances and cable sizes should allow for future growth and flexibility. The installation of aerial cable entrance facilities and associated supporting structures shall be coordinated with ITS.

    - Design professionals and contractors shall contact ITS' Network Infrastructure design team for evaluation and determination of exceptions to design guidelines for entrance conduit.

D. EMERGENCY BLUELIGHT TELEPHONE (EBLT) CONDUIT

The FSU main campus has over 300 EBLT devices located throughout the property. Each new campus building project will typically incorporate one or more EBLT's into the design. The exact location of these instruments will be determined under the guided recommendation of the FSU Public Safety Office with the FSU Police Department. The service conduit(s) will be provided under the direction the Architect/Engineer (A/E) during the design of the new construction project.

1. Each EBLT requires a single 2" PVC schedule 40 telecommunications conduit. No interconnections to other EBLT's. are permitted. The conduit should originate from the nearest building TR. This conduit will be located at a minimum depth of 30" with marker tape placed 18" below grade and above the conduit. A 12" X 12" traffic rated junction box shall be provided within 6 feet of the EBLT where the 2" conduit will terminate. 1 – 1" conduit will be installed from this junction box into the EBLT pad. The conduit run shall not exceed 200 ft. from the point of origination to termination. Conduit and boxes identified here are the use of telecommunications cabling alone, and shall not be shared with electrical conduits and/or conductors, or other utilities. Install a WP12LC Tone Tape or an insulated #12 AWG copper conductor.

2. Installation guidelines other than telecommunications pathway, such as foundation details, power requirements, tower mounting, etc., are provided by the manufacturer in cooperation with the A/E. ADA requirements apply to every installation. Refer to section VI for EBLT device specifications.

III. INSIDE PLANT & RELATED INFRASTRUCTURE

A. HORIZONTAL PATHWAY DISTRIBUTION SYSTEMS (INTRA BUILDING)

Telecommunication wiring distribution may be made through various ceiling distribution systems, especially where suspended ceilings are utilized.

1. HORIZONTAL CONDUIT DESIGN RECOMMENDATIONS

a) Preferred Design Method

"Homerun" Conduit System – Each workstation Voice / Data outlet box shall be installed using a minimum 3/4" conduit; CATV and wireless access point outlet boxes shall be installed using minimum 3/4" conduit. All conduits shall be home-run or routed directly to the main telecommunications room (MTR) or telecommunications room (TR) of the same floor. (Physical Star Topology). Conduit shall be EMT with STEEL set screw or compression fittings. No die-cast fittings are permitted. Flex conduit shall not be used in buildings for telecommunications raceway. Horizontal conduits designated for outlets shall not feed floor to floor or be daisy chained from outlet to outlet.

Because the facilities conduit distribution system, once installed, is of "fixed capacity", it is often cost effective to install sufficient distribution conduits to accommodate potential changes and growth.

1) The total individual conduit length including pull boxes used for telecommunications systems should not be longer than 250 feet.

2) Conduit runs should take the most direct path possible, following parallel lines of the building.

3) There should be no continuous sections of conduit longer than 100 feet. For sections that are longer than 100 feet, insert pull boxes so that no segment between pull boxes exceeds the 100 foot limit.

4) There should be no more than two 90 degree bends between pull boxes. Additionally, pull-boxes shall not be used instead of or otherwise placed within a 90 deg. bend.

   If a conduit run requires more than two 90 degree bends, then pull boxes should be installed to minimize the bends; however, a third bend may be permitted in a pull section if any of the following exceptions apply:

   a. The run is shorter than 33 feet.

   b. The conduit size is increased to the next trade size, and

   c. One of the bends is located within 12 inches of the end of the cable feed end.

   d. Total bends in the conduit run shall not exceed 270 deg. maximum.

5) Conduit bend radii shall be as specified in the current edition of the National Electrical Code for conductors without lead sheath. Field and machine bent radii are acceptable.

6) Provide a pull cord with a minimum test rating of 200 lbs. pulling strength in each conduit. Greenlee Jet-line, Part number 430 or equivalent.

7) Conduits should be swabbed clean, shall be kept dry and unobstructed, be labeled for identification, reamed and fitted with bushings.

8) Terminate conduits through the structural floor in the telecommunications rooms three (3) inches above the floor surface. For conduits entering from the ceiling conduits should be installed to turn down and extend to 8 1/2 feet above finished floor in the Telecommunications rooms or equipment rooms. All conduits shall be dressed at the same level and installed with rigid conduit straps to the wall.

9) Pull-Boxes - Pull boxes shall be a minimum of 4″W x 12″L x 4″D (Raco 956 or Equiv) for a single 1" or 3/4" conduit. For each additional conduit two (2) inches should be added to the width of the box. 4 inch square outlet boxes shall not be considered for pull-boxes under any circumstances. Pull Boxes are not to be used for termination or splice boxes under any circumstances. Install pull-boxes in easily accessible locations, preferably above suspended ceiling. In the case of hard-coat ceilings, an access panel shall be installed in the ceiling directly beneath any pull boxes. The opening shall be a minimum of 24" x 24" to allow for access (or larger if recommended by design professional). Pull Boxes should be provided with a suitable hinged panel or cover arranged for access from the bottom. Conduits should be arranged to allow a straight pull through the box with no bends. Do not use a pull-box in lieu of a bend. Telecom Pull boxes shall not be used by other utilities.

   NOTE: Designs that require pull boxes be mounted more than 10 feet above the floor shall first be approved by ITS.

10) Telecommunications Workstation Outlet Boxes - All standard telecommunications wall mounted workstation outlet boxes installed in dry wall, plaster or concrete block shall be four (4) inches square by at least 2 1/4″ deep made by Steel City or equivalent. All boxes shall be trimmed out, allowing for a clear and unobstructed 4″ opening. Provide all boxes with flush cover (Raco 787 or equiv). Boxes should be installed 18 inches above finished floor or the same height as electrical outlets at the workstation. Do not install outlet boxes back to back to serve adjacent rooms. Boxes should be offset to avoid compromise of the effectiveness of the sound barrier. Boxes shall not be installed and connected by the same conduit in a daisy chain method or from floor to floor.

11) Outlet boxes for wall instruments, payphones and other special applications shall be 4″W x 4″H x at least 2 1/4″D. These boxes should be mounted at 48″ above the finished floor unless obstructed and/or otherwise noted by the design professional. Installation of outlets where obstructions exist shall meet all ADA requirements for clearance as specified below.

b) Secondary Design Choice

Cable Tray Conduit System - Ceiling raceway (cable tray) systems are considered as a secondary option for campus buildings. This option is frequently chosen because of lower initial installation cost of the telecommunication pathway only. The overall savings however are negligible when long term costs are considered. The ITS design team does not generally recommended this option due to long term maintenance issues, increased costs of plenum rated materials, increased installation labor costs, the potential for wire damage and the potential fire code violations.

1) Cable tray should 12" ladder style tubular raceway with 6" side fence; Homaco Part TRC-512, or as approved by the ITS design team. Raceway sizing and installation shall be made based on manufacturer recommendations. Cable tray capacity is 40% to 50% as determined by the static load capacity of the tray and length of the support span and is limited by ANSI/NFPA 70, Section 318.

2) Supports shall be installed no more than five (5) feet apart and within two (2) feet of any fitting.

3) The cable tray conduit system uses cable tray in conjunction with 1" and 3/4" conduits from the outlet box. Conduits should be continuous from the outlet box to the cable tray. Where the conduits meet at the cable tray, they should be reamed and cleaned and a grounding bushing installed. The conduit should be bonded to the cable tray using the installed grounding bushing and a#12 AWG solid copper conductor.

4) Transition pans, curved runways, runway "T", or horizontal radius runway sections shall be used to avoid sharp turns that may cause damage to cable.

5) Ceiling raceway shall be readily accessible and placed in ceilings that utilize removable tile. If transition of hard-coat ceiling is required access hatches of a minimum of 24" x 24" should be installed every 15 feet.

6) Ceiling raceways shall be installed in ceilings of hallways and shall avoid passing over office spaces, offices, classrooms and other occupied spaces.

7) There shall be no other utility or support system structures running directly through the ceiling raceways; e.g., all-thread rod, Kindorf or Unistrut channel. Sprinkler heads, HVAC ductwork and similar utility system apparatus shall not drop through ceiling raceways. When designing the layout of horizontal pathways in the ceiling spaces, ensure that other building components (e.g. lighting fixtures, structural supports, air ducts) do not restrict access.

8) Telecommunications Raceways not be shared by power cables. Refer to the NEC (NFPA 70) or consult with the design professional and ITS.

9) Cable Trays shall have adequate clearance above the tray for installation of cabling and to withstand pulling cables during installation. Raceways should be installed allowing a minimum of:

10) Three (3) inches of clear vertical space above the ceiling tiles to ensure accessibility to the tray. When sufficient space is available above raceway provide up to six (6) inches between tray and ceiling tiles.

11) Twelve (12) inches of clear vertical space above the tray.

12) Because cable installed in tray is susceptible to electro-magnetic interference (EFI), raceways should be routed to avoid electrical equipment and interference to the degree possible. Avoid crossing or running tray parallel to florescent lighting fixtures and electrical devices that produce EMI. Always keep a minimum 4 inches clearance from these devices. All metallic cable trays must be grounded/bonded. Tray bonding and grounding should follow all applicable building and electrical codes including ANSI and NFPA 70, section 318-3 (c).

13) Ceiling raceway shall be used in conjunction with 1″ and 3/4" conduits from outlet box(s) and run to the ceiling raceway. Conduits should extend all of the way to the tray. Conduit should be properly cleaned, a bushing installed and bonded to the cable tray.

14) The design and installation of Ceiling Raceway Systems shall be installed to meet ANSI/NFPA70, Article 318 – Cable Trays, and all applicable national, state and local codes. The selection, design and installation of Ceiling Raceways should be pre-approved and coordinated with ITS.

c) <u>Third Design Choice</u>

Zoned Conduit System - Zoned conduit systems are recommended for areas with a high density of telecommunications outlets (computer labs, concentrated modular office spaces, etc.) into zones. Each voice/data outlet within a zone is a continuous run of 1″ conduit from the outlet location to a centrally located junction box. The junction box will have a specified number of larger conduits which route back to the TR located on the same floor from where the outlets are served.

1) The smallest zoned conduit system would concentrate four separate outlet locations into one 2″ conduit. The 4 incoming 1″ conduits will terminate in a junction box 12″W x 12L x 6″D. The junction box will have 1 outgoing 2″ Conduit, which will route back to the TR on the same floor.

2) The ratio of 4 – 1″ conduits to 1 – 2″ conduit should always be maintained. For example: 8 – 1″ incoming conduits will require 2 – 2″ outgoing conduits. It should also be noted that alternatively, 1 – 4″ conduit can substitute for 2 -2″ conduits.

3) The size of the junction box will increase in size by 6″ in width and length and 2″ in depth for every 4 incoming 1″ conduits. For example, 8 – 1″ incoming conduits will require a junction box => 18″W x 18″L x 8″D; 12 – 1″ incoming conduits will require a junction box => 24″ x 24″ x 10″D.

4) The use of junction boxes larger than 24″ is not recommended. Any application that would require the use of a larger junction box should be coordinated with the ITS Network Infrastructure design team.

5) All junction boxes used in the zoned system must have either a hinged or screw type cover plate.

6) Junction boxes must be located in readily accessible locations. They should be accessible from a corridor from a removable acoustical ceiling panel. Installation above hard-coat, drywall or other type non-accessible ceiling systems should be avoided.

   Note: High speed twisted copper data cables are highly susceptible to degradation of operation due to any change in physical characteristics; i.e., flattening of cable. Devices that do not provide continual support of the cables are not recommended. The use of J-Hooks, D-rings, cable hangers and other devices for horizontal distribution are not acceptable.

B. INTRABUILDING BACKBONE RISER CONDUIT SYSTEM

A vertical telecommunications conduit riser system shall be provided for bringing telecommunication cables from the Main Telecommunications room MDF to the various floors of the building. As a design guideline, the vertical cable riser system should use a series of vertically aligned 4" sleeves in each floor beginning in the ceiling of the telecommunication room in the basement and ending in the floor of the telecommunication room of the uppermost floor. Ideally, all telephone rooms in multi-story building should be vertically stacked; however, this is not always possible. A design deviation from a system using sleeves to a piped system should be considered instead. The design professional should consult with ITS on a case by case basis to ensure that needs are met.

C. RISER CONDUIT DESIGN RECOMMENDATIONS

1. The vertically aligned 4" sleeves should be located in the vertically aligned (stacked) telecommunications rooms on each floor. Riser conduits or sleeves entering through the floor shall extend 3 inches above finished floor at the wall. Riser conduits or sleeves extending down from the ceiling shall extend to 8 1/2 feet above finished floor. If turns are required they shall meet the bend radii already specified in this document. All conduit ends shall be dressed at the same level and installed with rigid conduit straps or equivalent to the wall. Design professionals and installation contractors shall contact the ITS project manager to address exceptions due to structural conflicts.

2. All sleeves and Riser Conduit shall be 4 inches in diameter.

3. Sleeves should not be place in the middle of the Telecommunications room floor, but placed next to the wall that has plywood attached, preferably starting in the left corner when entering the door.

4. Construct all sleeves to conform to the National Electrical Code and local Fire Codes.

5. All Sleeves should extend 3 inches above the finished floor level.

6. All sleeves should be clean, dry, unobstructed, labeled for identification, reamed and fitted with bushings.

7. After the riser cable has been installed, all unused sleeves shall be fire stopped.

8. The quantity of sleeves depends upon the building's usable floor space serviced by the sleeves. The quantity and size of the sleeves shall be applicable to conduit when vertical stacking of rooms is not possible. Table 2 shows the recommended quantity of sleeves to be provided, and typical vertical riser arrangements, and including one spare for emergency use and one for coax or fiber optic use.

Table 2: Recommended Sleeve Quantities

Usable Building Floor Area (x 1000 Ft. Sq.)	No. Of Sleeves
0 - 50	4 (minimum)
50 – 100	6
100 - 200	8
200 +	10 *

Consult with ITS and Facilities during design to confirm exact requirements based upon building usage.

D. <u>ACCESS / SECURITY SYSTEM CONDUIT REQUIREMENTS:</u>

1. Door Requirements:

   a) Perimeter access doors should have: Card reader / Electronic lock, door contacts and request to exit devices.

   b) Perimeter stairwell door should have: door contact and request to exit devices.

   c) Classroom doors should have: card reader, door contact and request to exit.

2. Security Sensors / Camera locations: These devices require a single gang outlet box at each location. A 3/4" conduit shall be provided from the outlet box to the TC located on the same floor as the device. If a cable tray conduit system is used the conduit should route from the outlet box to the cable tray.

3. Door Conduit Requirements: Each ground floor exterior door and other specified doors shall be provided with a 12" x 12" junction box and a 1" conduit "homerun" to the TR. Provide the following:

   a) From the J-box provide a 1/2" conduit to the door contacts in the header (2 for double doors).

   b) From the J-box provide a ¾" conduit to the card reader or pin pad location. Terminate in a single gang box.

c) From the J-box provide a ½" conduit to the strike side in the door frame (for electric strike.)

d) Provide a ½" conduit to the hinge side in the door from power supply provided with the electrified panic devices when used. From the J-box provide a ½" conduit to the power supply.

e) Holes shall be drilled in the door header frame for wiring the door contacts.

f) Provide a ½" conduit from the request to exit box to the J-Box. The request to Exit box shall be a standard single gang outlet box mounted horizontally 1 foot above the door frame inside the room being exited.

4. Electrical Requirements:

a.) Access Control Panels should be located in the TC and be provided with 120 VAC, 20 amp dedicated circuit from the building emergency generator.

b.) Doors with electrical emergency exit bars require 120 VAC, 20 amp dedicated circuit from the building emergency generator.

Note: FSU ITS maintains examples of the most current access control door Configurations. These may be found in the current version of the FSU Design Guidelines and Specifications. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met.

E. WIRELESS ACCESS SYSTEM CONDUIT REQUIREMENTS

1. Wireless Access Points (WAP)

a) A raceway system for owner provided wireless access points (WAP) will be designed for all new and renovation construction projects. Basic requirements for this system will follow those outlined for telecommunications/data outlet boxes except as noted below:

b) Raceway conduits may be installed in accordance with any of the three raceway distribution methods as described under III.A.1 Horizontal Pathway Design Recommendations, type's a., b., or c.

c) 3 - WAP device locations may be connected via a continuous run of 3/4" conduit, but must "homerun" to the telcom room (TR) at that point.

d) ITS will permit more than 3 WAP's be connected to a single conduit "homerun" If the conduit size is increased to 1". No more than 6 WAP devices locations installed per "homerun.

e) If a cable tray system of distribution is utilized, then the same requirements as standard data outlets will be observed.

F. SPECIAL USE CONSIDERATIONS

Some specific types of areas and uses differ from "office/conference room" type space as mentioned above. Therefore, these areas should be addressed in the list below:

1. Classrooms: A minimum of one outlet should be installed on every wall. This outlet would be configured with 1 - voice jack, 1 – data jack and 1 – CATV jack. Teaching consoles should have 1 – outlet with min. 6 – data jacks installed. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements as it pertains to classroom technology systems.

2. Laboratories: These areas are unique and at times may require more telecommunications resources than other areas. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements.

3. Modular Office Furnishings: Modular furniture may require special hardware for telecommunications resources than other areas. The design professional should consult with the Facilities project manager, associated departments and the ITS Network Infrastructure design team to ensure that all needs are met. You may also wish to reference Facilities Design Guidelines and Specifications (Aug. 2010) for additional requirements.

4. Fire/Burglar Alarm Panels: A dedicated 3/4" conduit shall be run from each fire and burglar alarm panel to the TC backboard. This is required to UL approve systems. Please refer to the latest revision of NFPA and NEC codes available.

5. Elevators - A dedicated 3/4 inch homerun conduit shall be run from the TC located on the same floor as the elevator equipment room and should terminate in the elevator equipment enclosure. Elevator instruments are normally provided by the elevator equipment manufacturer and are pre-installed in the elevator cab.

6. Floor Outlets – Floor outlets shall be multi-service recessed floor boxes, Wiremold/Walker part number RFB4-SS with RFB-4TKO-SS internal communications brackets. Any equivalent box shall be approved in advance by ITS.

7. Internal Emergency Blue Light Phones (EBLT): Emergency phones located inside require a dedicated 1" "homerun" conduit from the TC to the Flush Mount Enclosure box where the phone is to be installed. Roll up access for ADA is required in all public devices, with a maximum reach of 48".

G. MISCELLANEOUS REQUIREMENTS:

1. Wiremold 4000 – Areas with a high concentration of telecommunications and power outlets are often designed with surface mounted raceway systems manufactured for a clean professional finish. These systems permit power wiring and telecommunications cabling to be distributed together in a dual channel raceway, and are approved for this application by NFPA 70/NEC. These raceway systems are also used in existing buildings and renovations where existing building materials make it difficult to recess conduit and boxes. Any desire to

substitute this system requires written approval by ITS Network Infrastructure during the design phase

2. Open (Free) Wiring - Open wiring is prohibited in new construction projects, including renovations and remodeling projects.

3. Conduits installed in slabs or other concrete structures shall be PCV Schedule 40 or Rigid Galvanized Conduit. The minimum size for horizontal cabling is one (1) inch.

IV. TELECOMMUNICATIONS ROOMS / EQUIPMENT ROOMS

A. DEFINITION

This section identifies 3 (three) physical spaces within a building that are critical to the proper management and transport of telecommunications (voice, video, data) services. They are the Main Telecommunications Room (MTR), Telecommunications Rooms (TR) and the Customer Premise Equipment (CPE) Room. Any of these rooms may be referred to as a Telecom Room.

The primary telecommunications room for the entire building is the Main Telecommunications Room (MTR). This room serves as the entrance facility for the building where all outside plant conduits terminate. It houses the Main Distribution Frame (MDF), where the service entrance cables terminate and interface with the intra-building backbone distribution cabling system and to the horizontal cross-connect and cabling serving that floor. The MDF is considered the point where the regulated telephone company will install the building entrance protectors. This point of interface is called the demarcation point. The demarcation point is where the cabling responsibility of the Service Provider (regulated telephone company) ends and where the cabling and equipment responsibility of the University ITS begins.

Other wiring rooms/rooms within a building are referred to as Telecommunications Rooms (TR). TR's are "floor serving". There shall be a minimum of one TR per floor. A TR is not required on the same floor as an MTR unless needed due to cable length requirements. It is recommended that multiple TR's should be provided on the same floor if usable floor space exceeds 10,000 sq. ft. <u>or</u> the conduit length between the horizontal cross-connect in the TR and any Telecommunication outlets being served would exceed 270 total feet. Maximum allowed length of horizontal cable installed to outlets must not exceed 295 feet. Pathway length should be kept to a maximum of 270 feet to accommodate the cable length.

The MTR and TR rooms contain the intermediate distribution frames (IDF's) which include the terminations for the backbone cables in the riser system coming from the MDF and the terminations for the horizontal cabling and cross connects on the floor served. In addition to cable terminations and cross connects in these rooms they may in some cases serve as an equipment room for data, video and other equipment.

The Main Telecommunications room MTR and TR rooms are not to be shared facilities for other services and therefore should not house electrical equipment, plumbing, janitor sinks, or to be used as a storage area. HVAC Duct other than that serving the room, electrical conduits for other areas, sprinkler system piping, drain pipes, steam pipes, chilled water pipes, or any other systems should not be routed through the interior of the MTR, TR or CPE rooms. Any other conceived use for the telecommunications rooms that does not follow the intended use of telecommunications is not permitted.

The design professional shall make provisions for separate CPE room(s) within newly designed and renovated buildings where private departmental / customer computer and server equipment will be located. Such rooms shall be contiguous to the MTR and TR rooms. If this is not possible, these areas shall be connected via a series of 4"conduits. If the rooms cannot be contiguous, the designs must be approved by the ITS

B. REQUIREMENTS

1. MTR / TR Room(s) and Customer Premise Equipment (CPE) Rooms

The design for these equipment rooms shall conform to the following specifications:

a) Wall Linings - All walls should be finished, i.e. sheet-rock/painted, and lined with 3/4 inch thick, AC Grade plywood backboard, 8 foot high by 4 foot wide and affixed in such a manner that it will support the weight of the cable, terminals, and other equipment. This allows for coverage of the entire area on which connecting hardware and cable management hardware may be mounted. The plywood should extend around the entire room, corner to corner on every wall. Smooth side shall be installed out. The plywood backboard shall be void free and treated with two coats of fire retardant paint materials. Use flush hardware and supports to mount plywood. The strength and placement of mounting hardware shall be sufficient to handle the total anticipated load (static and dynamic) and mounting of cabling components. The placement of the plywood backboard shall be on top of the wall covering, i.e. sheet-rock, etc. and is not a substitute for the wall covering.

b) Lighting recommendations –

1) A light intensity level of 50 footcandles should be provided, measured at 3 ft. 6" above finished floor.
2) Do not use dimmer switches.
3) Locate light fixtures a minimum of 8', 6" above the finished floor.
4) Emergency lighting shall be provided and circuited to the building emergency power system.

c) Power –

1) Provide at least one dedicated 120 VAC, 20 amp (non-switchable) quadraplex receptacle on each wall.
2) Locate receptacles at least 6 inches above finished floor.
3) Receptacles must not be controlled by wall switches.
4) Provide one (1) dedicated 120 VAC, 20 amp (non-switched) receptacle to be installed at the end of the End Relay Rack in each communications room at 18 inches above finished floor. For special applications or high density telecommunication rooms, such as rooms with servers, node equipment or power over Ethernet equipment, a 30 AMP twist-lock electrical outlet may also be required. Consult with ITS Network Infrastructure design team during design to make this determination. Installation of the relay racks is performed by the ITS Network Infrastructure. The design professional shall coordinate the placement of the electrical outlets with ITS during design.

5) If the building is provided with an emergency generator system or UPS (uninterruptible power supply), the electrical power and lights in the MTR / TR room shall be supplied from that power source.
6) Switches, thermostats or other devices shall be installed beside the door and not in walls containing telecommunications backboards. At no time should these devices be mounted on walls that will contain the TBB or CBB (Communications Backboards).

d) Room Sizing –

1) MTR / TR Room Sizing - The recommended minimum floor dimension for an MTR shall be 90 square feet (i.e. 9' x 10') and the minimum TR on each floor shall be 70 square feet (i.e. 7' x 10'). These minimum sizes shall be increased as building size, floor square footage served or usage increases. The design professional shall consult with ITS if questions arise concerning the proper sizing. The following recommendations are made for sizing of both MTR and TR:

Area Served	Room Dimensions
5,000 sq. ft. or less	70 sq. ft. (i.e. 7' x 10')
5,000 sq. ft. to 8,000 sq. ft.	90 sq. ft. (i.e. 9' x 10')
8,000 sq. ft. to 10,000 sq. ft.	110 sq. ft. (i.e. 10' x 11')

**Single floors that are above 10,000 ft. may require an additional communications room due to limits on communications cable lengths.

2) Smaller Single Story Buildings – In smaller single story buildings less space is needed. In most cases there will be only one Telecommunications Room, Room or Terminal Can. The following minimum is recommended for these applications:

Building Floor Area Served	Served by
Less than 5,000 sq. ft.	Shallow Room (3' x 8.5 ') Walk in room (5' x 5')
Less than 1,000 sq. ft.	Wall Cabinets, Enclosures, etc.

Note: The design professional shall work with ITS to determine the sizing of any cabinets or enclosures.

1) Work Clearance - The NEC Section 110-16 provides requirements for working space and clearance around electrical equipment that is exposed (i.e. unguarded, uninsulated). Provide the following clearances for equipment and cross connect fields in the TR:

- Allow a minimum of 1 meter (3.3 ft.) of clear working space from equipment and the wall where wall mounted cross-connect fields are being mounted when determining the size of the Room.
- Allow for 6 inches depth off wall for wall mounted equipment.

- Provide space of at least 4 feet from center line of rack to wall in front and in rear of each equipment rack or cabinet. Provide isles at least 32 inches wide.
- In corners a side clearance of 12inches is recommended.

e) Relay Racks are typically installed in MTR, TR and CPE rooms for the termination of horizontal data cabling, fiber optics and LAN and other equipment. Installation is typically made by the university ITS. The size of a typical Relay Rack is 19 inches wide, 7 feet 6 inches high, has a 32” footprint and meets ANSI/EIA-310D.

f) RFI / EMI Restrictions –
- Due to RFI and EMI the MTR / TR / CPE rooms shall not house any electrical equipment (i.e., step down transformers, electrical panels, etc).
- The equipment room shall be in a location where electromagnetic interference is minimal to none.

g) Pathway Installation –
- Conduits are to be clamped to the wall so that they will support the pulling of cable and shall be bonded to the Telecommunications ground using grounding bushings.
- Conduits shall be dressed even, reamed, cleaned, bushings installed and contain pull cord capable of 200 lbs. of pull strength. Sleeves, conduits and raceways must not be left open after installation of cabling. Once cable is installed fire-stop all sleeves, conduits, and raceways in accordance with building codes.

h) If two telecommunications rooms are located on the same floor they should be connected with a minimum of 2 - 4 inch conduits, unless otherwise approved during design. Terminate conduits through the structural floor in the telecommunications rooms three (3) inches above the floor surface. For conduits entering from the ceiling or walls the conduits should be installed to <u>turn down</u> and extend to 8 1/2 feet above finished floor in the Telecommunications rooms or equipment rooms. All conduits shall be dressed at the same level and installed with rigid conduit straps to the wall. Design professionals and installation contractors shall contact ITS to address exceptions due to structural conflicts.

i) Cable Tray - Each MTR and TR shall have Cable Tray for the routing of cable inside the rooms that is a minimum of 12” wide installed from corner to corner on every wall mounted 8 feet above finished floor. All trays must be bonded and grounded to the Telecom ground bus bar for the room. Typical cable tray shall be Homaco TRC-512 with all associated hardware. Substitutes must be approved by ITS.
When cable trays are approved for use versus conduit for horizontal cabling they should protrude into the telecommunication room and be installed in a continuous loop around the room at the top edge of the 8 foot high TBB which should be on all four walls of the room. Sizing and manufacturer shall be coordinated with ITS.

j) Ceilings –
- To permit maximum flexibility and accessibility, false ceilings (drop ceilings) are <u>not</u> permitted in MTR or TR rooms.

- Over-head clearances shall be at least 9 feet (i.e., HVAC duct work, sprinkler heads, etc.).

k) Location –

- To minimize the horizontal cable lengths within a maximum of 295 feet, locate the telecommunications room / room (TC) on each floor as close as possible to the center of the area it is to serve.
- Ensure that the Telecom rooms are directly accessible from the hallway or other common area. Telecom room should have only one door and not be used as a passage way to other rooms.
- It is recommended that all TC rooms be vertically aligned (stacked) above the MTR and each other.

l) Entry –

Personnel entry to MTR / TR room(s) shall be through a locked door at least 36 inches wide, 80 inches high. The door should 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. The door is to be keyed by the FSU key bank for the ITS equipment room key. In special applications where a Telecommunications Terminal Cabinet (Box) is used, the box installed shall be capable of being locked. Personal entry to a locked panel shall be via an FSU key bank key for ITS.

m) Dust Elimination –

The walls and ceilings of all equipment rooms shall be dust free and painted with a light color latex paint. The floor shall be tiled with VCT or concrete which has been sealed with sealant.

n) Room Layout - In new buildings the MTR and TR shall be designed to be vertically stacked directly over each other. The MTR and TR rooms shall be laid out as to allow for proper use of space.

- All Outside Plant (OSP) 4” conduits entering the MTR shall be located on one wall, preferably starting in the left-hand corner inside the door. If it is not possible to locate in the left-hand corner inside the door, Conduits should be installed beginning in a corner of the room. Avoid installing the OSP conduits or Riser sleeves in the middle of the backboard (wall).
- It is recommended that the 4” intra-building backbone riser sleeves be placed directly above the OSP conduits in the MTC and in the same location in each stacked TC room so straight pulls can be made from the floor sleeves to the ceiling sleeves.
- Horizontal conduits shall enter on another wall and other services shall be properly distributed along the remaining walls. Any questions about room layout should be directed to the ITS design team.
- Avoid mixing 4" entrance, riser and horizontal conduits.

o) Grounding / Bonding – Refer to Section III for requirements.

p) Fire Protection – Provide fire protection for MTR and TR rooms if required by applicable codes.

q) Environmental Control – Provide heating, ventilation and air conditioning that will maintain continuous and dedicated environmental control 24 hours per day, 365 days per year. Since the MTR and TR rooms house equipment the normal temperature range should be 65 degrees to 78 degrees with minimum 30% to maximum 55% relative humidity. Switches, thermostats or other devices shall be installed beside the door and not in walls containing telecommunications backboards. At no time should these devices be mounted on walls that will contain the TBB (Telecommunications Backboards)

V. TELECOMMUNICATIONS GROUNDING AND BONDING

Statement: The information provided in this document for the design of the Telecommunications grounding and bonding system does not replace national, state, local or other applicable codes, laws or regulations.

Telecommunications grounding and bonding is additional grounding and bonding specifically for telecommunications systems and serves to minimize electrical effects and hazards, augment electrical bonding, and lower the system ground reference potential. Requirements and guidelines for this system are found in ANSI/TIA/EIA-607.

A. GROUNDING PRACTICES

1. Main system ground:

a) The first choice for connection of the Telecommunications Grounding/Bonding system is direct attachment to the closest point in the buildings electrical service grounding electrode system. Electrical power cabling and Communications cabling must be effectively equalized. (reference NEC 800-40). The architect/engineer shall specify that a #3/0 AWG copper ground conductor be provided to the TBB backboards of the MTR and each TR connection to the Telecommunications grounding and bonding system. This grounding conductor shall be installed by a qualified electrician. ITS Network Infrastructure personnel will connect grounding and bonding conductors to telecommunications panels and other equipment.

b) In buildings without electrical service install a driven ground rod(s) as necessary to achieve 5 ohms to ground.

c) If the ground conductor is installed in conduit or raceway, the conduit or raceway must be bonded on both ends to the ground.

VI. BLUE LIGHT EMERGENCY TELEPHONES

The construction budget for renovations or new construction projects should include the costs of conduit, Talk-A-Phone Emergency Telephones and hardware necessary to install emergency phones. The A/E will incorporate this specification into the contract documents when applicable. ITS installs the cabling and telephone line required. The exact location of instruments shall be recommended by the Public Safety Office within the Florida State University Police Department.

Talk-A-Phone units require AC power for the lighting which should be dedicated, 20 Amp, Non-switched service. The two most common Units which are to be used for exterior installations are listed below. Model numbers and features change frequently so the Office of Telecommunications should be contacted for current model numbers:

1. Blue Light Emergency Phones

   a) Tower Emergency Phone Unit
      Talk-A-Phone, Tower with ETP-400 Phone, Part Number _ETP-MT/R-FSU_
      Note: Tower unit to have circulation vent
   b) Wall Mounted Emergency Phone Unit
      Talk-A-Phone, Wall Mount unit with ETP-400 Phone, Part Number _ETP-WM-FSU/400_

Internal Emergency Phones – Emergency phones located inside require the following:

A dedicated 1"" homerun conduit shall be run from the telecommunications room for the voice line to a FME – Flush Mount Enclosure box where the phone is to be installed. **See ADA requirements for height of the enclosure**. A 120 volt A/C, 20 amp dedicated circuit shall be provided to a single gang outlet mounted in the bottom of the FME Box. The design professional should consult with the OTC concerning the university instrument of choice or any required signaling devices.

VII. APPLICABLE CODES AND STANDARDS

The design and installation of FSU telecommunications infrastructure attempts to meet parameters of all applicable local, state and national codes and standards. Issues that fall under codes are a requirement. Though many telecommunications design issues fall under established standards that are not code, these standards have been adopted at FSU and it is highly recommended by this office that the standards listed in this document be followed. At times, conflicts arise between published guidelines such as REA, EIA, TIA, NFPA, IEEE, NCTA, BICSI, and individual company policies. Therefore, this document reflects portions of and/or references the following specifications. Drawing and design documents should be specific for each project and include, either as a direct excerpt or by reference, information from these sources:

- AT&T, former Bell System Practices (BSP's)
- General Telephone, installation and construction practices
- Northern Telecom, installation practices
- RUS (formerly REA), Rural Utilities Services USDA/RUS
- BICSI, Telecommunications Distribution Methods Manual
- ANSI/TIA/EIA-568A, Commercial Building Telecommunications Cabling Standard.
- ANSI/TIA/EIA-568B, Commercial Building Telecommunications Cabling Standard
- TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
- TIA/EIA TSB-75, Additional Horizontal Cabling Practices for Open Offices.

- ANSI/TIA/EIA-569A, Commercial Building Standard for Telecommunications Pathways and Spaces.
- ANSI/TIA/EIA-606, Administration Standard for Telecommunications Infrastructure of Commercial Buildings.
- ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
- ANSI/NFPA-70, National Electrical Code
- NFPA-101, Life Safety Code
- NFPA-780, Standard for the Installation of Lightning Protection Systems.
- Other applicable NFPA Codes.
- ANSI/IEEE Codes, All Applicable Codes.
- NESC, National Electrical Safety Code (ANSI/IEEE C-2, overhead and underground telecommunications cable).
- ISO/IEC 11801, Information Technology. Cabling for Customer Premises.
- IEC 603-7, Part 7, Modular Connectors
- FCC Part 68, Connection of Terminal Equipment to the telephone network.
- FCC Part 15, Radiation Limits.
- FCC Part 76, Cable TV Service. Code of Federal Regulations (CFR) – 10CFR47, Part 76.605. Signal Quality for CATV. Federal Communications Commission (FCC).
- Publications and Industry Standards for CATV. Society for Cable Television Engineers (SCTE)
- Local Uniform Building Codes
- National Cable Television Association Handbook
- General Instruments/Hewlett Packard, broadband testing procedures
- Individual university facility and construction guidelines
- Department of Management ~~General~~ Services, Division of Communications, State of Florida.
- Americans with Disabilities Act

Finished drawing and design documents should not conflict with the above standards and should not deviate from the intent or spirit of this document. It is the responsibility of the design professional for all designs to meet the most current codes and standards at the time of construction.

VIII. GLOSSARY OF TERMS

ADA	Americans with Disabilities Act
Aerial Service	Telecommunications Cable installed on supporting structures such as poles, sides or buildings, and other structures.
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
Backboard	Plywood covered wall in telecommunications room or in terminal boxes used to mount termination devices, hardware and equipment.
Backbone	Cabling and pathway used to connect the telecommunications rooms, cross-connects, entrance facilities and equipment rooms.

Bridge Tap	The connection of two circuits in parallel to each other or a cable pair continued beyond the point at which the pair is connected to an instrument.
Buried Service	A cable installed under the surface of the ground (not in conduit) in such a manner that it cannot be removed without disturbing the soil. Also called direct buried cable, trenched, or bored.
Busbar	A copper bar used as a common point for connection of the building electrical service ground to all telecommunications hardware and equipment in a room or terminal box.
Cable Bend Radius	The radius that a cable can bend before risk of damage or decrease in transmission performance.
CATV	Community Antenna Television (Cable TV)
Coax	Coaxial Cable. A central conductor surrounded by dielectric and a tubular outer conductor.
Conduit Duct bank	An arrangement of conduit ducts in tiers, encased in concrete used for installing telecommunications cables between buildings.
CPE Room	Customer Premise Equipment Room. Often called Data Equipment Room. This room houses private departmental / customer equipment.
Cross Connection	A connection made between cables, subsystems and equipment by the use of patch cables, or jumper wires run between the terminating devices.
CUP	Florida State University Central Utility Plant.
D Ring (Distribution Ring)	Cable Management Device attached to the backboard.
dB	Decibel
Demarcation point	A point of interface where two services are connected. An example at FSU would be the point at which the local dial tone provider terminates their cables in the Main Telecommunications Room for cross-connection to the Intrabuilding cabling.
EIA	Electronics Industries Association.
EMI	Electromagnetic Interference. An unacceptable or undesired response, malfunction, degradation, or interruption to the intended operation of electronic equipment caused by the coupling of electrical or magnetic fields.
EMT	Electrical Metallic Tubing
Encased Conduit	Conduit contained inside poured concrete.

Exposed Cable	Any cable that is located so that it is subject to lightning, power induction, or differences in ground potentials.
F Connector	Coaxial Connector commonly used for terminating CATV Cables.
Outlet Faceplate	A plate or cover which holds multiple communications jacks, mounted on a surface, and covering the electrical box and communications cables in the wall.
FCC	Federal Communications Commission
FDDI	Fiber Distribution Data Interface
Foot-Candle	a unit of luminance on a surface that is everywhere one foot from a uniform point source of light of one candle and equal to one lumen per square foot
Gas Tube Protector	An Overvoltage Protector with metallic electrodes in a gas atmosphere contained in a glass or ceramic envelope.
Horizontal Channel	The Horizontal cabling which includes all elements of the Horizontal cabling Link, plus the equipment cords in the telecommunications room and the work area. Contains all elements needed to support telecommunications applications over the horizontal cabling.
Horizontal Link	The horizontal cabling which includes all horizontal components except for equipment cords in the telecommunications room and at the work station.
ICEA	Insulated Cable Engineers Association
IDF	Intermediate Distribution Frame. A field of termination devices on which the intrabuilding backbone cables are terminated for cross-connection to the horizontal cabling system. Normally found in the Telecommunications Room on each floor.
IEC	International Electromechanical Commission.
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IMC	Intermediate Metallic Conduit
Interbuilding Backbone	A Cable between two buildings.
ISDN	Integrated Services Digital Network. An integrated data network in which the same time division switches and digital transmission paths are used to establish connection for different services.
ISO	International Standards Organization
ITS	Information Technology Services

KV	Kilovolts (1000 volts)
LAN	Local Area Network. A geographically limited data network used for the local transport of voice, data, and video.
Loose Buffer	In a fiber optic communication cable, one type of component used to encapsulate one or more optical fibers for the purpose of providing such functions as mechanical isolation, protection from physical damage and fiber identification. The buffer may take the form of a miniature conduit, contained within the cable and called a loose buffer, or loose buffer tube, in which one or more fibers may be enclosed, often with a lubricating gel.
Maintenance Loop	An additional length of cable on the end of an installed cable that allows for later use if any of the cable must be shortened or the termination devices moved.
Manhole	A hole through which a person may gain access into an underground vault or structure.
Marker tape	A plastic tape placed in the ground to identify buried cable location if dug up.
MDF	Main Distribution Frame. Also called the Main Cross-connect. The cross-connect in the Main Telecommunications Room (room) where the entrance cables terminate and cross-connect to the building Intrabuilding Backbone Riser cables.
Media	The physical path for telecommunications services. (i.e., copper cable, fiber optic cable, coaxial cable, radio, etc.)
Mhz	Megahertz. One million hertz or one million cycles per second.
Modular Jack insert	The modular communications jack that snaps into a faceplate.
MTC	The Main Telecommunications Room (room) for the entire building. This room serves as the entrance facility for the building where all Outside Conduits terminate. It houses the Main Distribution Frame (MDF), where the service entrance cables terminate and interface with the intrabuilding backbone distribution cabling system and to the horizontal cross-connect and cabling serving that floor. The MDF is considered the point where the regulated telephone company will install the building entrance protectors.
Multimode Fiber (MMF)	An optical fiber that supports the propagation of more than one bound mode. A multimode optical fiber may be either a graded-index (GI) fiber or a step-index (SI) fiber.
MUX	A device that combines multiple inputs into an aggregate signal to be transported via a single transmission channel.
NCT	Network & Communications Technology; a departmental subset of Information Technology Services

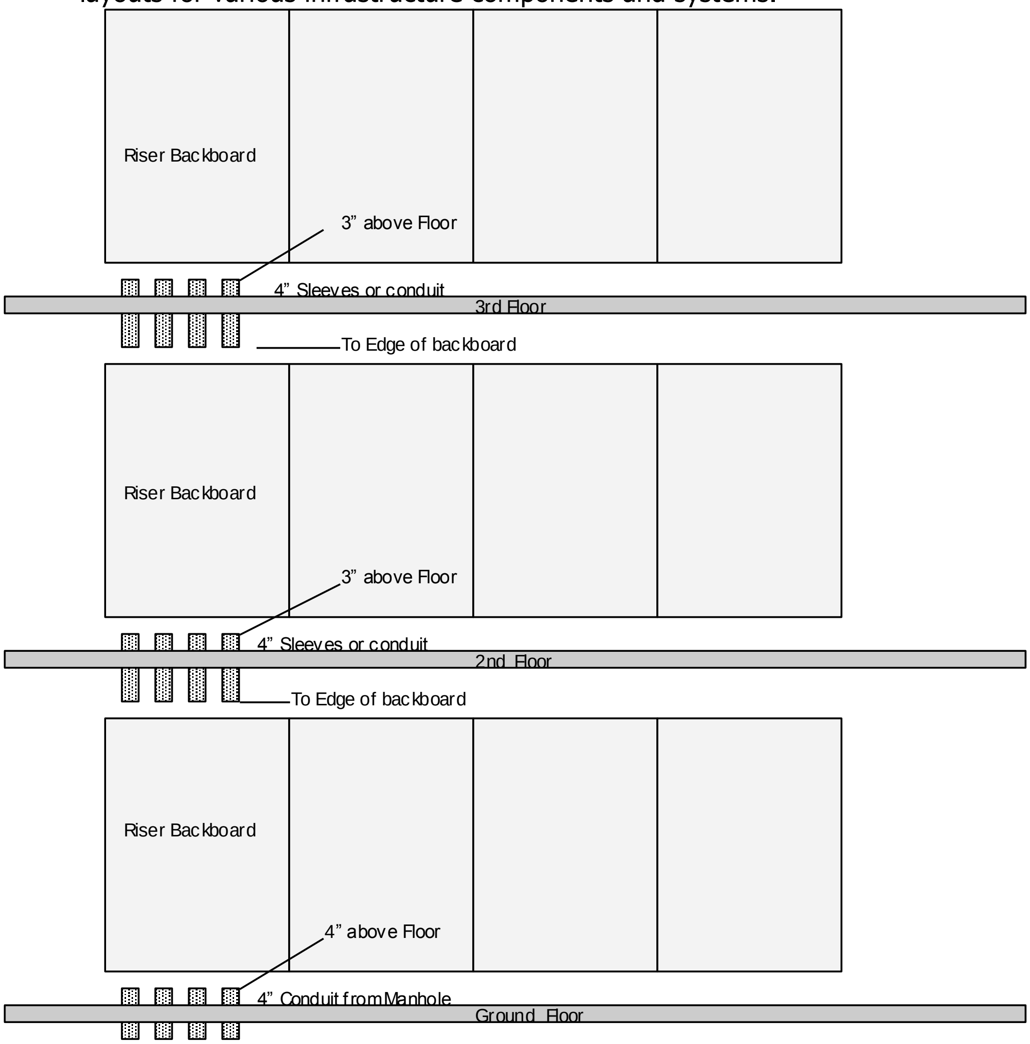
NEC	National Electrical Code.
NESC	National Electrical Safety Code.
NFPA	National Fire Protection Association.
NI	Network Infrastructure; a division of Network & Communications Technology for ITS.
OFNP	Optic Fiber Non-conductive Plenum.
OSHA	Occupational Safety and Health Administration.
OSP	Outside Plant. Telecommunications facilities located outside of the building. Either underground, direct buried or aerial.
OTC	Office of Telecommunications
Outlet	A faceplate with modular jacks located at the workstation.
Pathway	Structures that conceal, protect, and support telecommunications cables. (i.e. Conduit, cable rack, trays, J-hooks, under floor ducts, cellular ducts, trench ducts, Raised access floor, etc.)
PBX	Private Branch Exchange. Telephone system usually serving as a small Central Office for the individual business and located on their site. Provides access to the public switch network.
PE Cable	Filled Cable for use in OSP applications. Designated by the Rural Utilities Service.
Plenum rated	Cable used in a designated area, closed or open, used for the transport of environmental air.
PSI	Pounds per Square Inch
Pull Box	A device to access a raceway, used for access to allow for pulling cable.
Pulling Eye	Metal loop securely fixed to the end of a cable or anchored in the wall of a manhole to allow for the pulling of the cable into the duct bank.
PVC	Polyvinyl Chloride
Raceway	An enclosed channel or pathway designed to hold cables.
Relay Rack	A vertical frame upon which one or more units of equipment and patch panels are mounted.
RFI	Radio Frequency Interference. Any Radio Frequency disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment.

RGC	Rigid Galvanized Conduit
Riser Cable	Intrabuilding Backbone Cable that runs vertically to the IDF in a Telecommunications Room (room).
Single Mode Fiber	An optical fiber in which the signal travels in one mode. The fiber has a small core diameter, typically 8.3 μm.
Sleeve	A Conduit placed through a wall or floor to allow the passage of telecommunications cables.
Solid State Protector	An Overvoltage Protector using high-power semiconductor technology providing fast action and balanced circuits.
STP	Shielded Twisted Pair. A transmission line composed of a twisted 2-wire metallic transmission line surrounded by a sheath of conductive material that protects it from the effects of external fields and confines fields produced within the line.
Sump, Manhole	A fitting at the lowest point of the manhole floor used to pump a manhole dry before working in it.
T-1 (Carrier)	A digital transmission system which operates on two twisted pairs at a speed of 1.544 Mbps. The system is capable of carrying 24 channels (individual circuits) at 64Kbps.
TBB	Telecommunications Bonding Backbone. A 6 AWG or large copper conductor that provides for direct bonding and runs from the Telecommunications Main Bonding Bus bar to the bonding bus bar in each TC and CPE room.
TC	Telecommunications Room. The Telecommunications Rooms (TC) are "floor serving" and at least one is located on each floor. The IDF and Horizontal cable for the floor are usually located in the TC (also referred to as TR).
Telecom	Telecommunications
Terminal Block	An insulating base with binding posts used to terminate telecommunications cables and cross connect between cables.
Terminal Box	A metal box with a hinged lockable door used for installing terminal blocks, terminating cables and cross connecting. The box provides protection against dust, mechanical damage, weather and vandalism.
TIA	Telecommunications Industry Association
Tight Buffer	A tight buffer consists of a polymer coating in intimate contact with the primary coating applied to the fiber during manufacture. The protective thermoplastic coating is normally a diameter of 900 microns.

TMGB	Telecommunications Main Bonding Bus bar. The main bonding bus bar is located in the Main Telecommunications Room and provides a connection point for the main building electrical service ground to safely carry lightning and other power fault currents away from the telecommunications systems. The TBB to other Telecommunications Rooms is connected to the TMGB.
TSB	Technical Service Bulletin
Underground Cable	A telecommunications cable installed in an underground duct system which separates the cable from direct contact with the soil.
UPS	Uninterruptible Power Supply
USOC	Universal Service Order Code
UTP	Unshielded Twisted Pair. A transmission line composed of a twisted 2-wire metallic transmission line surrounded by a sheath of non-conductive material.
Wire mold	A surface mounted enclosed channel designed to hold cables.
Workstation	An individual user interface where the desk, computer, communications, and other equipment is located and connected to the telecommunications outlet.

IX. ILLUSTRATIONS 1 & 3 (Illustration #2 purposely left out)

Illustrations are to aid the design professional and installer in the development and installation of a telecommunications infrastructure in new and existing (renovation) projects. It includes recommended layouts for various infrastructure components and systems.



Note: All Conduit and Sleeves are to be clean, dry, unobstructed, reamed, labeled, capped for protection and fitted with bushings. Conduit is to be provided with pull tape with a minimum pull rate of 200 lbs.

Fig 1. RISER CONDUIT LAYOUT

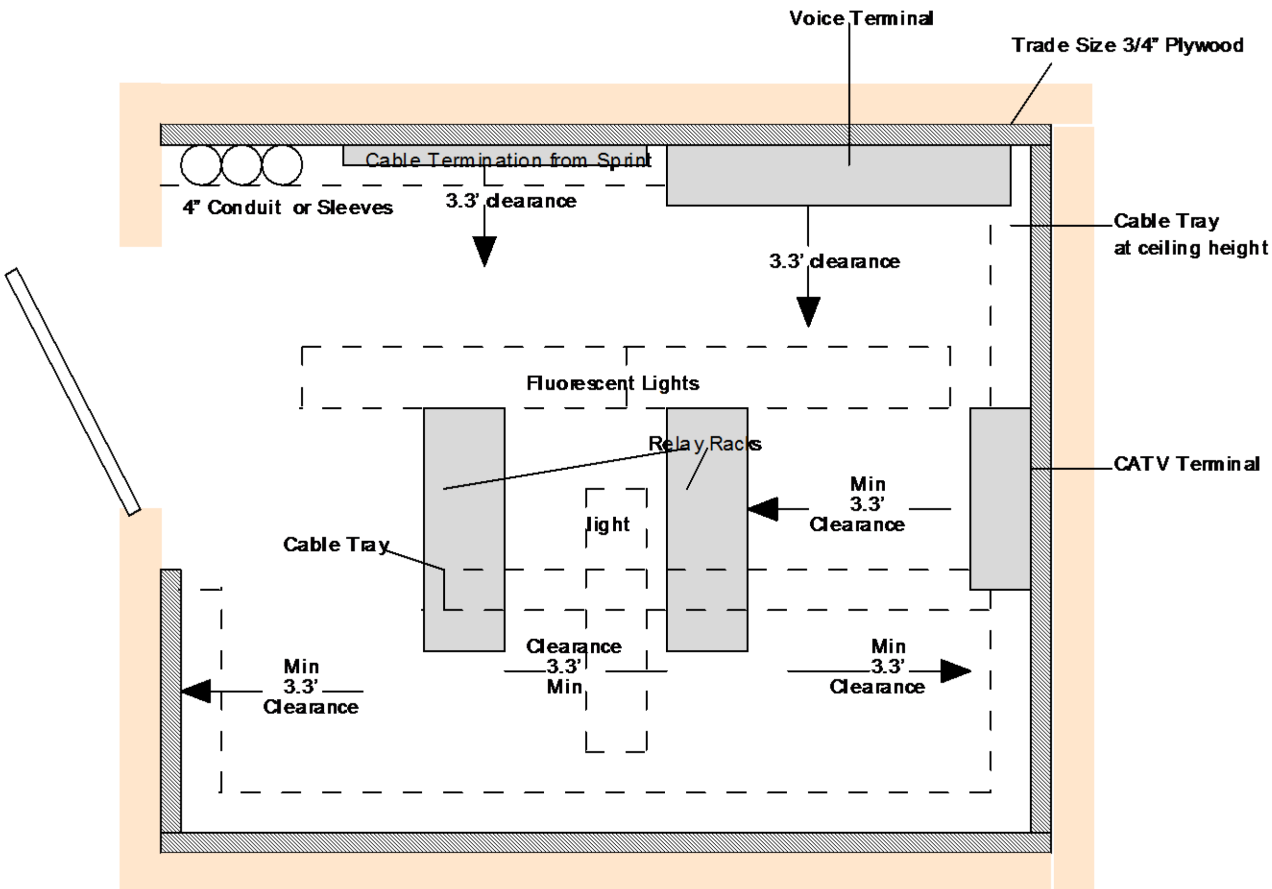


Fig 3. TYPICAL TELECOMMUNICATIONS ROOM
MINIMUM 7' X 10'

Florida State University

Networking Equipment Guidelines for Construction and Renovation Projects

Revision 2.2

July 25, 2012

Prepared by: FSU Information Technology Services

Introduction

The purpose of this document is to provide design guidelines and operating specifications for data networking equipment installed in newly constructed or renovated facilities at Florida State University. FSU Information Technology Services (ITS) is generally responsible for the design, installation, operation and maintenance of these networks. ITS will work closely with Facilities Planning and Construction, departmental representatives, and the design professional to ensure that appropriate network hardware is specified for each project.

Definitions

Networking Equipment - Those components aside from the building wiring infrastructure that are necessary to implement a local area network. This includes routers, switches, media converters, uninterruptible power supplies (UPS), patch cables, etc.

Building Wiring Infrastructure - The horizontal copper wiring between telecommunications room and wall jack, the vertical fiber optic and/or copper wiring between telecommunications rooms, and the fiber optic entrance cable.

Local Area Network (or Building Network) - The integrated system of building wiring infrastructure and networking equipment that allows computers and network activated devices to communicate with other computers and network activated devices within a building. The building network is connected to the campus core network to allow computers and network activated devices in the building to communicate with computers and network activated devices outside the building and across the Internet.

Network Design

Local area networks in campus buildings are typically configured in a star topology. A building entry switch is installed in the main telecommunications room. The building entry switch is connected to the campus core network via the fiber optic entrance cable and acts as an extension of the campus core network. The building switch feeds secondary switches located in the intermediate telecommunications rooms via the fiber optic riser system. The secondary switches feed wall jacks via the horizontal copper wiring. (Refer to the FSU Telecommunications Infrastructure Standard for details concerning wiring specifications and telecommunications room design.)

The building entry switch has redundant power supplies, a high-speed backplane, and high-bandwidth uplinks to the secondary switches. Provisions for redundant backbone fiber feeds and/or alternate routing between the building entry switch and the campus core network should be considered early in the project. The best selections for secondary switches from current industry products are those that are modular in design, stackable, 1-3 RU in height with 24 or 48 ports per switch. Ports should be equipped with Power-over-Ethernet (POE) or be POE upgradeable. Minimum link speeds for newly purchased switches is 10/100/1000 Mbps on copper ports with 10 Gbps optical uplink and stacking capability.

Switches are physically mounted in the telecommunications room equipment racks in close proximity to the data wiring patch panels. This allows for minimum patch cord length, efficient troubleshooting, and cable management. The use of Ethernet hubs or mini-switches outside the telecommunications room is prohibited. All data connections should be wired back to the telecommunications room.

UPS are installed in telecommunications rooms wherever networking equipment is installed. These units provide filtered, uninterrupted a/c power to the equipment. If a networking device is equipped with dual power supplies, one power supply is connected to the UPS and the other connected to a building electrical wall outlet.

Wireless networking is prevalent in all new construction. The physical placement of wireless access points within the building vary from building to building, depending on the area of coverage required, number of users, physical characteristics of the building, materials used for construction, electromagnetic interference, etc. Considerations for wireless connectivity should be made early in the project.

Specifications

Ethernet Switches

The FSU network relies on standards based equipment to ensure interoperability. Ethernet switches shall adhere to the following standards:

• 802.3 10Base-T
• 802.3u 100Base-TX
• 802.3u 100Base-FX
• 802.3u 100Base-LX
• 802.3z 1000Base-SX/LX
• 802.3ab 1000Base-T
• 802.3ae 10-Gigabit Ethernet
• 802.3af Power over Ethernet
• 802.3x Flow Control
• 802.3ad Link Aggregation
• 802.1d Ethernet Bridging
• 802.1D MAC Bridges
• 802.1p/q VLAN Tagging
• 802.1w Rapid Spanning Tree
• 802.1s Multiple Spanning Tree
• 802.1X Port-based Network Access Control
• 802.1Q Generic VLAN Registration Protocol
(GVRP)
• 802.3AB LLDP
• 802.1p Mapping to Priority Queue
•SNMP Management Information Base (MIB) II, SNMP MIB extensions, Bridging MIB (RFC
1493)
•Internet Group Membership Protocol (RFC 1112)
•Telnet Remote Management

Wireless Access Points
Wireless access points shall adhere to the following standards:

• 802.11a 5 GHz 54 Mbps OFDM
• 802.11b 2.4 GHz 11 Mbps DSSS/CCK
• 802. 11f IAPP
• 802.11g 2.4 GHz 54 Mbps
• DSS/CCK/OFDM
• 802.11h DFS/TPC
• 802.11i AES hardware
• 802.11n 2.4/5 GHz 300 Mbps MIMO
• 802.1p/Q VLAN tagging and priority
• 802.1x wireless station authentication
• 802.3 10BaseT
• 802.3u 100Base-Tx
• 802.3af Power over Ethernet
• SNMP Management Information Base (MIB) I and II
• Telnet Remote Management

Patch Cables
Patch cables shall be ADC/Krone "TrueNet" Category 5E cables in any of the following lengths: 4, 7, 10 or 15 ft. These cables are matched specifically to the ADC/Kone building-wiring infrastructure installed by ITS. The specified lengths correspond to the critical wavelengths of data transmission frequencies and, when installed in the ADC/Krone impedance matched system, ensure zero bit errors from wall jack to switch port.

Uninterruptible Power Supplies
UPS are 120-volt input and 120-volt output with 15-minute battery backup at full load. These units are normally mounted in the lower 1/3 of the telecommunications equipment rack and provide power to the networking equipment. All UPS should connect to the building network and have SNMP management for power and environmental monitoring. UPS load capacities are determined according the electrical requirements of each individual telecommunications room.

Heat Load
Power dissipation and heat load for networking equipment is determined on a room by room basis. Provisions should be made in the building HVAC design to accommodate the heat load.

Equipment Costs
Networking equipment costs vary according to the type and use of the building (classrooms, laboratory space, administrative offices, student housing, etc.). Projects typically average ±$1.50 per gross square foot.

Florida State University Design Guidelines

Request for Design Approval

Date Review Requested: ____________________

Date Review Completed: ____________________

Project Name/
Project # ____________________

Project Completion Date: ____________________

Submittal Contents: ____________________

Submitted By: ____________________
Title:

Department: ____________________

(Items below to be filled out by Facilities)

Approval

- ◻ Submittal approved as noted below. No waivers required.
- ◻ Submittal approved. Design Guideline deviation granted as per below.
- ◻ Submittal rejected.

Item:

Reference (page no.) ____________________

Requirement ____________________

Action Requested ____________________

Benefit ____________________

Negative Impact ____________________

Comments

____
Department Representative

____
Project Manager

FACILITIES EMPLOYEE & CONTRACTOR REQUEST FORM

This form must be completed by ALL Facilities employees & Contractors PRIOR to obtaining their FSU CARD

FULL NAME

DEPARTMENT

POSITION TITLE

SUPERVISOR / SPONSER

IF CONTRACTOR, COMPANY NAME

Once you have completed the top section, please take directly to the Keyshop for approval – see map below

FACILITIES KEY SHOP OFFICE USE ONLY

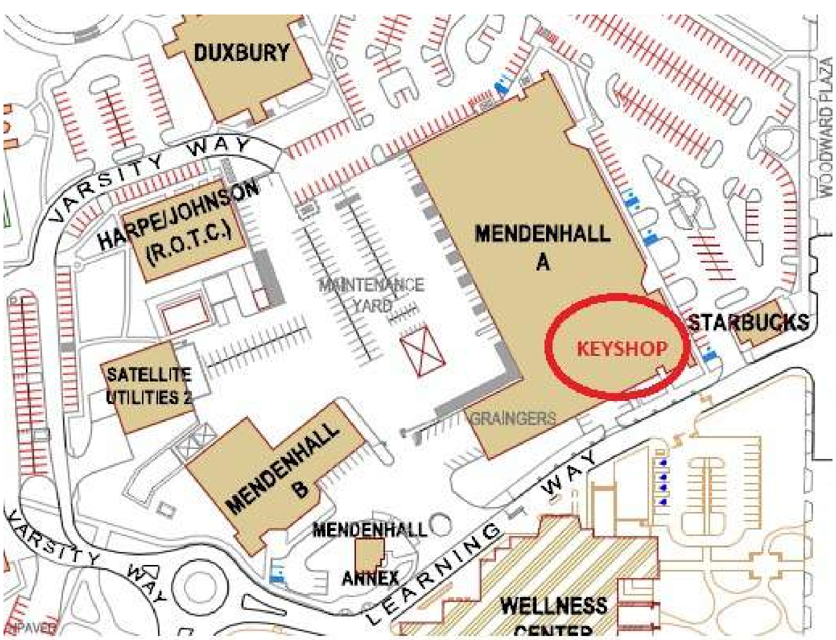
CARD TYPE ____ **FACILITIES BADGE** ____ **CONTRACTOR CARD**

STOCK TYPE ____ **MAG STRIPE ONLY** ____ **PROX CARD**

APPROVED BY

PRINTED NAME

DATE



ARCHITECTURAL DESIGN GUIDELINES ELEMENT

NOTE: Unless otherwise noted, the goals, objectives and policies contained in this element shall guide development of the Main Campus and Southwest Campus in Tallahassee as well as the Panama City Campus in Panama City, Florida.

Introduction

The Main Campus of The Florida State University is a rich repository of architectural treasure. From the Jacobean (and Gothic) styles of the historic zone to the more severe, modern architectural vocabulary of the northwest campus area, FSU has a proud architectural heritage upon which to build. Future campus designs should build upon this heritage.

Five concepts should guide future developments on the campus. First, FSU should extend the character of the original campus through the design of new and expanded facilities and architectural elements that build upon the warm and gracious feelings evoked in the historic zone. It seems difficult in the late twentieth century to create buildings that are identical to the campus' Jacobean Revival buildings, such as the Westcott Building (see **Photo 15.1**), the Longmire Building, Jennie Murphree Hall, Montgomery Hall, and Landis Hall. The special use of Gothic Revival, as in the Johnston Building and Dodd Hall (see **Photo 15.2**), also seems less than easy to attain. However, today's architects can indeed create facilities that genuinely and recognizably reflect the beauty of the historic buildings on campus. Three successful examples of facilities benefiting from this creative effort are the College of Medicine (see **Photo 15.3**), the Chemistry Building, and the Student Life Building.

Second, the notion of defined space is crucial to creating humanistic spaces that are inviting and academic in nature, rather than barren and sterile. In order to achieve the proper scale and positioning of campus buildings, it is necessary to follow the objectives for achieving a characteristic open space/quadrangle at FSU that are discussed in Element 3.

Third, the difference between facilities that are "monumental" (dominant) and those which are "fabric" (subordinate) should be noted. Monumental buildings are those which occupy prominent positions, such as at the end of a quadrangle, and whose architecture dominates and sets the tone for the entire quadrangle. The massing and architectural details of these buildings should belong to the rich design heritage of Westcott Building. Fabric buildings, in contrast, are subordinate buildings in their courtyard and are those that require less detailing and whose massing can be simpler, such as straightforward rectangular "boxes." However, these buildings should still be fine and handsome in appearance. An excellent example of a subordinate, fabric building that is still outstanding is Montgomery Gymnasium.

The fourth concept is that of mixed-use facilities. A great deal of the present success of the FSU campus is due to the variety of facility uses that are intermingled. This gives a variety and energy to the campus land uses that would be absent if buildings were segregated by function. For instance, the mixture of library, academic, residence, and athletic facilities around Landis Green give that space a 24-hour activity level that encourages interaction between different campus users and that lends itself to the serendipity of chance encounters. All of this helps to produce an excellence in campus life that is truly beneficial to the university experience.

The fifth concept is that of the picturesque. This architectural idea, meaning a landscape of delightful, asymmetrical building forms and building compositions, is important to the campus development. Although the Jacobean style lends itself to and often takes advantage of symmetrical building forms (as at the Westcott Building), one of its major strengths lies in its ability to organize asymmetrical building parts into an aesthetically pleasing whole. This ability should be exploited on the campus so that architects can create contemporary facilities that flexibly house a variety of functions, without forcing those functions into symmetrical boxes. In addition, this same asymmetrical condition can be applied to the development of all the buildings in a courtyard. Although the plan indicates a fairly symmetrical build-out of the new quadrangles, this is merely schematic in its graphic presentation. In actuality, if the building program necessitated the building of a very large facility, that facility could be massed in such a way that its asymmetrical shape could avoid overwhelming a courtyard, even if an entire side of a courtyard was needed for a single structure.

Photo 15.1 Jacobean Revival (Westcott Building)

Photo 15.2 Gothic Revival (Dodd Hall)

Photo 15.3 Contemporary Jacobean (College of Medicine)

These large-scale concepts are not the only guidelines that FSU should follow as it develops its campus. FSU should continue to develop its campus beautifully and successfully by means of a coordinated design strategy at two levels of detail: at the campus scale (in terms of framing open spaces, defining courtyards and enclosure, etc.) and at the individual building scale (material, scale, proportions). Both of these levels of detail will be addressed below.

Goal 1
To establish excellence in architectural design that will help produce an aesthetic and functional campus.

Objective 1A
FSU will seek to extend throughout its Main Campus the desirable architectural character of the original Jacobean Revival historic zone.

Policy 1A-1
The designers of new facilities throughout the campus will base major aesthetic decisions on the Jacobean Revival style. Elements to consider using include:

- the Jacobean arch (see **Figure 15.1** and **Photos 15.4**, **15.5**, and **15.6**) and, if a Gothic Revival facility is contemplated, use of the Gothic arch (see **Figure 15.1** and **Photos 15.2** and **15.7**);

- Planar, red brick facades with areas of decorative brick patterning (see **Photos 15.8** and **15.9**);

- sculptural building elements, such as entrance and corner pavilions and porches, towers, and window bays (see **Photos 15.10**, **15.11**, **15.12**, and **15.13**);

- tile or slate pitched roofs, punctuated by dormers and gables (see **Photo 15.14**), or flat roofs hidden behind crenellated parapets (see **Photo 15.10**);

- building podiums that raise the first floor slightly above ground level (see **Photos 15.6** and **15.15**);

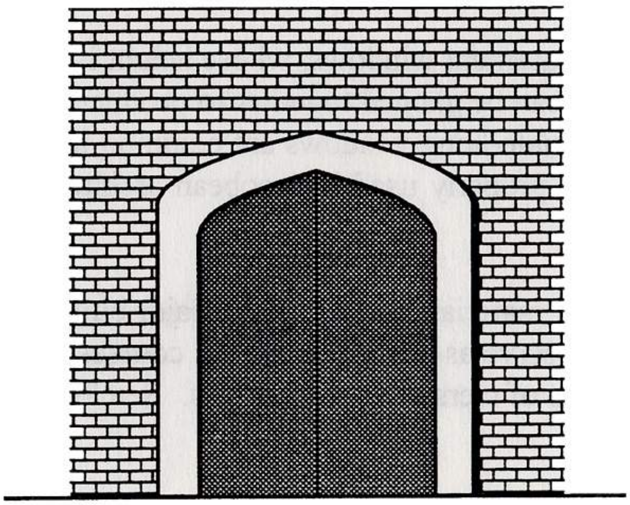
- gables and window groupings that are centered between (not straddling) building piers (see **Figure 15.2** and **Photos 15.6** and **15.16**);

- windows that are, or appear to be, casement windows, whose height is greater than their width -- though these windows can be ganged together to produce a horizontal band of fenestration. (Although double-hung windows are common in the historic zone, casement windows are more properly used in Jacobean architecture.) See Photos **15.9**, **15.12**, and **15.13**; and

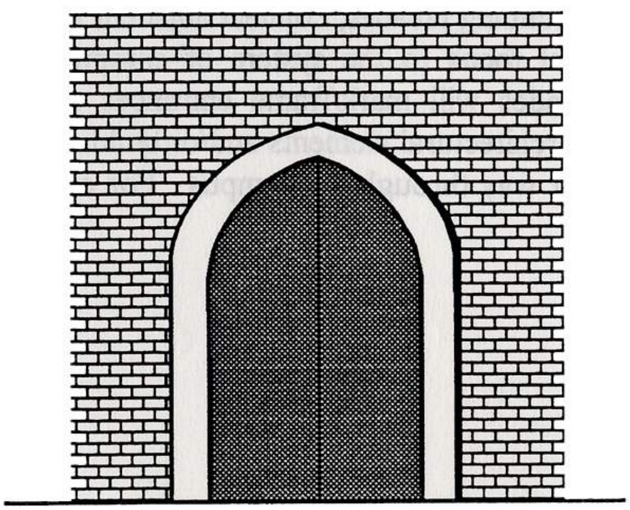
- ornamental details in stone (or similar material) that highlight major building portals, accent door and window openings, serve as quoins and string courses, accent roof lines and gables, and punctuate the top of piers and crenellations. See Photos **15.1 thru 6**, **15.15**, and **15.17** and **15.18**.

Policy 1A-2
The designers of all independent architectural elements such as covered arcades/bridges, fountains, gateways, and kiosks will base major aesthetic decisions on the Jacobean Revival style. See Policy 1A-1 above for elements to consider. These elements shall be placed in such a manner as to frame vistas, punctuate building facades, connect adjacent facilities, and especially, to provide a clear, architectural focus to the system of campus pedestrian connections. Gateways and covered arcades will mark/frame entrances and exits to quadrangles and will relate to other similar architectural elements and/or building portals so that pedestrians are easily able to find their way through the campus. For examples, see **Photos 15.19** and **15.20**.

Figure 15.1 Jacobean and Gothic Arches



Jacobean Arch



Gothic Arch

Revised: 02 June 2011
Effective:

Photo 15.4 Jacobean Arch

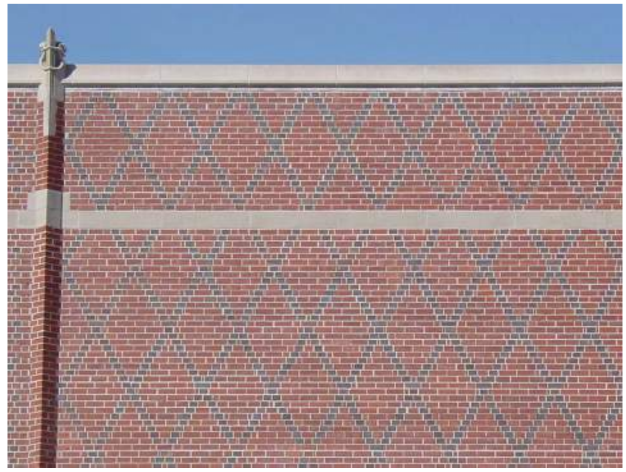
Photo 15.5 Jacobean Arch

Photo 15.6 Jacobean Arch and Proper Gable/Pier Design (Montgomery Gymnasium)

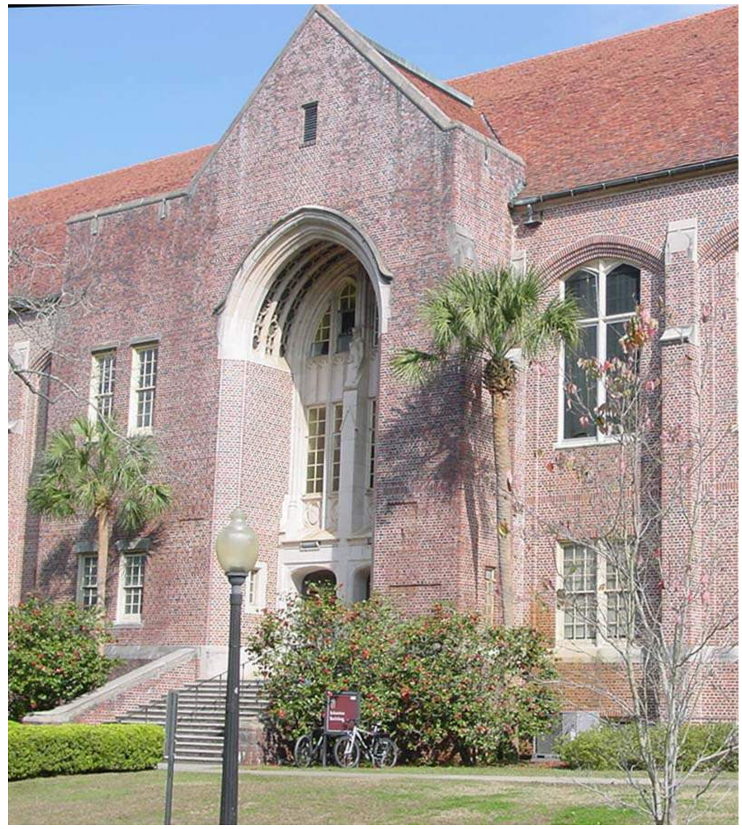
Revised: 02 June 2011
Effective:

Photo 15.7 Gothic Arch

Photos 15.8 and 15.9 Decorative Brick Patterning



Photos 15.10 and 15.11 Sculptural Building Elements



Photos 15.12 and 15.13 Sculptural Building Elements

Photo 15.14 Pitched Roof and Gables

Photo 15.15 Building Raised on Small Podium

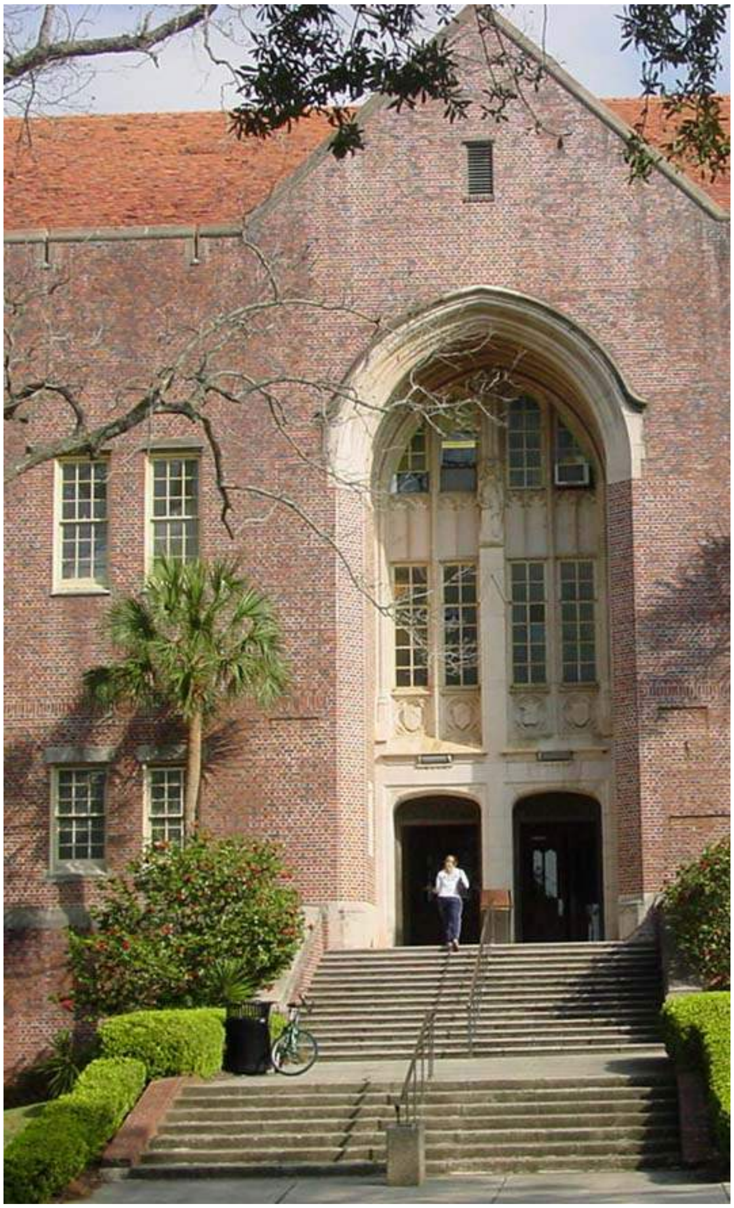
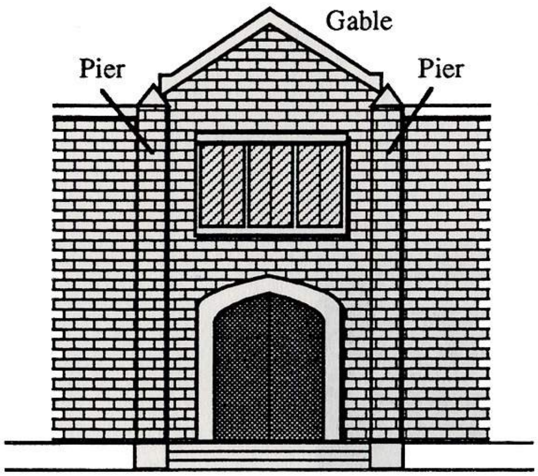


Figure 15.2 Gable and Pier Relationships



Correct Gable and
Pier Relationship

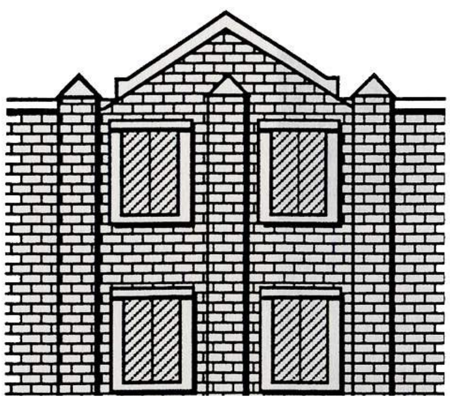


Photo 15.16 Proper Gable/Pier Design

Photos 15.17 and 15.18 Ornamental Details

Policy 1A-3
The designers of renovations/additions to campus facilities will, wherever appropriate, base major aesthetic decision on the Jacobean Revival style. See Policy 1A-1 above for elements to consider. In the case of renovations to buildings of drastically dissimilar aesthetic appearance (such as the Brutalist style of McCollum Hall), renovations/additions can be in a style more closely conforming to the original building.

<u>**Objective 1B**</u>
The University will select the appropriate architectural impact for new facilities and facility improvements/additions based on a considered balance between dominant and subordinate buildings, allowing for different University needs -- aesthetic, functional, and programmatic.

Policy 1B-1
Follow the campus-siting armature of quadrangles and courts established in the Master Plan, **Figure MP.1**, to balance buildings with a monumental presence with those of a more modest appearance. Each quadrangle/court will have dominant and subordinate buildings. The architecturally dominant buildings will normally be located on the short ends of each quadrangle, those ends being the main spatial foci. See **Figure 15.3**. For more unusual/asymmetric spaces, such as the Woodward quadrangle, the Campus Development and Space Committee will carefully consider which site has the most impact and place the architecturally dominant building there.

Policy 1B-2
Flexible selection of monumental or more modest fabric building typology for each new facility will be determined not only by campus placement (including relationship to major open spaces and other quadrangle buildings) but also functional nature and potential for mission change.

Photos 15.19 and 15.20 Independent Architectural Elements

Figure 15.3 Siting of Monumental and Fabric Buildings

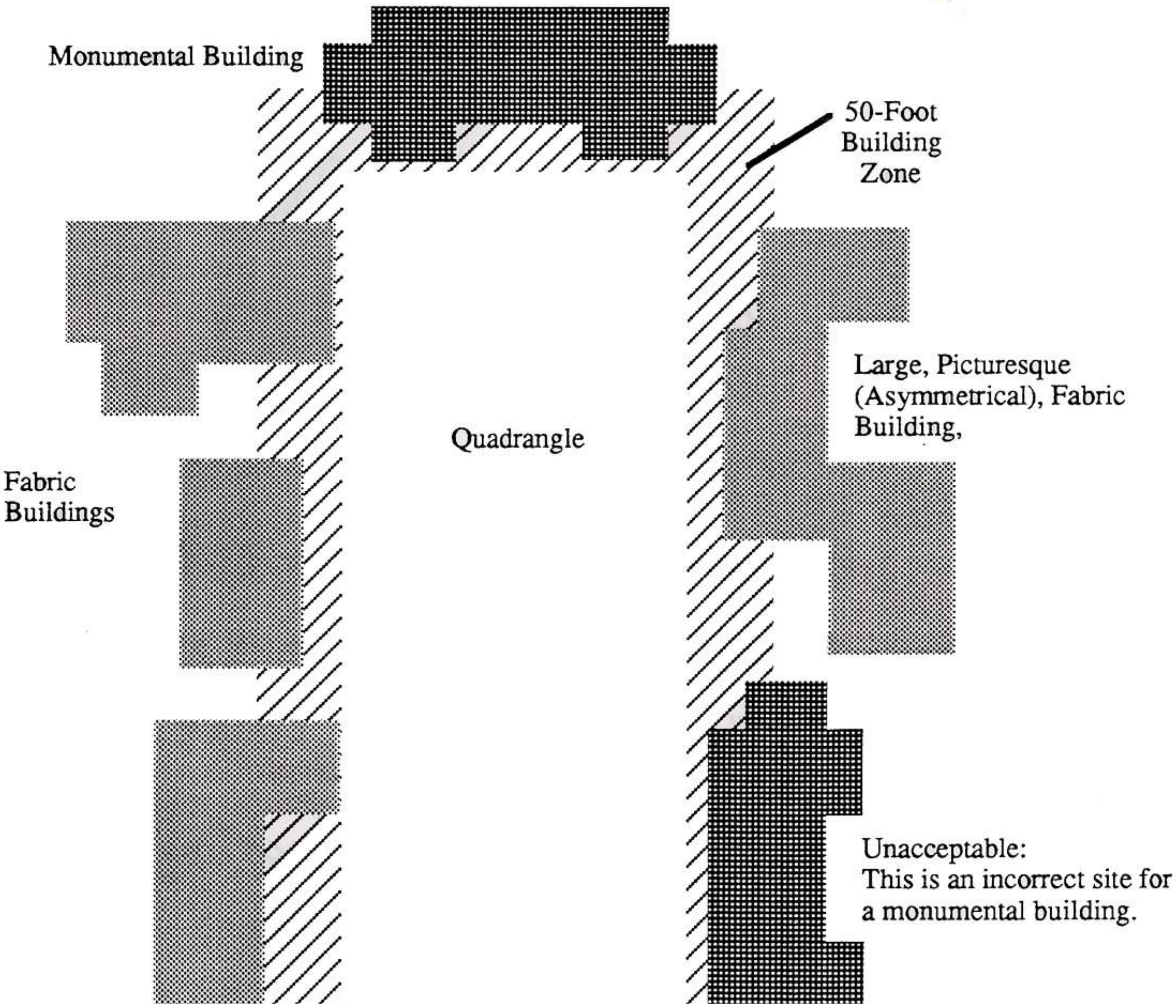
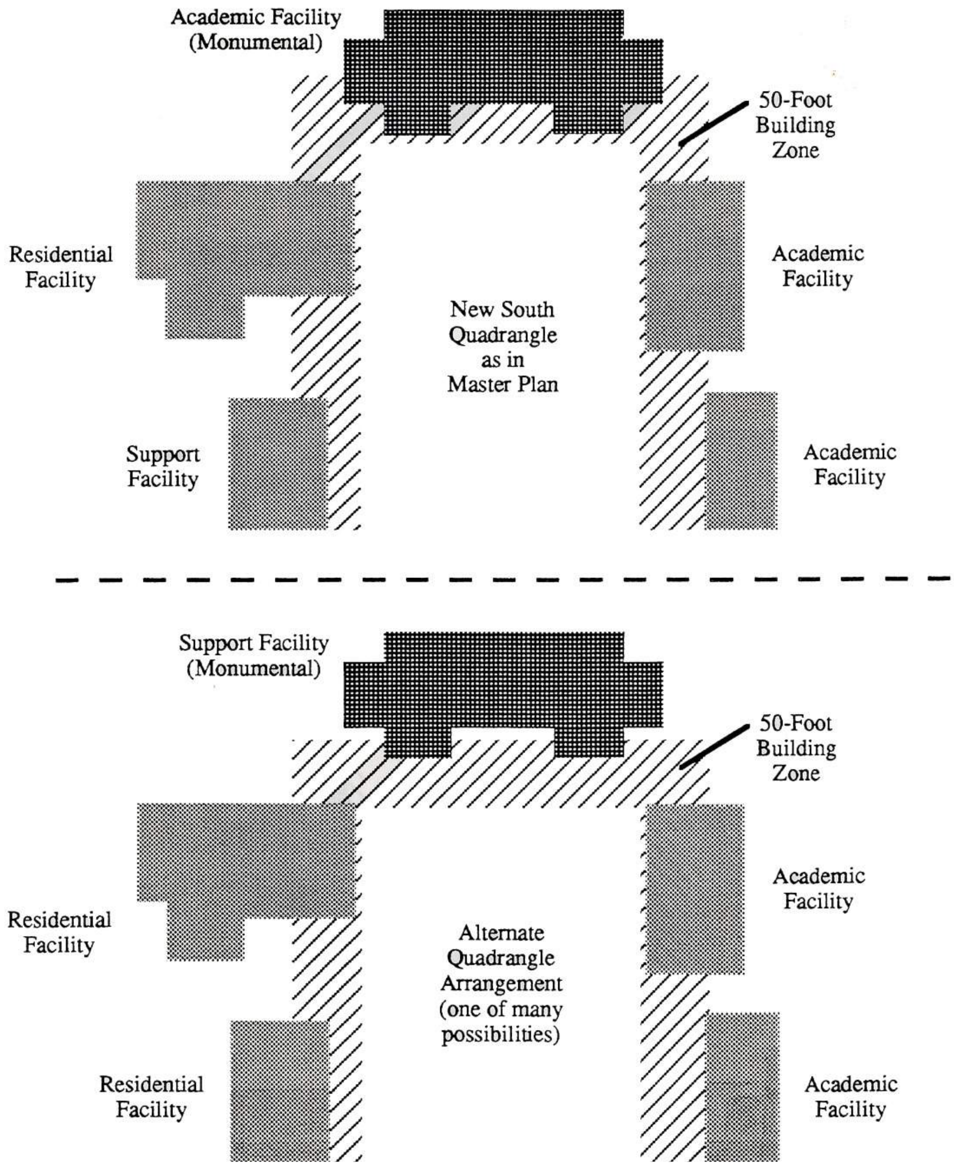


Figure 15.4 Flexibility of Mixed-Use Quadrangles



Policy 1B-3
All quadrangles shall be mixed-use (i.e., some mixture of academic buildings, administration/support buildings, residential buildings, etc.). Buildings should be sited within quadrangles based upon necessary campus adjacencies as well as their appropriate position as monuments or fabric buildings. The assignment of building types -- academic, support, residential -- throughout this document is purely schematic. Each quadrangle, as it is developed, will be reviewed for the appropriate mix of functions. See **Figure 15.4** as an example of this flexibility as it could apply to the South quadrangle.

Objective 1C

Individual facilities should be planned and designed to have building elements that are permanent and strongly support the campus aesthetic and to have building elements that are more flexible and, therefore, less permanent in nature. See Figure 15.5.

Policy 1C-1
Develop the facility's cladding and its entry sequence (doorway, vestibule, central public space) and vertical circulation as the long-term core element of each facility.

Policy 1C-2
The basic building material for the exterior cladding is brick. Architectural details, such as portals and window surrounds, will be composed of stone or similar materials, to add character and focus to the building facade. See **Photos 15.1**, **15.2**, and **15.3**. Colors for the brick and details will be as close as possible to those used in the historic zone.

Policy 1C-3
The entry sequence shall be composed of structural and ornamental materials that foster the creation of a Jacobean Revival aesthetic. Exterior materials shall be brick, stone (or similar materials), tiles, and/or other materials similar to those used in the historic area. Interior materials shall be brick, stone (or similar materials), tiles, wood paneling, stucco, and/or other materials similar to those used in the entries and grand, ceremonial spaces in buildings in the historic area. See **Photos 15.21** and **15.22**.

Policy 1C-4
Except for the cladding and entry sequence, internal plan arrangements must have great

flexibility for economical rearrangement through proper material selection and structural placement/type. Close attention should be paid to structural bays and their ability to support future floorplate reconfigurations.

Policy 1C-5
Building support elements (HVAC, electricity, hard-wired communications, water, and waste-handling of all varieties) should be reconfigurable, in order to support the flexibility of the building and of future technological changes. During the facility programming process, identify those elements likely to need the greatest flexibility or ease of modification and then ensure that they are designed to accommodate future building and technological changes.

Policy 1C-6
Minimize level changes to ease future reconfiguration.

Policy 1C-7
To provide designers with the most options for flexibility while also providing visual diversity, the massing of new facilities should normally be picturesque (asymmetrical) in organization.

Policy 1C-8
Individual facilities, both new and renovated, should be considered for mixed uses (i.e., classrooms, lab, lecture).

Objective 1D
Reduce facility-operating costs through proper architectural design.

Policy 1D-1
Plan and build all facility improvements and additions as well as new facilities in a way that will reduce long-term facility operating costs.

Figure 15.5 Permanent versus Flexible Schematic Building Elements (in Generic Building Layouts)

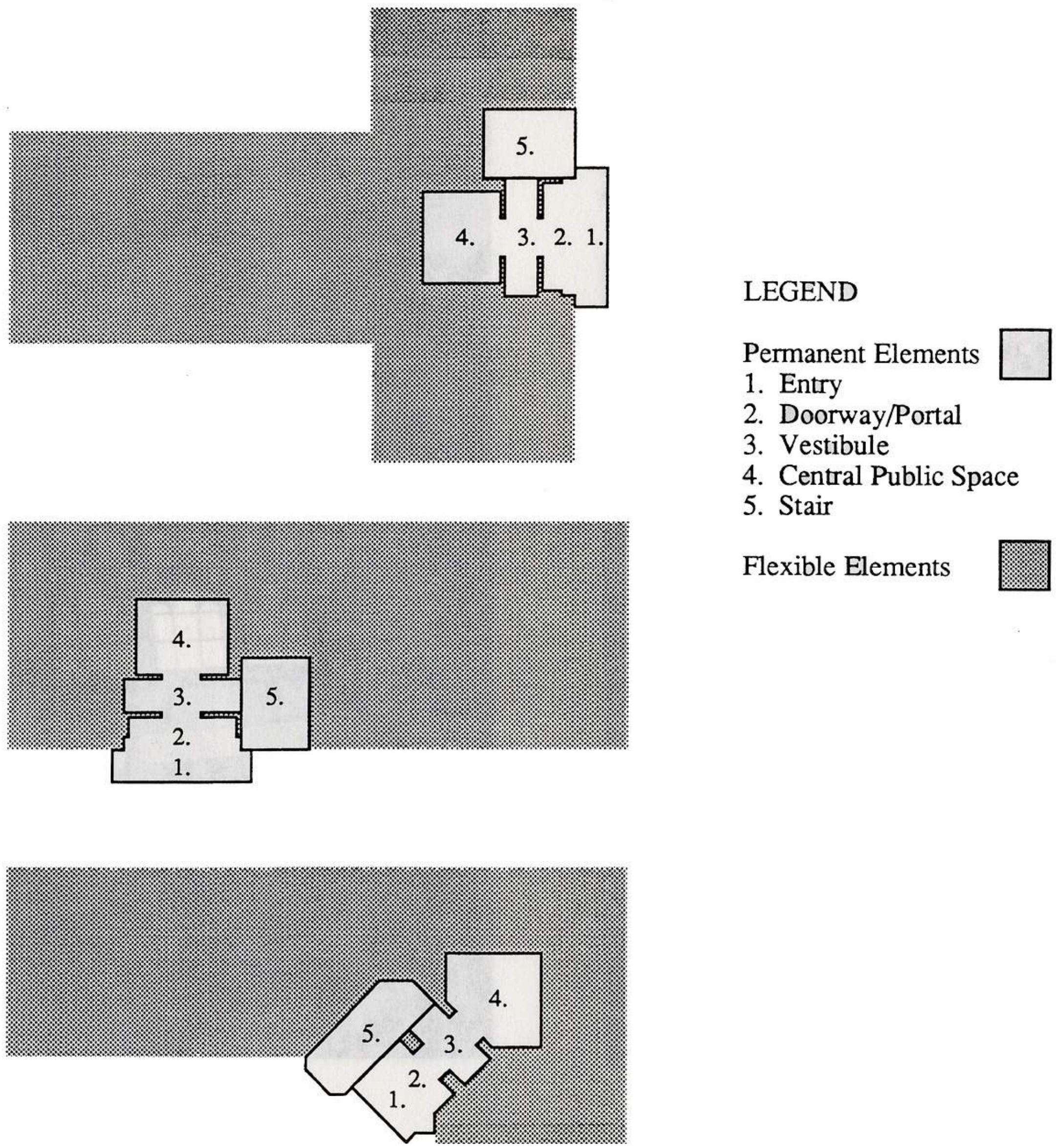


Photo 15.21 Exterior Entry Sequence (Gilchrist Hall)

Photo 15.22 Interior Entry Sequence (Dodd Hall)

Policy 1D-2
Select energy-efficient and low-maintenance exterior and interior materials, architectural details, and building equipment and fixtures.

Objective 1E
To the greatest extent economically and physically feasible, all historic facilities that undergo rejuvenation and retrofit will be brought to necessary accessibility and life safety codes without adversely impacting the quality of the facility.

Policy 1E-1
Bringing historic facilities into compliance with necessary codes will be done with minimum adverse impact to the visual quality of the facility's exterior presence.

Policy 1E-2
Bringing historic facilities into compliance with necessary codes will be done with minimum adverse impact to the quality of the facility's entry sequence (porch, vestibule, hall, staircase) and important ceremonial rooms.

Policy 1E-3
The architectural planning and design process will also be governed by the currently applicable State of Florida statutes, the requirements of the Florida State University, and other applicable codes and standards which are listed in the at the end of this Element and shall be considered an integral part of this Master Plan.

Objective 1F
The University will conform to the following additional architectural design guidelines.

Policy 1F-1
The University shall continue to prioritize and seek funding for the mitigation of accessibility issues in University facilities. Priorities for mitigation shall consider the following items (in priority order):

- building access from exterior;

- exterior signage;

- accessible toilet facility;

- accessibility of all public spaces, including auditoriums; and

- interior signage.

Policy 1F-2
The University will use the guidelines in this element to develop its on-campus edges and will coordinate with the City of Tallahassee to create compatible standards for the off-campus edges.

Policy 1F-3
In the event that FSU develops satellite University facilities occupying sites on campuses that are not part of the State University System of Florida, Board of Governors, the University will establish joint coordination methods regarding the design of those facilities.

Policy 1F-4
The architectural planning and design process will also be governed by the currently applicable State of Florida statutes, the requirements of the Florida State University, and other applicable codes and standards which are described at the end of this Element and shall be considered an integral part of this Master Plan.

Policy 1F-5
FSU will continue the current initial design review process accomplished by the Campus Development and Space Committee, assisted by the Facilities Department. This initial design review will carefully consider each of the above guidelines. See the Plan's **Appendix** for this Committee's process, which is an integral part of this Master Plan.

Policy 1F-6
FSU will use the design review process to adjust these architectural guidelines. The Campus Development and Space Committee, assisted by the Facilities Department, accomplish this process. This review mechanism, which is a post-occupancy evaluation process, will regularly review the effectiveness of the architecture guidelines and adjust them as necessary.

Objective 1G

FSU will seek to extend throughout its Panama City campus and on its other properties and sites an approachable, friendly style of architecture that builds upon the character of the existing buildings, where appropriate, and enhances the existing architecture of the campus/site as much as is feasible. These properties shall not be required to use the architectural character of the Main Campus.

Policy 1G-1
The designers of new facilities on the Panama City campus and on other FSU properties will base major aesthetic decisions on the character of the existing buildings, where appropriate. It shall be a primary aesthetic policy to build upon the strengths on existing facilities, in order to achieve a community of facilities that look coordinated and compatible.

Policy 1G-2
The designers of new facilities on the Panama City campus and on other FSU properties will base major aesthetic decisions on enhancing the existing architecture of the campus/site as much as is feasible. While the aesthetic theme of the site should be followed, designers of future facilities are encouraged to build facilities that are more user-friendly, pleasant, functional, accessible, energy-efficient, durable, and open to outside views of gathering places, landscaping, and outdoor amenities. Designers of these facilities should consider the provision of covered outdoor waiting areas, outdoor landscaped courtyards, pedestrian connections to other buildings, and other elements that foster academic life and the mission of the University.

Supplement to Architectural Design Guidelines Element Goals, Objectives, and Policies

Codes and Standards

Regarding building codes and State oversight of university projects, substantial changes have been made to the regulatory system that controls university development over the past several years. The restructuring of the higher education governance system, the adoption of a statewide building code, the evolution of University Boards of Trustees, and the advent of a University permitting department are just a few examples of such changes. Because some of these changes are still somewhat evolving, it is difficult to fully predict or evaluate how campus construction, and the systems and policies that oversee it will be impacted.

The vast majority of all capital construction projects completed at Florida State University, regardless of whether they fall within the category of either a major or minor project, are administered by the Facilities Department. All construction activities that occur on the Florida State University campuses are tightly regulated by a series of existing and new statutes, standard practices, guidelines, and policies. The responsibility for ensuring that the completion of this project meets these requirements has been assigned to the Facilities Department; that portion of the process remains unchanged.

The planning, programming, design and construction phases of any capital project are generally regulated by three areas of governance: Florida Statutes, building/life safety codes, and University standards, guidelines, and policies. Not surprisingly, there is a certain amount of overlap between many of these items.

Florida Statutes, especially those found in Chapter 1013, provide specific direction on various aspects of the University's capital improvements program, including capital budgeting, master planning, and the like. Other legislation is represented elsewhere in the Statutes, including information on the statewide building code. Of course, any discussion about legislation must also include federal initiatives, such as the Americans with Disabilities Act (ADA), which apply equally to all University projects.

Over the years, the University and the former Board of Regents developed and adopted various sets of guidelines and policies that assisted in the administration of construction and renovation projects. Though many of the former BOR policies and Chancellor's Memoranda have been rescinded by the Florida Department of Education, Florida State has chosen to adopt a similar set of policies and procedures. These can be found at the following website:

http://www.vpfa.fsu.edu/policies/facilities/forms.html

A number of University guidelines and specifications are maintained in the "Design Guidelines and Specifications" section of the Facilities Planning and Construction website at http://www.fpc.fsu.edu/guidelines.html. The University's Campus Master Plan provides guidance on the design of new facilities and landscaping components in the form of "Architectural Design Guidelines and Landscape Design Guidelines" These guidelines describe the University's general design intent towards these project components. More specific direction can be found in the "Florida State University Design Guidelines and Standards," which are also kept on-line at this website. These guidelines contain specific information about preferred materials, methods of construction, systems information, and the like.

Other University departments have likewise promulgated similar kinds of guidelines. For instance, the Office of Telecommunications has standards and guidelines specifically developed for architects and engineers, which provide important information on telecommunication system infrastructure, and operating specifications for data networking equipment. This standard should be rigorously followed.

Generally speaking, the design professional shall meet with the Facilities Department and other appropriate University departments prior to the commencement of the design phase to discuss all applicable statutes, codes, guidelines, standards, policies and procedures. Any questions concerning the applicability of any particular form of governance must be sufficiently answered so as to remove any confusion or question about how a project will be administered and by which statute or code. It shall be the responsibility of the design professional, the construction manager, or the general contractor to ensure that every capital project follows the requirements of all applicable statutes and codes. It should also be noted that the design professional shall ensure that the design documents comply with all codes until the date the project is permitted for construction as part of the basic service requirements.

It is worth noting that the Florida State University Building Code Administration Section, a unit of the University's Environmental Health and Safety Department, ensures that all new building construction, additions, alterations, repairs, remodeling or demolitions and all installations of building systems meet Florida Building Code requirements including all electrical, plumbing, mechanical, gas, gas fuel, fire prevention, energy conservation, accessibility, stormwater and flood plain management requirements. This office supervises, directs and enforces the permitting, plans examination and inspection program in all University buildings, including parking garages. When the Building Code Administrator is satisfied that all code requirements have been met, a certificate will be issued that allows completed buildings to be occupied.

It is the responsibility of the design professional, the construction manager and the University's construction project manager to ensure that all plans review and construction inspection requirements are met. It is highly recommended that at the commencement of this project, the design professional, the construction manager, and/or the general contractor meet with the University's Building Code Administrator to discuss the project and any possible code issues, schedules of plan review, and other administrative procedures.

FLORIDA STATE UNIVERSITY MASTER PLAN

LANDSCAPE ARCHITECTURAL DESIGN GUIDELINES ELEMENT

NOTE: Unless otherwise noted, the goals, objectives and policies contained in this element shall guide development of the Main Campus and Southwest Campus in Tallahassee as well as the Panama City Campus in Panama City, Florida.

Goal 1
To establish and maintain a high level of quality in the design of landscape treatments on the University campus.

Objective 1A
Establish a hierarchy for landscape treatment of vehicular circulation routes.

Policy 1A-1
The main streets bordering the campus (Tennessee Street, Stadium Drive, Macomb Street, and Gaines Street) shall have specific landscape treatments based on hierarchy of importance to campus entry, but they shall have as common elements the following characteristics:

a) a consistent street tree planting with designated trees and spacing.

b) pedestrian walkways and/or bikeways along one or both sides.

c) pedestrian crosswalks articulated at key intersections with special paving.

d) the ground plane shall be predominantly sodded lawn area, with the exception of low maintenance groundcover at special intersections or entrances.

e) consideration shall be given for articulation of fine grading and mounding of landforms.

f) islands in the boulevards and side verges shall be bermed or sloped for aesthetic or functional purposes.

g) signs and wayfinding information shall be coordinated with landscape treatment and location.

Policy 1A-2
The University shall continue to work with the City of Tallahassee and other local agencies on the evolving design for improvements to the Gaines Street corridor. The Campus Master Plan shall be amended accordingly to reflect a final design solution for the improvements to Gaines Street once they have been determined.

Policy 1A-3
Stadium Drive and Macomb Street shall also be characterized with formally spaced canopy trees and pedestrian walkways. Being more residential in character, both streets shall have flowering broadleaf evergreen trees. Each street shall have a singular tree species for continuity and consistency

Policy 1A-4
Tennessee Street interfaces with commercial elements that are not part of the University. The streetscape and landscape treatment shall also be formally spaced, large canopy trees where space and sight lines to commercial facilities permit. Wherever possible the streetscape shall reinforce the concept of a formally lined streetscape to add coherence and image to the campus perimeter. Special walkway treatments shall occur at commercial interfaces. A pedestrian walkway shall be provided.

Policy 1A-5
Working with the City of Tallahassee, the streetscape image established by the perimeter roads (Gaines Street, Tennessee Street, and Stadium Drive and Macomb Street) shall be extended beyond the campus to connect with the rest of the city. The streetscape image established by the University should be extended as part of the overall fabric of the city.

Policy 1A-6
The main vehicular entrances (gateways) to the campus shall be appropriately reinforced with landscape and/or architectural features (gateways, pylons) to signify entrance and arrival. Special alignment of trees, understory plant material, grading, accent lighting and view consideration shall be part of the entrance treatment.

Policy 1A-7
The interconnecting entrance roads to the inner loop (Pensacola Street, Chieftan Way, Call Street, etc.,) shall be treated with large, formally spaced canopy trees. The regular, systematic planting shall signify circulation, corridor and direction. Walkways shall border both sides of the streets.

Policy 1A-8
The landscape treatment of internal emergency access lanes, access to special parking areas, and access to service areas within campus shall be understated and subservient to the adjacent landscape context. Considerations shall be given to screening and buffering where appropriate.

Objective 1B
Establish a hierarchy for landscape treatment of parking facilities.

Policy 1B-1
It is the intent that vehicular parking areas be both functional and aesthetically pleasing. Large canopy trees shall dominate the parking areas for shade. The trees shall have significant clear trunks for unobstructed sight visibility. Within off-street parking areas (parking lots), there may be two alternatives. The first, the traditional approach, requires landscaped areas in the form of interior islands and perimeter landscape strips. The second design alternative eliminates interior islands, but creates tree canopy through clustered islands of tree plantings randomly spaced throughout the parking area (See **Figures 16.1, 16.2, 16.3**).

Policy 1B-2
For design alternative one, each row of landscaped islands that measure not less than five (5) feet in width and not less than eighteen (18) feet in length shall terminate each row of parking spaces. At least one (1) tree shall be planted in each terminal island (See **Figure 16.1 (a)**). Divider medians may be provided within each row of parking spaces, and is an optional but recommended addition. Divider medians shall form a continuous landscaped strip between abutting rows of parking spaces. The minimum width of a divider median shall be five (5) feet. Trees shall be planted in divider medians to provide adequate shade canopy (See **Figure 16.1 (b)**).

Policy 1B-3

All interior landscaped areas not dedicated to preservation of existing vegetation shall be landscaped with grass, groundcover, shrubs or other appropriate landscape treatment.

Policy 1B-4
Perimeter landscape buffer areas shall be created around the perimeter of lots. The perimeter landscape strip shall be continuous except where it is pierced by accessways. The minimum width of landscape strips shall be ten (10) feet in width, and include canopy trees, groundcover or sodded lawn areas, and continuous shrub masses to screen views of cars. Adequate sightlines shall be maintained between the underside of the tree canopy and the top of the shrub lines for security views inward. Walkways shall receive confluences of pedestrian traffic and connect to desire lines (See **Figure 16.2**).

Policy 1B-5
For design alternative two, existing parking lots which contain no landscape island treatment or tree canopy shall be retrofitted with planting islands, or parking row terminal ends, to allow for trees to be planted for shade. Low groundcovers shall be planted on the groundplane in these areas (See **Figure 16.3**).

Figure 16.1 Parking Layout (Landscape)

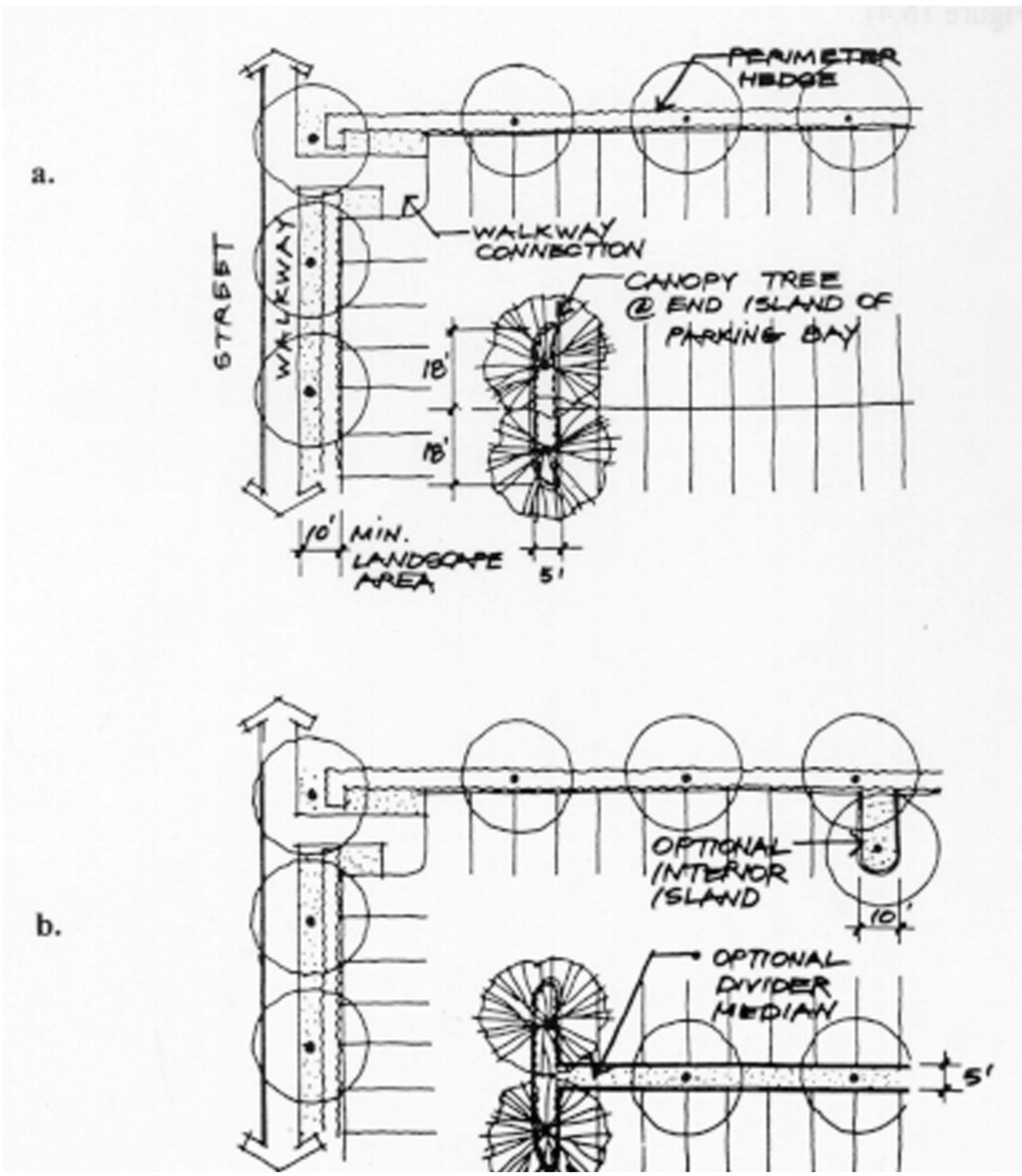


Figure 16.2 Parking Layout (Landscape)

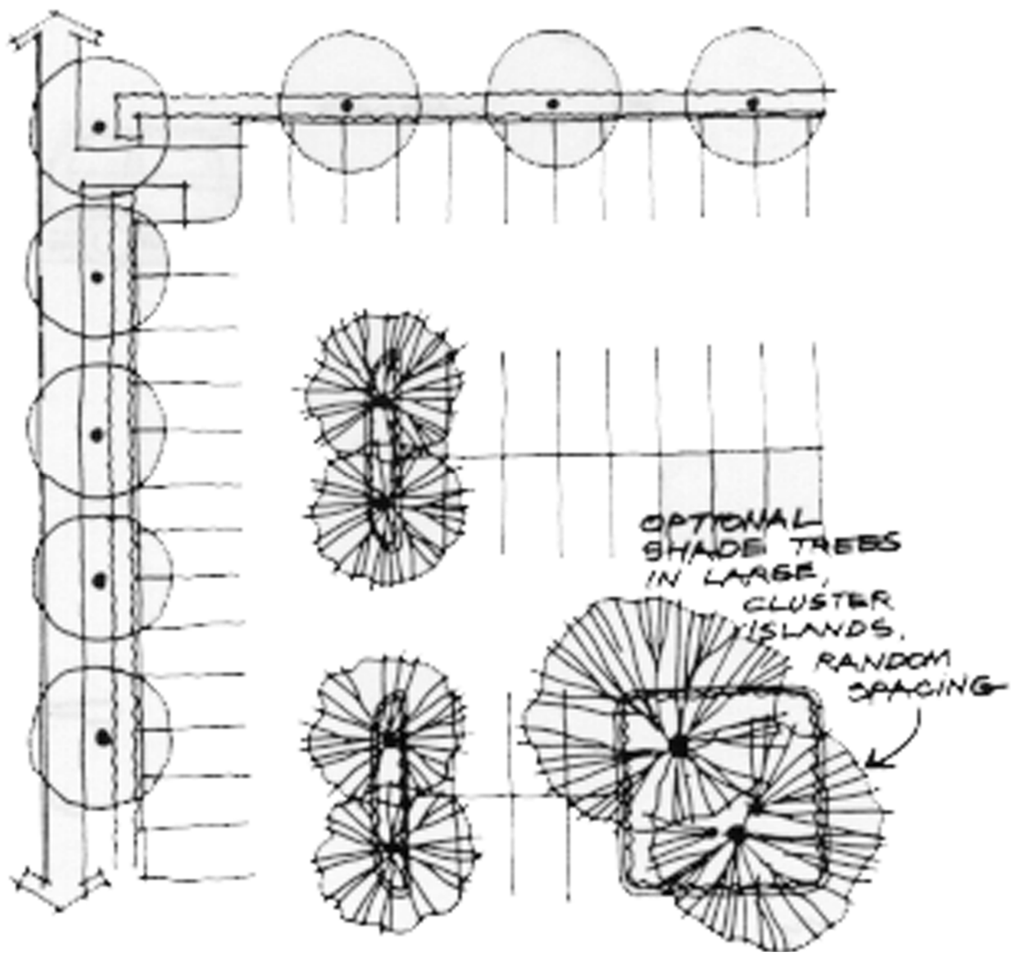
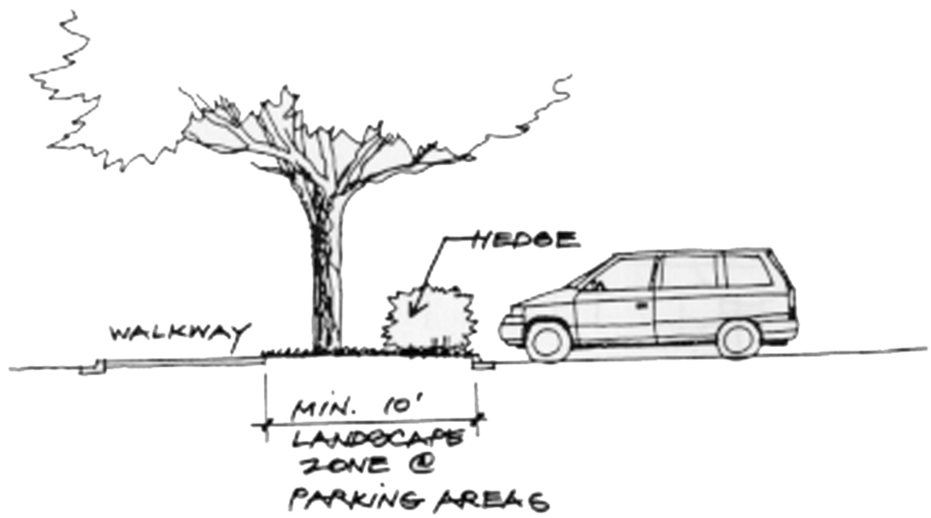
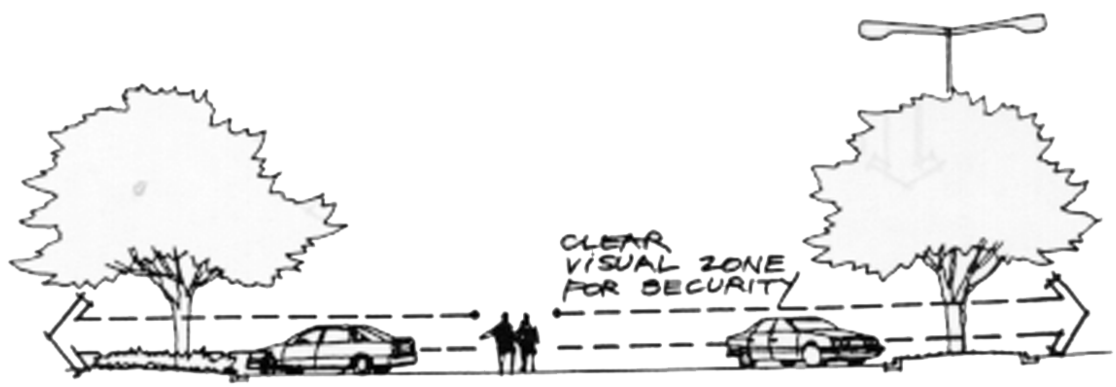


Figure 16.3 Parking Lot Landscape





<u>Objective 1C</u>
Establish a hierarchy of systems, types, scale, consistency of materials, and a structure of pedestrian walkways that help to define and articulate open spaces.

Policy 1C-1
The historic section of the campus is characterized by diagonal, intersecting and parallel walkways that reinforce desire lines and which reinforce quadrangle spaces. This treatment shall be the dominant vocabulary for the campus pedestrian system as the quadrangle/courtyard spatial concept is expanded.

Policy 1C-2
For all pedestrian circulation types, there shall be established a hierarchy of materials and dimensions. A common palette of materials shall unify the entire campus:

a) Walkways and special pavements shall not become subservient to individual buildings and their complementary materials.

b) As a base material, concrete shall be the dominant walkway material. The finish, scoring and connection details shall be consistent and uniform. Special materials, patterns, banding, etc. may be used to articulate Pedestrian Malls, Plazas, or special features. The materials and palette shall be established by specific guidelines.

The width of the pedestrian circulation routes shall vary and be established by hierarchy, usage and urban design considerations. Sidewalks shall be no less than 6 feet wide.

Policy 1C-3
Walkways that interconnect the quadrangle and academic clusters shall also follow the concept of diagonal walkways respecting desire lines and parallel walkways adjacent to vehicular circulation routes. In addition to the Historical Zone Quadrangle circulation concepts, there shall be three other circulation types; the Call Street Pedestrian Corridor, the Woodward Mall and the Student Life Mall.

Policy 1C-4
The Call Street Pedestrian Corridor shall be reinforced and extended along Call Street and at

the closure of Woodward Avenue. The Pedestrian Corridor is characterized by wide pavement similar in scale to vehicular streets. They accommodate a significant volume of pedestrian traffic and function as major collectors and as major linear open spaces. At significant intersections and connecting points, the Pedestrian Corridor shall be highlighted with an expanded plaza that will serve as a focal point and meeting place. Consideration shall be given for parallel bikeways designed in a manner that suggests the circulation routes are part of a unified mall instead of two separate systems.

Policy 1C-5
The Park Walkway is the third type which shall be characterized by gently undulating walkway/bicycle ways that are more informal and park-like in character, and which meander between major landforms (berms) and features (retention lakes).

Policy 1C-6
Wide sidewalks and formally spaced, large canopy trees shall typify the Student Life Mall/Woodward Mall. This pattern shall remain uninterrupted, except at intersections and significant view corridors.

<u>Objective 1D</u>
Enhance bicycle use on campus and continue to provide convenient locations for bicycle parking facilities.

Policy 1D-1
Bicycle racks shall be standardized in order to achieve overall simplicity and uniformity. Selection of the standardized bicycle rack shall be based on efficiency, ease of use, safety to bicycle, maintenance, and accessibility. The location of bicycle facilities shall be convenient to academic and housing entrances, but preferably in an unobtrusive yet safe and secure location. Bicycle facilities shall not visually intrude upon quadrangle and other open spaces. Landscape treatment shall consist of canopy trees for shade and low hedges for screening.

Policy 1D-2
As campus population and density increases, a detailed study shall be made and appropriate measures taken to segregate bicycle traffic from pedestrian walkways within the campus core and high volume pedestrian corridors. These measures shall be implemented through the use of dedicated bicycle pathways where feasible, and divider lanes along wide walkways.

Objective 1E
With the expansion of the campus and as the need for intra-campus transportation increases, establish provision for bus shelters at all stops where there presently are none. Consideration should also be given for adequate canopy cover, for shade and weather protection, based on usage.

Policy 1E-1
The bus shelters shall be safe and utilitarian. They should not be major architectural statements. The shelters, regardless of area of canopy or capacity, shall be of the same architectural vocabulary throughout campus. Landscape treatment around the bus shelters shall be designed with ample paving, low and setback landscaping, and adequate lighting to ensure clear visibility into and from the shelter.

Objective 1F
Establish a comprehensive emergency access system for the campus that includes access to new buildings as needed, a helicopter landing pad area for emergency evacuation, and coordinate with local fire and emergency departments as to their standards and needs.

Policy 1F-1
Emergency access and service access generally share facilities.

Policy 1F-2
Emergency access is through internal service and parking lot areas and widened walkways that allow periodic service and maintenance access and/or emergency vehicles.

Policy 1F-3
Apart from service corridors, pedestrian areas that also function as emergency lanes shall be cordoned off with removable bollards or signs to discourage their use and avoid conflict

between pedestrians and unnecessary traffic. The design of emergency corridors shall consider required clearance (tree canopy and overhangs), stabilized pavement/base, and turning radii of equipment.

Policy 1F-4
Coordination shall be made with local fire and rescue departments to comply with minimum access standards for emergency equipment on campus, and inspect and update as required.

Objective 1G
In conjunction with the buildings and facilities, the planted areas will serve to establish a campus identity, reinforce open spaces, and create a comfortable environment. Campus planting will also establish a structure of continuity for the campus, helping to tie old and new sections, and the many architectural styles, together into a cohesive statement.

Policy 1G-1
From a broad perspective, the regional topography, urban form and vegetation shall serve as points of reference, elements of continuation and, in the case of the Capitol, establish visual landmarks. The elevation changes shall serve as indicators for appropriate plant selection; from flood plain areas to uplands **(See Figure 16.4)**.

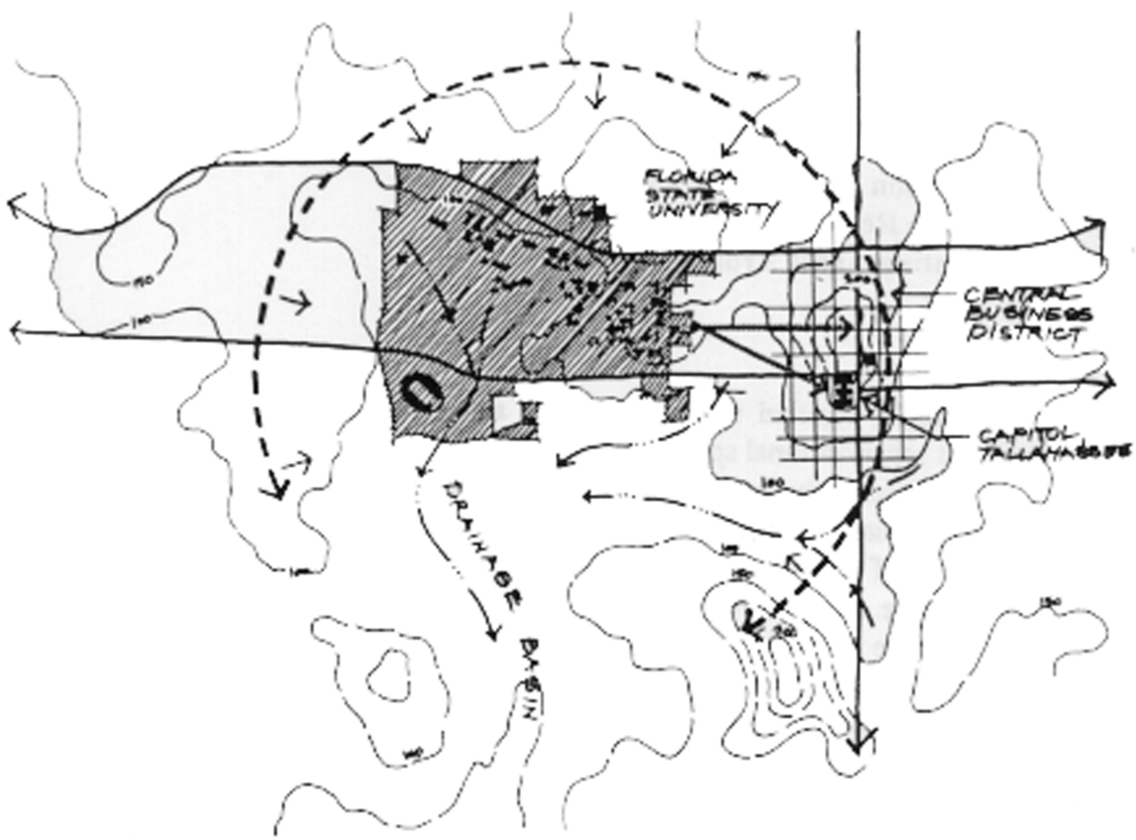
Policy 1G-2
The large "heritage" Live Oak trees, Dogwoods, Redbuds, Magnolias, Pines, Azaleas and Camellias are located in the older part of campus. The dominant plant palette for the City of Tallahassee shall be the overall framework for landscape development.

The continuation of this palette and aesthetic shall be the element that lends visual coherence to all existing and future campus development and which gives the campus a special identity bound to a region.

Policy 1G-3
The large "heritage" Live Oak trees located throughout the Panama City Campus shall be the overall framework for landscape development. These large and majestic oak trees dominate and embrace the outdoor space and give the campus a sense of place, identity, and permanence. Complementing the oaks are simple grassed areas. Accent plantings of

flowering shrubs and trees bring color to the campus in the spring. The continuation of this palette and aesthetic shall be the element that lends visual coherence to existing and future campus development and which gives the Campus its special identity.

Figure 16.4 Regional Landform & Context



Objective 1H
Establish landscape treatments for the various open space typologies, based upon the following categories of campus structure:

- **Campus Quadrangles**
- **Pedestrian Malls**
- **Courtyards**
- **Pedestrian Nodes**
- **University Center or The Commons**
- **Active Recreation Area**
- **Planting Areas Around Buildings**

Policy 1H-1
The quadrangle, typified by Landis Green and other quadrangle spaces, shall form the predominant organizational space for future development. The quadrangle shall replicate in scale and character the qualities found in the historic area. Landscape treatment shall be simple utilizing diagonal walkways respecting desire lines, walkways that parallel and define the boundaries of the quadrangle, simple, open, grass areas and tree massings that reinforce the open space. Plant groupings can be formally or informally spaced, but the overall treatment shall be to reinforce qualities of space and place within the quadrangle. Individual landscape treatment of buildings, as they abut the quadrangle, shall reinforce the totality of the quadrangle and its special sense of place. Features such as fountains, monuments, sculpture, and special site furniture can occur at selected intersections of walkways and expanded pavement areas. Walkways shall be designed to be in scale with the quadrangles and surrounding buildings. Walkways shall also be designed considering hierarchy and volume of traffic (See **Figures 16.5, 16.6, 16.7, 16.8**).

In addition to spatial reinforcement, the placement of landscape treatment shall reinforce significant visual straight lines, points of connections, axial relationships and main entrances. Pedestrian lighting, street furniture and signage shall also complement and reinforce the sense of a unified open quadrangle space.

Figure 16.5 Campus Quadrangle

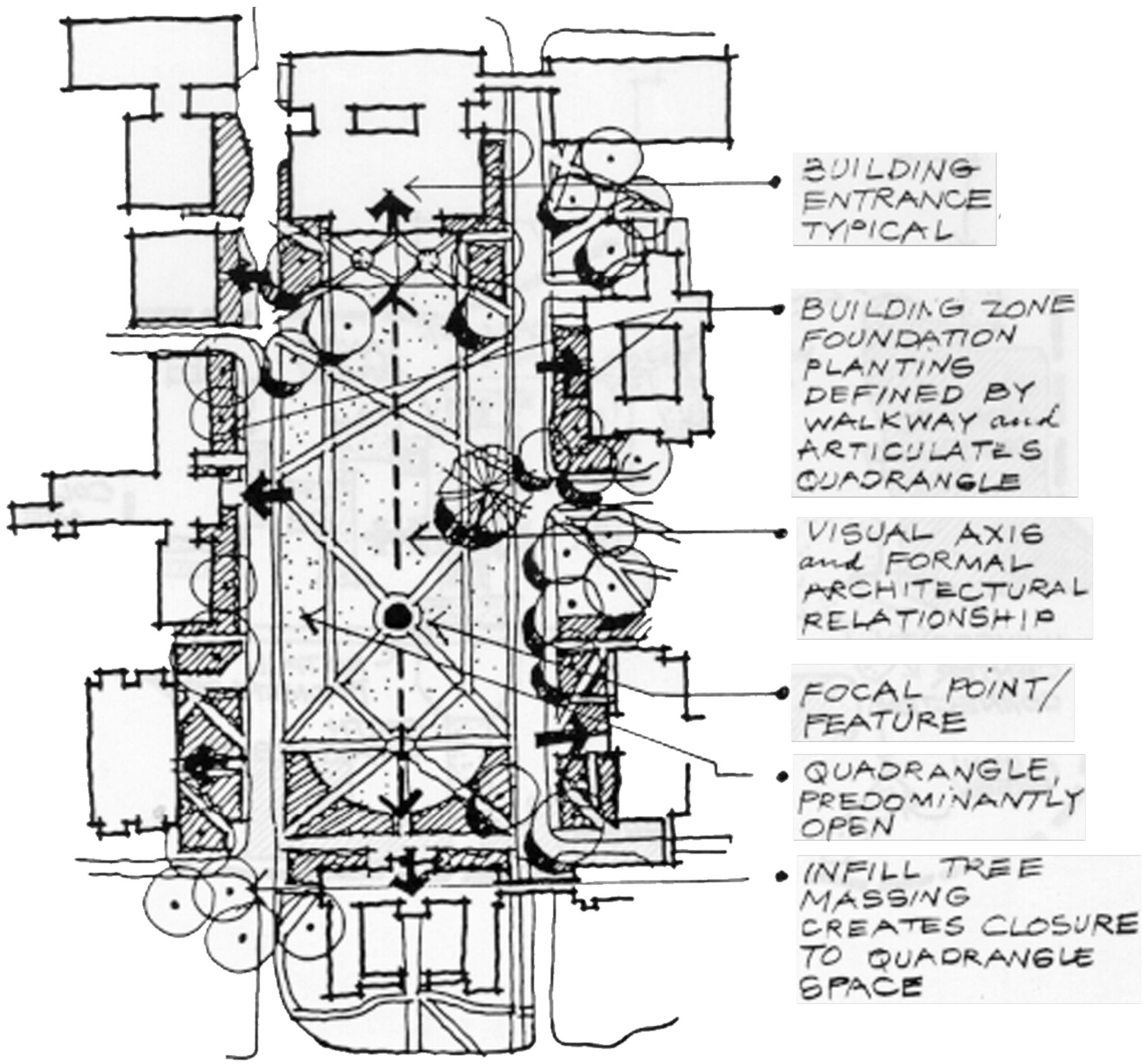
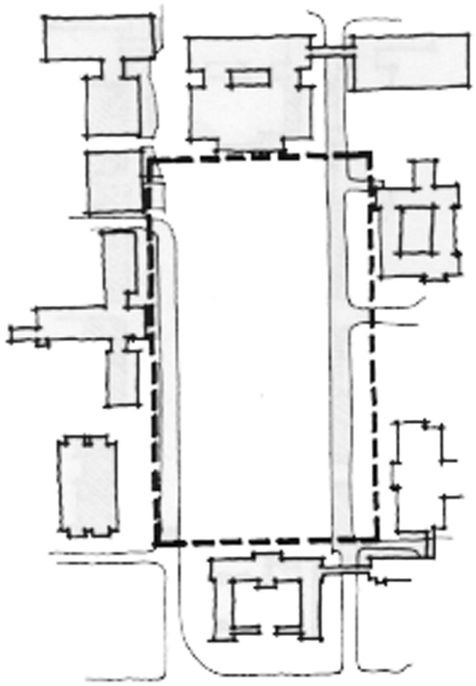


Figure 16.6 Campus Quadrangle (Landis Green)

Building Zone



Building Relationship

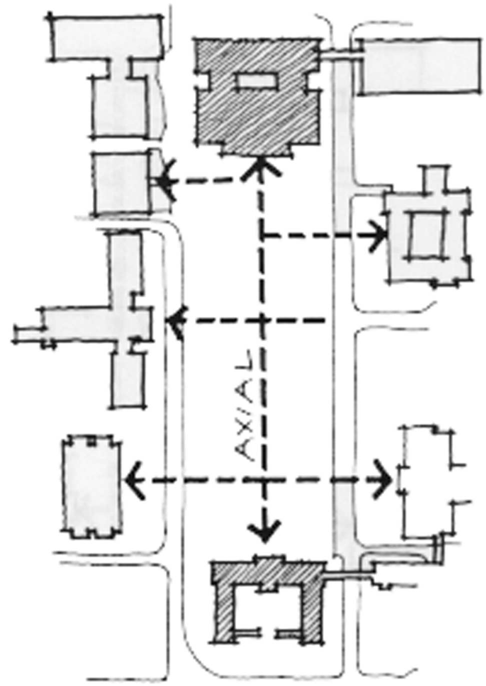
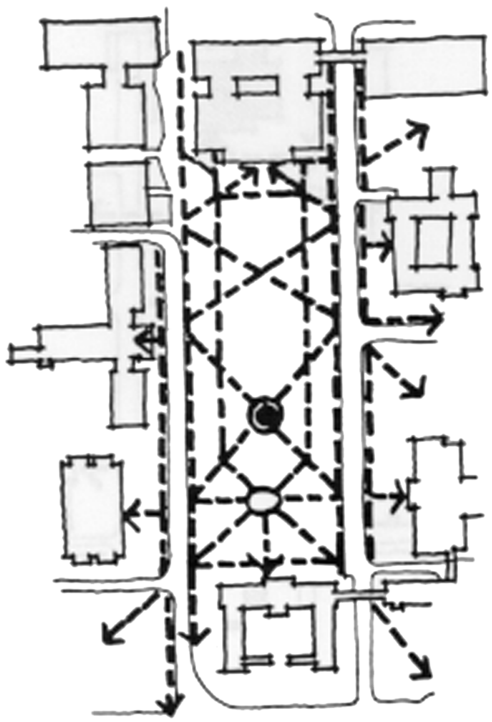


Figure 16.7 Campus Quadrangle (Landis Green)

Diagonal Walkway



Planting Zone (Shrub)

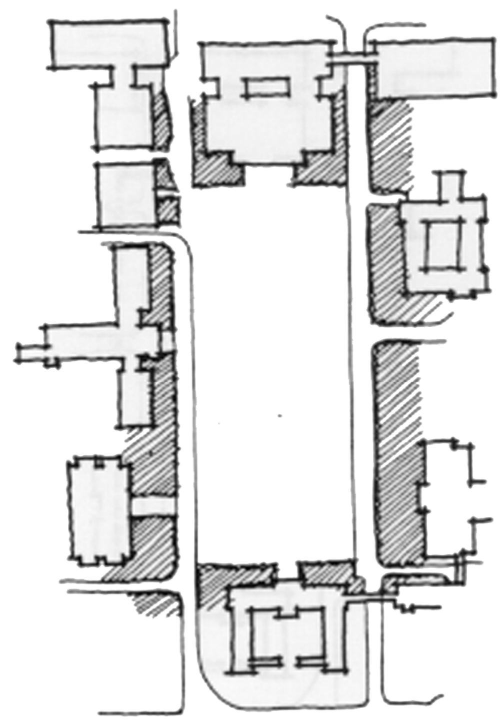
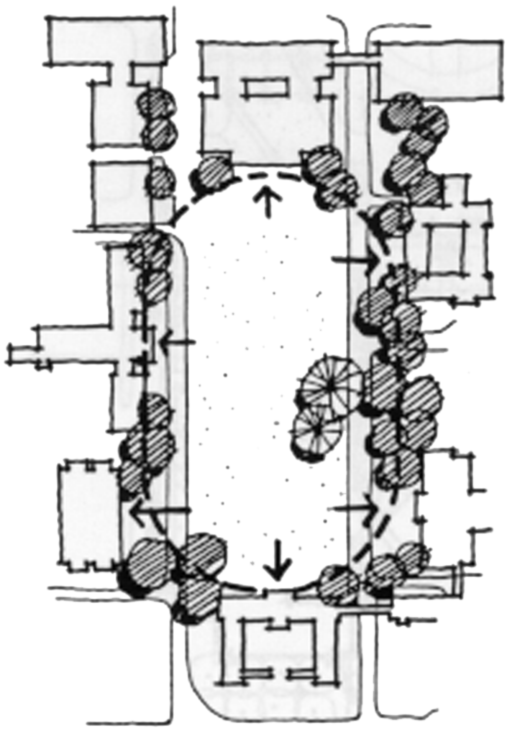


Figure 16.8 Campus Quadrangle (Landis Green)

Spatial Definition

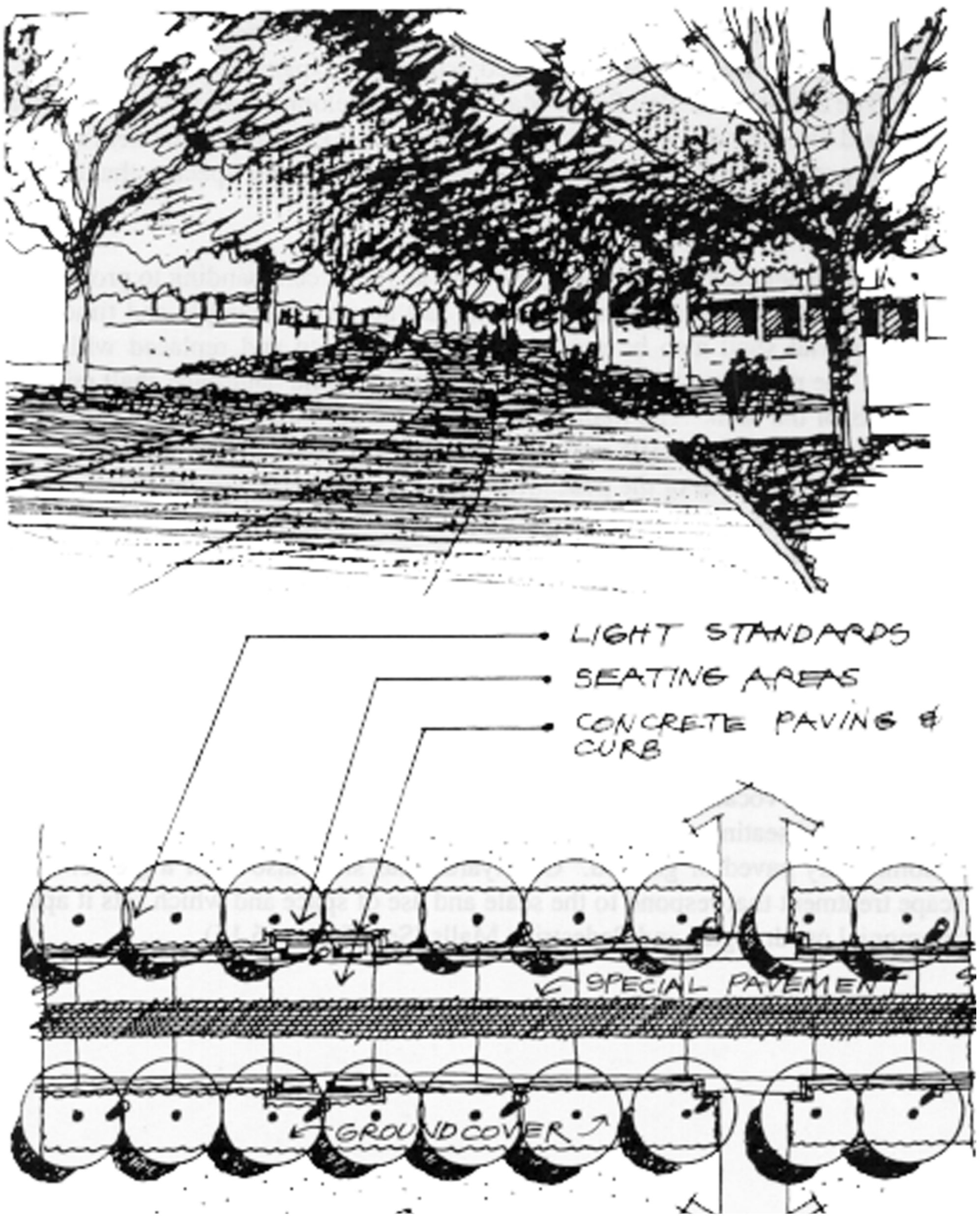


Policy 1H-2
The Call Street Pedestrian Corridor shall remain a significant pedestrian corridor and linear pedestrian street. The corridor is a major armature to which various buildings and colleges connect. Call Street is a broad, pedestrian promenade and collector of traffic. Significant features include large canopy trees forming a shaded esplanade, expansive pavement and a linear alignment. The extension of Call Street Pedestrian Corridor and the development of the pedestrian mall at the Woodward Street closure extend this vocabulary. Landscape treatment shall consist predominantly of regularly spaced, large canopy trees, of a single species, that duplicate in scale and character the existing mall (See **Figure 16.9**).

The corridor shall be detailed with special pavement and/or accent banding to provide interest and pedestrian scale. The materials selected shall be elegant, simple and timeless. The pavement material shall also be capable of being repaired and replaced with ease and consistency. The placement of benches, pedestrian lights and landscape shall reinforce the linear aspects of the mall. The corridor shall allow for a designated bikeway that is separated from pedestrian traffic and designed in a manner that minimizes pedestrian conflict. The pedestrian corridor's main purpose is to act as arteries for traffic. As such, it funnels large numbers of people through the campus. Its design should therefore facilitate strong directional movement.

Policy 1H-3
Courtyards are secondary spaces as adjuncts to a building or a cluster of buildings. Their relationship and use are therefore more functional than ceremonial or as traffic arteries. Landscape treatment in these zones shall offer more flexibility and relate more to individual building design and vocabulary. As use areas, courtyards shall include break-out spaces and informal study and seating areas, offering areas of sun and shade. Courtyard areas can also be predominantly paved or grassed. Courtyard areas shall also offer a greater variety in landscape treatment that respond to the scale and use of space and which sets it apart from the ceremonial quadrangles and Pedestrian Corridors and Malls (See **Figure 16.10**).

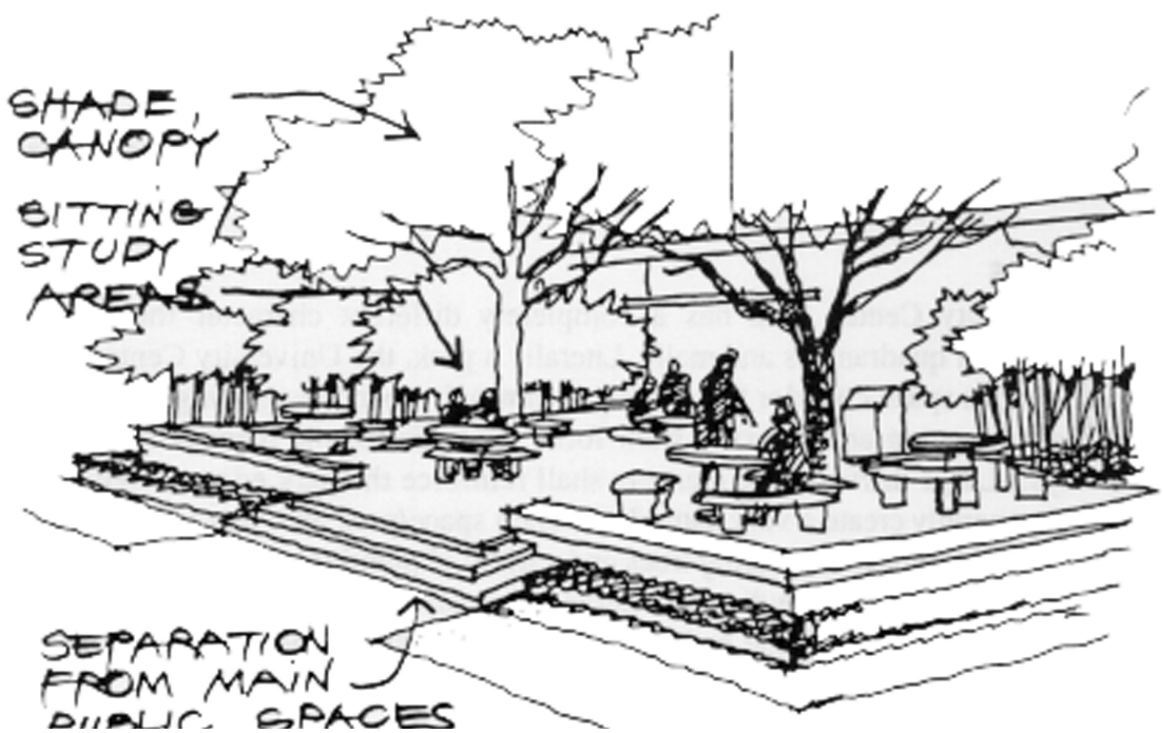
Figure 16.9 Pedestrian Corridor



Policy 1H-4
The University shall maintain a pedestrian node (plaza) that celebrates the intersection of Call Street corridor and Woodward Mall and other major confluences of pedestrian traffic as a special meeting place and point of reference. The pedestrian node functions as an oasis characterized by a dominance of paving and tree canopy. The landscape treatment is to remain more urban in character, with tree pockets, seating and special features, e.g. specimen plant material, fountain, kiosk, etc. Special pavement in the plaza area complements and is consistent with that of the pedestrian corridor.

Policy 1H-5
The "Langford Green" shall remain a highly visible open space mall that diagonally connects the intersection of Lake Bradford Road and Gaines Street with the University Center on alignment with the long central axis of Campbell Stadium.

Figure 16.10 Courtyards



Policy 1H-6
The visual character of Jefferson Street, between Lorene Street and Copeland Street, shall be maintained as mixed-use village area with an urban streetscape character. Special pedestrian pavement and street furniture shall serve to highlight this area as a linear village center.

Policy 1H-7
The sports field facilities shall be located on lower lying areas of the campus within potential flood zones. The planting concept for this area shall consist of large drifts and massing of trees separating major play fields. The planting of trees between areas shall create large, outdoor rooms that serve to break up the large expanse of open space. Landscape shall also serve to buffer and transition the play fields from parking lots and building zones.

Consideration shall be given to the correct placement of trees to prevent maintenance and visual conflict areas for the sports facilities. A major bikeway and pedestrian connection shall be established from the west through the playing fields. The main pedestrian/bikeway connections shall be informally lined with canopy trees for shade, comfort and stronger definition of alignment.

Policy 1H-8
The landscape treatment adjacent to buildings shall be simple with a limited plant palette. Planting beds and foundation planting shall be in large, geometric areas that serve to transition from common open space areas to individual buildings. Massing and size of planted areas shall be in scale with the building and complement or reinforce the overriding landscape of the common, open space areas and campus landscape character. The landscape treatment shall consider reinforcement of main entrances, side and back yards. Placement of trees shall reinforce the architectural elevation. Priority shall be given to issues of safety and, therefore, heights of shrubs and small trees shall be limited to ensure adequate sight availability. Grade or elevation differences shall transition smoothly rather than abruptly and treated with appropriate groundcover or other stabilizing treatments. Consideration shall also be given for seasonal display and spring flowering trees and shrubs. Service areas shall be adequately screened from general view with the use of hedges, buffer planting and/or architectural walls.

Paved pedestrian entrance areas shall be simple and relate to overall pavement of open space circulation. Heavily articulated and patterned pavement is discouraged unless consistent with pedestrian corridors or major campus circulation treatment.

Objective 1-I
Establish criteria for the selection of plant materials for use on campus, and consider the following:

- **The Established Plant Palette in Historic Zone**
- **Functional and Aesthetic Requirements**
- **Preservation of Existing Trees**
- **Xeriscape (Drought Tolerant and Native Material)**
- **Maintenance**
- **Security and Safety**

Policy 1I-1
The plant palette for the campus shall consist of Live Oaks trees, Dogwoods, Redbuds, Pines, Magnolias, Azaleas and Camellias as found on the older part of campus. There shall be a dominance of Live Oak trees that provide canopy, dappled shade and overall structure to the landscape. Accent plantings shall focus on evergreen and deciduous flowering trees and shrubs that give distinction in spring, for which the area is noted. Palm trees and other exotic plants shall be reserved for special limited plantings. The overall intent is to achieve coherence and consistency with the use of a limited palette. In so doing, the overall campus shall appear to be not only unified, but also set in a landscape that is part of a region and which appears to be indigenous. The campus landscape shall be a unified landscape versus a collection of individual building zone landscapes which have no relation to adjacent landscapes or larger, overall contextual landscape treatment (e.g. spatial definition, extension for overall canopy, extension of formal alignments, view corridors, etc.).

Policy 1I-2
Functional and aesthetic requirements shall consider scale, hierarchy, context, adjacencies, spatial definition, screening, buffering, shade, view corridors, and seasonal color. Landscape and plant material shall serve to complement the building and articulate main entry points and provide transitional zones between building area and larger, common open spaces and circulation areas. Plants shall also serve to buffer or screen areas such as service areas, trash dumpsters, bicycle racks and service areas. Plants shall also serve to reinforce larger

landscape systems such as campus quadrangles, pedestrian malls and streetscape.

Policy 1I-3
The University shall maintain and update the existing tree survey for the campus with regard to size, condition and value.

Policy 1I-4
The selection of plant material shall consider the use of plant species that are indigenous to the native plant communities of the region and which promote the use of xeriscape principles whenever possible and appropriate. Reference shall be made to local sources that identify drought tolerant and native plant material. Plant material selection shall also consider location and amount of sun or shade and other factors. For instance, planting on uplands and drier sites will require different plants than on flood plains. Consideration shall also be given for different soil and water requirements. A significant aspect of xeriscape is water conservation. Provisions listed below will reduce water requirements:

- the preservation of existing plant communities.

- the re-establishment of native plant communities.

- the use of site-specific plant materials (selection of plant materials well suited to withstand the physical growing conditions that are normal for that location).

- the use of shade trees to reduce transpiration rates of lower story materials.

Policy 1I-5
Long-term maintenance requirements shall be a consideration for plant selection. Longevity and permanence (e.g. Oak Trees) shall also be a significant factor. Plants that grow quickly, thereby requiring more maintenance, pruning, etc., shall be discouraged. Additionally, plants shall be designed and located in a manner that is conducive to easier maintenance. For instance, a landscape zone that has a multitude of species will require greater maintenance than a simpler mass planting of a single material with an occasional accent plant.

Policy 1I-6

Personal security and safety is a significant factor in selecting plant material and specifying their location. Generally, there should be a clear zone (visual zone) between approximate knee height and sight line (or underside of canopy of tree) for all plantings to allow unobstructed views.

Objective 1J

To establish a plant list and matrix to identify plants suitable for use on the campus, that incorporate characteristics of low maintenance, low water use, long life, and are native or indigenous to the region.

Policy 1J-1

To the degree possible, landscape plans shall include the use of plant species (trees, shrubs and grasses) that are indigenous to the natural plant communities of the North Florida region. In cases where non-invasive exotic plant species may be used to enhance the landscape, plantings should be limited to those non-invasive species that are able to withstand long periods of drought and which require little fertilization and the use of pesticides.

Policy 1J-2

Plants contained in the following list shall be used for the selection of plant materials on campus. It is divided by plant category.

PLANT PALETTE

CANOPY TREES

Botanical name	**Common Name**
Quercus virginiana	Live Oak
Quercus laurifolia	Laurel Oak
Quercus shumardii	Shumard Oak
Acer rubrum	Red Maple
Liquidambar styraciflua	Sweetgum Tree
Platanus occidentalis	Sycamore Tree
Taxodium distichum	Bald Cypress
Pinus elliottii	Slash Pine
Gordonia lasianthus	Loblolly Bay Tree

Juniperus silicicola	Southern Red Cedar
Magnolia virginiana	Sweet Bay Tree
Persea borbonia	Florida Red Bay
Nyssa sylvatica	Black Gum Tree
Prunus caroliniana	Cherry Laurel Tree
Liriodendron tulipifera	Tulip Poplar Tree

ACCENT/FLOWER TREES

Botanical name	**Common Name**
Cupressocyparis leylandii	Leyland Cypress
Magnolia grandiflora	Southern Magnolia
Pyrus calleryana 'Bradford'	Bradford Pear
Ilex cassine	Dahoon Holly
Salix babylonica	Weeping Willow
Ilex attenuata 'East Palatka'	East Palatka Holly
Ilex attenuata 'Savannah'	Savannah Holly
Ligustrum japonicum	Glossy Privet
Betula nigra	River Birch
Koelreuteria elegans	Golden Rain Tree
Eriobotrya japonica	Loquat Tree
Cornus florida	Flowering Dogwood
Prunus augustifolia	Chickasaw Plum
Myrica cerifera	Wax Myrtle
Lagerstroemia indica	Crape Myrtle

SHRUBS

Botanical name	**Common Name**
Abelia x grandiflora	Glossy Privet
Camellia japonica	Camellia
Elaeagnus pungens	Silverthorn
Foresteria segregata "Pinetorium"	Pinetorium
Galphimia gracilis	Thryallis
Ilex cornuta 'Burfordii'	Burford Holly
Ilex vomitoria 'Yaupon'	Yaupon Holly

Ilex vomitoria 'Schellings Dwarf'	Schellings Dwarf Holly
Illicium asisaticum	Chinese Anise
Illicium floridanum	Purple Anise
Jasminium mesnyi	Primrose Jasmine
Jasminium nitidum	Shining Jasmine
Juniperus chinensis	Blue Vase Juniper
Juniperus chinensis 'Parsonii'	Parson's Juniper
Juniperus chinensis 'Pfitzerana'	Pfitzer Juniper
Juniperus conferta 'Blue Pacific'	Blue Pacific Juniper
Ligustrum japonicum	Japanese Privet
Ligustrum lucidum	Glossy Privet
Myrica cerifera	Wax Myrtle
Osmanthus fortunei	Fortune Tea Olive
Photinia x fraseri	Red Tip Photinia
Pittosporum tobira	Japanese Pittosporum
Pittosporum tobira 'Variegata'	Variegated Pittosporum
Pittosporum tobira 'Laura Lee'	Dwarf Variegated Pittosporum
Podocarpus macrophyllus	Yew Podocarpus

Botanical name	**Common Name**
Podocarpus nagi	Nagi Podocarpus
Pyracantha coccinea	Firethorn
Raphiolepis indica "Alba"	White Indian Hawthorn
Raphiolepis indica	Indian Hawthorn
Rhododendron Hybrids	Azaleas
Viburnum odoratissimum	Sweet Viburnum
Viburnum suspensum	Sandankwa Viburnum
Rosa hybrids	Rose

GROUNDCOVERS

Botanical name	**Common Name**
Annuals	Annuals
Cuphea hyssopifolia	Heather
Dietes vegeta	White African Iris

Gallardia grandiflora	Blanket Flower
Gardenia jasminoides	Radicans Dwarf
Hedera helix	English Ivy
Hemerocallis Hybrids	Hybrid Daylily
Juniperus horizontalis 'Prince of Wales'	Prince of Wales Juniper
Lantana camara - hybrid	Golden Lantana
Lantana montevidensis	Trailing Lantana
Liriope muscari 'Evergreen Giant'	Evergreen Giant Lilyturf
Liriope muscari	Lilyturf
Nephrolepis exalta	Boston Fern
Trachelospermum jasminoides	Minima Jasmine
Zamia floridana	Coontie

VINES

Botanical name	**Common Name**
Ficus pumila	Creeping Fig
Gelsemium sempervirens	Carolina Jasmine
Lonicera sempervirens	Coral Honeysuckle
Trachelospermum jasminoides	Confederate Jasmine

ACCENT PLANTS

Botanical name	**Common Name**
Nandina domestica	Heavenly Bamboo
Pennisetum setaceum 'Cupreum'	Red Fountain Grass
Tripsacum dactyloides	Fakahatchee Grass

WETLAND PLANTS

Botanical name	**Common Name**
Canna flaccida	Yellow Canna
Crinum americanum	String Lily
Juncus effusus	Soft Rush
Iris hexagona savan	Blue Fig Iris
Nymphaea odorata	Fragrant Water Lily
Pontederia cordata	Pickerel Weed

Sagittaria lancifolia	Arrowhead
Scirpus vaiidus	Bulrush
Spartina bakeri	Cordgrass
Thalia geniculata	Fire Flag

Policy 1J-3
It is the intent of the University to remove all non-native invasive plants (whether tree, shrubs or grasses) which are identified in the Exotic Pest Plant Council's "Florida's Most Invasive Species List" from the campus grounds. As these species are located on campus, FSU shall coordinate with the Florida Department of Environmental Protection (FDEP) and other appropriate governmental entities to ensure the proper removal and disposal of these exotic species.

Objective 1K
To establish standards for the selection of exterior furnishings, lighting, and graphics for use on campus.

Policy 1K-1
The selection of site furniture for the campus shall be from a coordinated family of furniture and shall remain consistent for the entire campus, regardless of adjacent architectural style. Street and site furniture style shall relate to campus image and identity as a whole, and shall not relate solely to an individual building or campus development project.

Policy 1K-2
Selection of site furnishings shall consider durability, ease of maintenance, and harmony with existing materials, styles, and colors chosen as an overall campus concept. Site furniture shall ultimately give a uniform appearance throughout campus and variations allowed only under extenuating circumstances. Colors, materials, and finishes shall be understated and classic. They shall be able to be easily refinished or resurfaced to match existing site furniture. An appropriate type of bench, trash receptacle, light fixture, etc., shall be chosen and existing outdated furnishings shall be replaced as needed, due to deterioration or vandalism, with the new style of furnishing.

Policy 1K-3
Benches shall be chosen that are of proper scale, size, and durable material to withstand the heavy use on campus. Older and less durable or deteriorated benches shall be removed and replaced with the selected new style as necessary. Benches with backs shall be used in selected areas, such as in front of the Library on Landis Green, as they are more comfortable for long periods; benches without backs, as used, shall be of similar style and the same material and color as benches with backs for visual uniformity and cohesiveness throughout campus.

Policy 1K-4
Trash receptacles: Trash receptacles shall be of sufficient size, type, and durability, and shall accommodate recycling programs in place or under consideration for the campus. Aesthetic considerations shall be addressed when specifying color, number, and placement of trash and recycling bins on campus. Permanent placement of trash receptacles shall occur on a level concrete pad adjacent to but aligned with the regular walkways, and sufficiently screened, by placing within planting areas and kept outside of long open sightlines. Haphazard or casual placement of trash receptacles shall not be allowed.

Policy 1K-5
Bollards used on campus for restricting vehicles from walkways shall be made of a durable material, either concrete or steel, and be of sufficient size and scale to be easily seen and to deter intrusion. They shall also be of a single style throughout the campus for uniformity and visual cohesion. Bollards shall not be of a size, or affixed, that they greatly impede removal for emergency vehicle access.

Bollards used to restrict vehicle, pedestrian, and/or bicycle traffic from planted areas shall be of a single style and material throughout campus for visual cohesion. They shall also be of sufficient size to restrict intrusion, and also of a scale befitting a campus. Bollards that are residential in scale, of a material that deteriorates quickly, does not hold up to light abuse, or is difficult to maintain a uniform appearance (e.g., the small wood post and chain system, shall not be used.

Bollards are also used as walkway and exterior stair lighting in some areas of campus, in several different styles, and have been installed with separate building projects. Bollard lights shall not be used as alternatives to overhead pole mounted lighting for walkway or stair lighting.

Policy 1K-6
Exterior stairs shall be constructed of concrete and be uniform in appearance throughout the campus. Accommodation shall be made to disabled persons on campus through the use of ramping and less severe changes in grade, which shall reduce the necessity of stairs within walkways. Stair handrails shall be of a consistent and durable material, preferably painted metal, in order to reduce the deterioration and maintenance involved with wood railings and the visual inconsistency of different sizes, styles, and colors.

Policy 1K-7
Walls used in the landscape, for retaining earth, or for visual screening shall be constructed of a durable material, such as concrete, and be uniform in appearance and characteristics throughout the campus. Walls shall not be constructed of railroad ties or other materials that deteriorate or need continual maintenance. Finishes or construction materials such as brick, stucco, or patterned concrete shall conform to adjacent building finishes and colors.

Policy 1K-8
Decorative fencing or fencing used as a perimeter to drainage areas or screening shall be of a durable style and material to reduce maintenance needs and deterioration. Style color and material shall be consistent through campus.

Security fencing shall be of chain link type, preferably vinyl coated in a dark color, preferably black, to lessen the visual impact. Height of fencing shall be determined by amount of security necessary.

Policy 1K-9
Service areas and trash dumpsters shall be well screened from pedestrian and vehicular corridors with planting, solid fencing, or masonry walls. Construction of trash enclosures shall conform to above Policies for Walls or Fencing, as required. Trash dumpsters shall be placed within an enclosure, and they shall not be placed in full view of walkways or along streets, or in parking lots.

Policy 1K-10
The University shall continue to implement the way finding and signage system adopted in 2000. The University shall maintain the results of the study. The graphics and signage study considered all aspects of signage on campus, from major entry signs, off-site directional signs, way finding, parking lot, building identification, and campus map directory signage. Graphics font, logo types, colors, etc. shall be coordinated with overall University graphics (i.e. letterhead, vehicle door signage, etc.). Graphics and signage shall be utilized to assist in the overall comprehension of the campus and layout and to facilitate easier direction finding. Signage shall be uniform in appearance, mapping, and coordination throughout campus. Individual building identification shall be consistent in type of signage and placement. Campus maps shall be installed at key visitor parking and entry points, and within campus at key pedestrian nodes and pedestrian traffic corridor intersections. Signs shall be of adequate size and contrast and be well illuminated at night. Shrubs or other foliage shall not obstruct visibility or lighting of signs.

Policy 1K-11
Light fixtures for exterior use on campus shall be selected so as to be compatible within a family of site furnishings, including benches, trash receptacles, etc. Colors, materials, and finishes shall coincide to allow a uniform appearance throughout the campus. Lighting element choice (e.g. High Pressure Sodium, Metal Halide, etc.) shall be used consistently throughout the campus, and consideration shall be given to the best properties of site lighting and minimal glare. High wattage lights that create hot spots and glare and impart heavy shadows around buildings and under trees shall not be used. Light fixtures shall be durable, low maintenance, and painted or anodized metal for longevity and easy repair. Older, high maintenance light fixtures shall be replaced as needed with the new type.

Policy 1K-12
The "Blue Light" Emergency phone system shall be maintained and extended throughout the campus. Consideration shall be given to proper placement at key points with adequate lighting and good visibility. The Blue Light system is a high priority item for the campus and shall be improved and upgraded as necessary.

Objective 1L
To establish standards for the design and implementation of landscape treatment of the campus edge, and to maintain continuity with adjacent related off-campus roadway and other context landscape treatment.

Policy 1L-1
The landscape treatment of the major traffic arteries that border the campus shall form the basis for the campus edge and establish overall imagery. Within this context, landscape treatment shall vary depending on abutting uses on the campus edge.

Consideration shall be given to view corridors and sightline buffering as needed. Certain areas or windows shall allow visual penetration into the campus and, at times, focusing or featuring significant architectural elements, landmarks or significant open space. In other cases, landscape buffer planting may be required to screen views from within or without the campus edge.

At vehicular entrances to the campus, the landscape edge shall open up or reinforce view penetration into campus. Boundary monuments, gateways, signs and other architectural features shall be used to reinforce the campus edge.

Objective 1M
To establish standards for landscape treatment of retention ponds, drainage corridors, and related elements.

Policy 1M-1
Retention ponds shall conform to the requirements of the Department of Environmental Protection regarding side slopes and wetland mitigation areas. The configuration of retention lakes shall be natural in outline and the grade transitions for the side slopes shall be smooth and continuous to appear as natural as possible. Gentle landforms around the pond shall reinforce the "natural" context. Trees and other plantings used shall be compatible with high water table and wet areas, and also conform to local native plant communities' guidelines, Plant List guidelines in this document, and Pest Plant restriction ordinances.

Objective 1N
To establish policy for efficient and proper timing and phasing of landscape improvements, as they relate to the construction process.

Policy 1N-1
The timing or phasing of landscape improvements shall follow the general sequence of construction as it relates to new construction. Landscape improvements shall occur following the completion of exterior building finishes and after installation of all utilities and hardscape elements. Where scheduling permits, the installation of plant material shall occur during the winter and spring periods. Installation during the summer months is less desirable, and shall be discouraged, as hot weather increases the attrition rate of plant material.

Objective 10
To establish adequate funding for landscape improvements as stand-alone projects or in conjunction with new building construction.

Policy 10-1
Maintain the campus existing tree inventory.

Policy 10-2
The tree maintenance program shall be continued in order to maintain the excellent health of the tree inventory on campus.

Policy 10-3
A plan shall be developed for the entire campus in order to establish a cohesive and comfortable landscape and open space system. The plan shall make an inventory of all campus areas; prioritize areas in need of renovation, replacement, and/or upgrading of plant materials, paving, trash receptacles, benches, etc. This study shall also determine the areas on campus in need of landscape improvement.

Policy 10-4
Landscape budgets shall be established and maintained as an integral portion of new construction and renovation projects.

Policy 10-5
Landscape improvement projects may be accomplished as stand-alone capital projects.

Objective 1P
To establish procedures for the review of all preliminary and final designs and drawings pertaining to campus landscape and site development to ensure adherence to the adopted Campus Master Plan.

Policy 1P-1
The Facilities Department shall review any and all site development, including building placement or removal; tree, plant material and groundcovers installation or removal; and site furniture and amenity installation, which includes lighting, benches, paving, trash and recycle receptacles, graphics and signage, bike racks, and landscape walls, which shall deviate from the standards established within these Policies.

Policy 1P-2
The Facilities Department shall oversee coordination of landscape, site furnishings, and exterior graphics construction and installation in accordance with the guidelines contained in this document.

Policy 1P-3
University Capital Improvement Projects that include site improvements and amenities (plant material and trees, grading, lighting, walkways, site furniture, etc.), and stand-alone campus landscape development projects (e.g., Plazas, Pedestrian Malls, etc.), shall have preliminary drawings and designs reviewed by all University Departments that will have involvement with the project during construction or after completion (e.g., Maintenance, Service, Grounds, Health and Safety, etc.) to enable said Departments to comment on impacts to their efficient and responsible duties of maintaining and servicing the completed project.

Objective 1Q

To establish priorities for the funding of accessibility improvements for persons with disabilities.

Policy 1Q-1
Accessibility for persons with disabilities in exterior (non-building) areas of campus shall be incrementally improved on an as-needed basis, and funding shall be made available.

Policy 1Q-2
The President's Committee for Persons With Disabilities shall oversee the prioritizing of problem areas and the implementation for rectifying those areas on campus found to be barriers to disabled persons.

Policy 1Q-3
The President's Committee for Persons With Disabilities shall review all comments, recommendations, and suggestions by faculty, staff, and students pertaining to areas on campus, but outside of buildings, that are deemed to be barriers to the safe and secure movement of physically disabled persons.