General Comments

THESE FACILITY DESIGN CONSIDERATIONS ARE A STARTING POINT FOR THE BASIS OF DESIGN, AND INCLUDE THE CAMPUS STANDARDS AND PREFERENCES ORGANIZED BY MASTERFORMAT™ 2004 EDITION. THE ARCHITECT AND ENGINEERS ARE ENCOURAGED TO IMPROVE UPON THESE GOOD PRACTICE STANDARDS, AND SUGGEST UPDATES TO CAMPUS. UPDATES SHOULD BE PROVIDED TO THE ASSIGNED PROJECT MANAGER, AND ALSO FORWARDED TO JOEL NEEL AT FACILITIES PLANNING AND CAPITAL PROJECTS (EMAIL: JNEEL@CALPOLY.EDU).

"CAMPUS STANDARDS" ARE NOTED WHEN A SOLE SOURCE IS REQUIRED TO MATCH AN EXISTING SYSTEM ON CAMPUS (KEYING, ENERGY MANAGEMENT CONTROLS, ETC.). THE FOLLOWING WORDS SHALL BE INCLUDED IN THE SPECIFICATIONS: "NO SUBSTITUTIONS ALLOWED," OR "SUBSTITUTIONS: NOT ALLOWED." THE SOLE SOURCE MAY INCLUDE A MANUFACTURER, OR A MANUFACTURER AND A SPECIFIC MODEL NUMBER.

"CAMPUS PREFERENCES" ARE NOTED WHEN CERTAIN ITEMS HAVE MET WITH SUCCESS ON CAMPUS. IN THE SPECIFICATIONS, THESE ITEMS SHOULD BE LISTED FIRST UNDER "PRODUCTS." THE CAMPUS WILL ATTEMPT TO LIST THE REQUIRED OR DESIRED FEATURES THAT MAKE THESE ITEMS A PREFERENCE. PER PUBLIC CONTRACT CODE SECTION 3400, THE DESIGNATED MATERIAL, PRODUCT, THING, OR SERVICE BY SPECIFIC BRAND OR TRADE NAME MUST BE FOLLOWED BY THE WORDS "OR EQUAL" SO THAT BIDDERS MAY FURNISH AN EQUAL MATERIAL, PRODUCT, THING, OR SERVICE. CAMPUS PREFERS THAT YOU USE THE WORDS "OR APPROVED EQUAL" SO THAT THE BIDDERS KNOW THAT THEY MUST REQUEST APPROVAL FOR THEIR PROPOSED SUBSTITUTION.

IN SOME CASES, THE CAMPUS DOES NOT KNOW OF ANOTHER "EQUAL" ITEM. THE CONSULTANT SHOULD MAKE EVERY EFFORT TO LOCATE "EQUALS" AND PROVIDE THEM IN THE SPECIFICATIONS. IF NO EQUALS ARE FOUND, THE SPECIFICATIONS SHOULD STATE "NO KNOW EQUALS" WHILE STILL ALLOWING FOR THE BIDDERS TO SUBMIT THEIR PROPOSED SUBSTITUTION.

"NOT RECOMMENDED" ARE NOTED WHEN CERTAIN ITEMS HAVE FAILED TO MEET CAMPUS NEEDS – REQUIRE HIGH OR FREQUENT MAINTENANCE, HAVE A SHORT LIFE, ARE NOT COMPATIBLE WITH CAMPUS SYSTEMS, ETC. THE CAMPUS WILL ATTEMPT TO LIST THE REASONS THESE ITEMS ARE NOT RECOMMENDED.

Architectural Considerations

GOALS – NO COMMENTS

FACILITY LAYOUT

Custodial Rooms and Grounds Maintenance Rooms:

Size: Rooms need to be adequately sized for equipment and supplies.

Custodial Stations: 10 feet by 12 feet, minimum.

Custodial Stations (buildings 90,000 square feet and larger): 200 square feet, minimum for one station. *Purpose: To accommodate a riding or walk behind floor scrubber, a carpet extractor, wet dry vacuum, upright vacuum, a high speed buffer, a low speed buffer, a custodial cleaning cart and rolling trash can.*

Grounds Maintenance: Provide a ventilated space for gas-powered equipment such as gas blowers, propane buffers, etc.

Walls surrounding Mop Sinks: Protect using FRP from floor to 5 feet high on wall. *Purpose: To protect wall from water damage from mop sink and wet hanging mops*.

Room Numbers:

General: Wayfinding for students, faculty, staff and visitors is of utmost importance for Campus. Once the room layouts have been determined, and no changes are anticipated, a proposed room numbering scheme may be developed.

Scheme Approval: Proposed room numbering schemes shall be reviewed and approved by the Trustees Representative or Project Manager, and the Campus CAD/Archive Coordinator (Rex Wolf, Facility Services).

Numbering Convention:

Numbers by Floor Level: Rooms on the lowest floor level, or ground level shall be in the 100's, the second level in the 200's, the third level in the 300's, etc.

Corridors: Use "100" for the ground level, "200" for the second level, "300" for the third level, etc.

Rooms Off of Corridor: In an office wing, or with rooms evenly spaced on both sides of the corridor (similarly in a hotel); consider placing the odd numbers on one side and the even numbers on the other side. Where the rooms are not evenly spaced, or the corridor is more of a gathering space, consider numbering the rooms sequentially down the corridor and clockwise from the main entrance.

Auxiliary Rooms: Any room opening off of another room without direct access to the corridor, such as office suite, or support and storage room opening from another room, add the letters A, B, C after the main room number. For instance, Room 204 with two auxiliary rooms, a tech support room and a storage room. Number clockwise from main room entrance (off corridor). For example, the tech support room is on the left and the storage room straight ahead, become Room 204A and 204B, respectively.

EQUIPMENT ARRANGEMENT – NO COMMENTS

Electrical Systems Considerations

GOALS – NO COMMENTS

FACILITY LAYOUT

Restroom Lighting:

Do not install light fixture over toilets and sinks. Campus prefers light fixtures be installed in center of room, outside of stalls. *Reason: Safety issue for workers replacing light tubes as ladders cannot be properly opened up over toilets and sinks.*

EQUIPMENT ARRANGEMENT – NO COMMENTS

Mechanical Systems Considerations

GOALS – NO COMMENTS

Plumbing Systems Considerations

GOALS

CSU Requirements: Conserve water resources, including installing controls to optimize irrigation water, reduce water usage in restrooms and showers, and promote use of reclaimed water. The use of decorative fountains should be minimized.

FIXTURES AND ACCESSORIES

Custodial Rooms:

Back Flow Valves: Install in each custodial station sink. *Purpose: To prevent backflow from drum or wall mounted Proportioning and Dispensing Systems used to automatically mix liquid cleaning and sanitizing concentrates with water and dispense diluted solutions into auto scrubber, mop buckets, etc.*

Telecommunication Systems Considerations

GOALS

CSU Requirements: Compliance with CSU Telecommunications Infrastructure Planning (TIP) Standards.

Division 02 – EXISTING CONDITIONS

Division 03 – CONCRETE

Division 04 – MASONRY

Division 05 – METALS

05 40 00 COLD-FORMED METAL FRAMING

05 41 00 Structural Metal Stud Framing

Backing in Walls:

- Campus Standard: Provide backing in areas where equipment will be installed on walls. [Review and confirm locations with Project Manager.]
- Campus Preference: Provide backing in additional areas where equipment may be installed on walls in the future. Provide minimum 20 gage steel studs at 16 inches on center.

Division 06 – WOOD, PLASTICS, AND COMPOSITES

06 10 00 ROUGH CARPENTRY

Backing in Walls:

- Campus Standard: Provide backing in areas where equipment will be installed on walls. [Review and confirm locations with Project Manager.]
- Campus Preference: Provide backing in additional areas where equipment may be installed on walls in the future. Provide minimum 20 gage steel studs at 16 inches on center.

06 40 00 ARCHITECTURAL WOODWORK

06 41 00 Architectural Wood Casework

Locks for Drawers and Doors:

- Campus Standards: Provide 2 keys per room of differently keyed drawers and doors where non-State keys are used.

06 60 00 PLASTIC FABRICATIONS

06 61 16 Solid Surfacing Fabrications

Lavatory Countertops:

- Campus Standards:
  - Solid polymer components (with performance characteristics similar to Corian®).
  - LEED™: Credit EQ 4.1 – VOC content and Material Safety Data Sheets (MSDS); and Credit MR 5.1 – Regionally manufactured and within 500 miles of project site.
  - Fire response characteristics: Class A per UL 723 (ASTM E84); Flame Spread Index of 25 or less, and Smoke Development Index of 450 or less.
  - Warranty: 10 years, minimum.
- Campus Preference:
  - Provide surface such as Corian® surfaces from the DuPont company.

Division 07 – THERMAL AND MOISTURE PROTECTION

07 60 00 FLASHING AND SHEET METAL

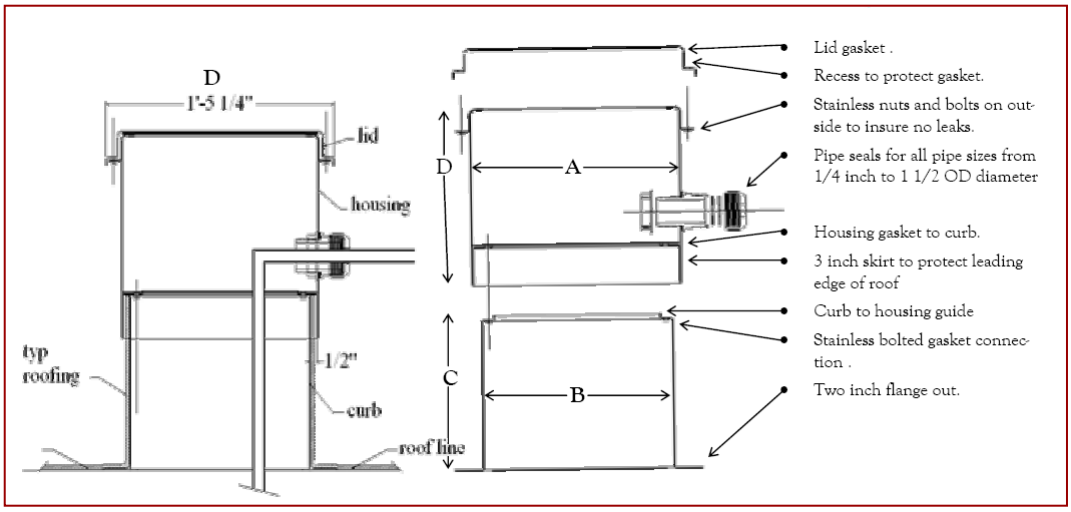
07 63 00 Sheet Metal Roofing Specialties

Campus Preference: For roof penetrations of service utilities.

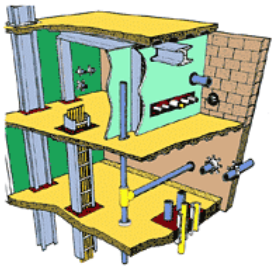
Manufacturer: LSC Corp., POB 6308, Phoenix, AZ 85005. Phone: 877-301-8592; Fax: 602-278-6397; Email: dougmh@msn.com

Pipe Chase Housing – Removable lid with gasket. Pipe seals for pipes from ¼-inch to 1½ -inches outside diameter. Housing with gasket to curb. 3-inch skirt protects leading edge of roof. Constructed of welded power coated aluminum and stainless steel bolted connections. 2-inch flange out onto roof. Tower extension allows for space to mount disconnects and control boxes. Some models are equipped with hose bibb and knock-outs for GFCI.

The Tower extends the housing providing space to mount disconnects and control boxes.



07 80 00 FIRE AND SMOKE PROTECTION



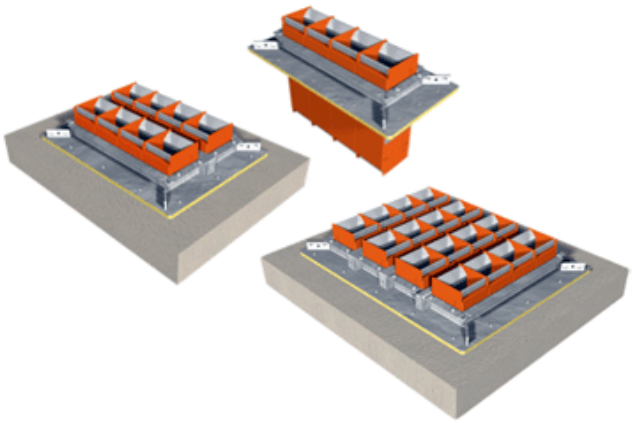
07 84 00 Firestopping

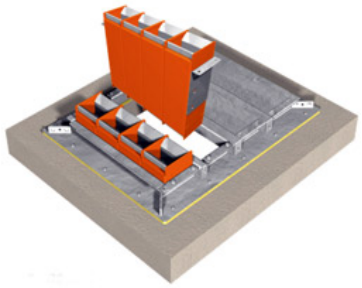
Campus Preference: For wall and floor penetrations of cabling for telecommunications, fire alarm and security.

Manufacturer: Specified Technologies Inc.
Model Series: EZ Path Fire Rated Pathways.
Website: http://sti.fmpdata.net/ftp/Estimation_Installation/ZIS1029_Grid_Install_Sheet.pdf

Wall – Model: **EZDP433GK-C** with four colored pathways to be organized as follows: ORANGE = Fire Alarm, BLUE = Communications-Horizontal Cabling, YELLOW = Security and Door Access, and WHITE = Communications-Backbone Cabling (between telecom rooms).

Floor – Model: **Series 44** Modular Grid System in either one, two or four modules with pathways in banks of four with the option to utilize blank firestop filler panels in multi-slot grids. Four colored pathways to be organized as follows: ORANGE = Fire Alarm, YELLOW = Security and Door Access, and WHITE = Communications-Backbone Cabling (between telecom rooms).





General:

Section includes: Firestopping at fire rated openings for conduit and cable trays.

Quality Assurance:

Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings not less than 1-hour.
2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings not less than 1-hour.

Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

Products:

Firestopping:

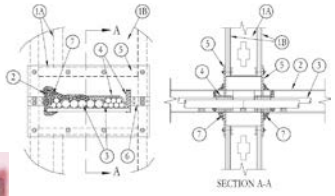
Campus Preferred Manufacturers and Models:

1. 3M Fire Protection Products
   Phone: 800-328-1687
   www.3m.com/firestop

   Product Data:

   http://solutions.3m.com/wps/portal/3M/en_US/EMDCI/Home/Products/FireProtectionProducts/
2. Tremco Inc.
   Phone: 866-209-2404
   www.tremcofirestop.com
3. Substitutions: Section __ __ __ - Product Options and Substitutions.

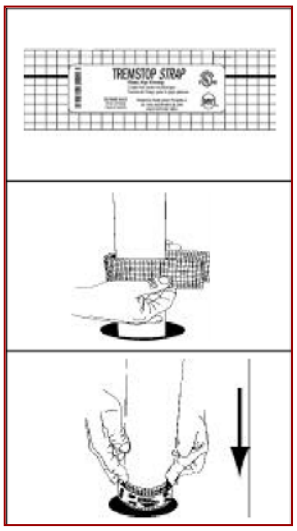
Cable Tray:



1. 3M, Model W-L-4004 - **24" x 4" steel or aluminum cable tray, 32% fill. Also referred as WL4004.**
2. Tremco, Model TREMstop PS, fire containment pillow system.

3. **Prohibited**: Intumescent putty.

Metal Pipe:



4. 3M, Model C-AJ-1001 or CAJ-1009
5. Tremco, Model C-AJ-1179 or C-AJ-1187
6. Substitutions: Section __ __ __ – Product Options and Substitutions.

Non-Metallic Pipe:

1. 3M, Model C-AJ-2005
2. 3M Fire Barrier FS-195+ Wrap/Strip – 2”x24”, Intumescent elastomeric strip with foil on one side (UPC # 00051115071157), and Plastic Pipe Device PPD6 (UPC # 00051115082535) for 6” pipe, or Restricting Collar RC-1-2” (UPC #00054007083245) for 2” pipe.
3. Tremco, Model C-AJ-2082 or FA-2024
4. Substitutions: Section __ __ __ – Product Options and Substitutions.

Cabling:

5. 3M, Models

a. Single, Fire Barrier Pass-Through Devices:
   1) 2-1/2" Square (UPC # 00051115165962) and Mounting Brackets 2-1/2" SQ Single Mount (Pair) (UPC # 00051115187506)
   2) Fire Barrier Pass-Through Device 4" Square (UPC # 00051115165979) and Mounting Brackets 4" SQ Single Mounting (Pair) (UPC # 00051115187520)
   3) Fire Barrier Pass-Through Device 4" Round (UPC #00051115165986) and Mounting Brackets 4" Round Single Mount (Pair) (UPC # 00051115187544)

b. Multiple, Square Pass-Through:
   1) Fire Barrier Pass-Through Device 4" Square and Mounting Brackets 4" SQ Triple Mount (Pair) UPC # 00051115187537).

6. Tremco, Model _____
7. Substitutions: Section __ __ __ – Product Options and Substitutions.

Division 08 – OPENINGS

08 06 05 Key Schedule

Use this area to list all keys provided on project referencing appropriate Sections. The Campus prefers to have one listing for all keys. The purpose of Key Schedule is to allow the Architect to coordinate requirements and specifications for all keys provided on the project (doors, cabinets, drawers, panels, accessories, toilet room fixtures, equipment, etc.), have one listing for all keys, organize key submittal to the University, and provide manufacturer model numbers for future key replacement.

Key Schedule for {project name} {building number}						
Purpose / Location	**Room Number**	**Keys Required**	**Total Keys**	**Model Number**	**Manufacturer**	**Section Reference**
Cabinet locks						06 40 00 – Architectural Woodwork
Construction - Master		20	20			08 71 00 – Door Hardware
Construction - Control		2	2			08 71 00 – Door Hardware
Control		4	4			08 71 00 – Door Hardware
Master		6 per each master set				08 71 00 – Door Hardware
Grand Master		4	4			08 71 00 – Door Hardware
Extra Blank		1 per each lock				08 71 00 – Door Hardware
Building Entrance		2/each lock or cylinder				08 71 00 – Door Hardware
Interior Doors		___ /each lock or cylinder				08 71 00 – Door Hardware

Key Schedule for {project name} {building number}						
Purpose / Location	**Room Number**	**Keys Required**	**Total Keys**	**Model Number**	**Manufacturer**	**Section Reference**
Toilet Accessories		6/ each building restroom/ accessory keyed differently				10 28 00 Toilet, Bath, and Laundry Accessories
Equipment						Division 11 – Equipment sections
Furnishings						Division 12 – Furnishings sections
Elevators		3 keys, 1 installed in elevator pit.				14 20 00 – Elevators
Fire Control Cabinets						21 00 00 – Fire Suppression
Fire Control Padlocks		2/ each Padlock (IC cores)				21 00 00 – Fire Suppression
Plumbing						22 00 00 – Plumbing
Plumbing Padlocks		2/ each Padlock (IC cores)				22 00 00 – Plumbing
HVAC Equipment Panels		2/ each Panel				23 00 00 – HVAC
HVAC Yard, Doors and Equipment Padlocks		2/ each Padlock (IC cores)				23 00 00 – HVAC
Electrical						26 00 00 –

Key Schedule for {project name} {building number}						
Purpose / Location	**Room Number**	**Keys Required**	**Total Keys**	**Model Number**	**Manufacturer**	**Section Reference**
Panels						Electrical
Emergency Generator Panels and Equipment		2/ each Padlock (IC cores)				26 00 00 – Electrical
Lighting Control Panels		2/ each Panel				26 00 00 – Electrical
Lighting Switches		2/ each switch				26 00 00 – Electrical
Electrical Yard, Equipment, & Switches Padlocks		2/ each Padlock (IC cores)				26 00 00 – Electrical
Communications Equipment						27 00 00 - Communications
Emergency Telephones (Blue Light Phones)		2/ each				27 00 00 - Communications
Communications Equipment Padlocks		2/ each Padlock (IC cores)				27 00 00 - Communications
Electronic Safety and Security Panels						28 00 00 – Electronic Safety and Security
Electronic Safety and Security Equipment Padlocks		2/ each Padlock (IC cores)				28 00 00 – Electronic Safety and Security

Key Schedule for {project name} {building number}						
Purpose / Location	**Room Number**	**Keys Required**	**Total Keys**	**Model Number**	**Manufacturer**	**Section Reference**
Irrigation Equipment						32 80 00 – Irrigation
Utilities						33 00 00 - Utilities

Closeout Submittal: Key Schedule – Provide hard copies and one electronic copy of completed Key Schedule along with keys separated and labeled.

08 10 00 DOORS AND FRAMES

08 11 00 Metal Doors and Frames

08 11 13 Hollow Metal Doors and Frames

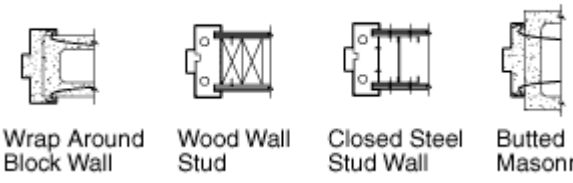
Steel Doors:

- Campus Standard:
  - Exterior: Full flush doors (ANSI A250.8-1998 (SDI-100)), 1-3/4 inches thick, galvannealed steel (ASTM A653/A653M-07), 14 gage closer reinforcement top and bottom with snap-in top caps.
  - Interior: Full flush doors (ANSI A250.8-1998 (SDI-100)), 1-3/4 inches thick, 14 gage closer reinforcement top and bottom.
  - Hardware preparation and reinforcement: Prepare for commercial hardware (ANSI A250.6-1997) and mortised locks (ANSI A115.1), no face holes unless coordinated with hardware schedule. Factory reinforce for surface applied hardware – 14 gage for closer. Locations per ANSI/DHI A115.
- Campus Preferred Manufacturer and Model: Steelcraft L16 Series

Steel Door Frames:

- Campus Standard:
  - Exterior: 16 gage welded door frames; A60 hot dipped galvannealed steel.
  - Interior: 16 gage knock-down door frames.
  - Reinforcement: 14 gage for closer, 4-7/8 inches ASA strike, and 4-1/2 inches hinges.
- Campus Preferred Manufacturer: Steelcraft.

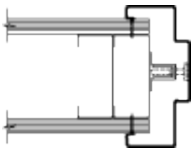
Typical Wall Conditions



- Exterior – Flush Frames: F-Series Frames, 16 gage.

  http://www.steelcraft.com/downloads/pdfs/steelcraft_spec_l1.pdf

- Interior – Drywall Frames: DW-Series (using Baseboards) and K-Series (Not using Baseboards), 16 gage.



  http://www.steelcraft.com/pc_frames_drywall.asp

  http://www.steelcraft.com/downloads/pdfs/steelcraft_spec_dw1.pdf

08 14 00 Wood Doors

General:

- o Close-out Submittals:
  - Samples for University Paint Shop: Submit documentation of painting system used on "pre-finished" doors, including 2 manufacturer's sample finishes for each color and system used on the project.

Campus Preference: 36 inches minimum, solid core, birch veneer.

08 40 00 ENTRANCES, STOREFRONTS, AND CURTAIN WALLS

08 41 00 Entrances and Storefronts

- o Campus Standard: No underfloor closures.

08 70 00 HARDWARE

08 71 00 Door Hardware

Door Schedules:

Keying:

- Telecommunication Spaces (Rooms): Use 112-series key lock. (Coordinate with Division 27 – Communications.)
- Master Padlocks: Use where less security is required. Coordinate with Trustees Representative during design process for specific Campus Project requirements, and Divisions 21, 22, 23, 26 (Electrical Panels), 27, and 32 (Bollards). Key alike to Campus Specifications #2359, and provide 2 keys per panel, etc.
- State Padlocks: Use where higher security is required, such as Electrical Yards and Switches, HVAC Yards and Equipment, etc. Coordinate with Trustees Representative during design process for specific Campus Project requirements, and Divisions 21, 22, 23 (HVAC Air Handling Units), 26 (Electrical Switchgear, Transformers), 27, and 32. Requires interchangeable cores complying with Campus Cylinders and Keying Standards. Interchangeable core.

Hinges and Pivots:

Hinges:

- Campus Preferred Manufacturers:
- Hager Companies: Exterior -- Stainless Steel, Ball Bearing Part #BB1191; Interior – Plated with 626 Finish, #BB1279BB
- McKinney Products Company, Division of Assa Abloy
- Stanley.

Pivots and Pivot Hinges:

o Campus Preferred Manufacturers:

- Rixson-Firemark, Inc.; Div. of Yale Security Inc.
- McKinney Products Company; Div. of Assa Abloy

Continuous Pin and Barrel Hinges:

o Campus Preferred Manufacturers:

- Markar Products, Inc.
- McKinney Products Company; Div. of Assa Abloy

Locks and Latches:

Mechanical Locks and Latches:

o Campus Preferred Manufacturers:

- Best Access Systems – 45H Series
- Corbin Russwin – ML2000 Series
- Schlage Lock Company; an Ingersoll-Rand Company – L94 Series

o Not Recommended:

- Adams Rite Manufacturing Co. – Products are low quality and don't holded-up.

Electrified Locks:

Electric Mortise Locksets:

o Campus Preferred Manufacturer: Best Access Systems – 45H Series.

Door Bolts:

Surface Bolts:

o Campus Preferred Manufacturers:

- Door Controls International
- Don-Jo Manufacturing
- Hager Companies
- Ives: H.B. Ives
- Rockwood Manufacturing Company

- Triangle Brass Manufacturing Company, Inc.

Flush Bolts:

o Campus Preferred Manufacturers:

- Door Controls International
- Don-Jo Manufacturing
- Hager Companies
- Ives: H.B. Ives
- Rockwood Manufacturing Company
- Triangle Brass Manufacturing Company, Inc.

Exit Devices:

o Campus Preferred Manufacturer:

- Von Duprin, Division of Ingersol-Rand – Series 98 or 99.
- Corbin Russwin – Series ED5000.

o Not Recommended:

- Adams Rite Manufacturing Co. – Products are low quality and don't hold-up.

o Campus Preference:

- Prefer rim device over vertical rods.

Cylinders and Keying: Campus Standards

Cylinders:

o Campus Standard Manufacturer: Best Access Systems. **NO SUBSTITUTIONS ALLOWED.**

o Cylinders: Small format interchangeable core type, constructed from brass or bronze, stainless steel, or nickel silver.

- Number of Pins: Seven
- Mortise Type: Threaded cylinders with rings and appropriate cam to suit lock function and type.
- Function: D-Storage; R-Classroom; N-Passage, A-Office, TA-Dormitory.
- Door Cylinders: Best Model 1E Series; Finish 626.

o Construction Keying:

- Construction Master Keys: Provide temporary construction master keys (20 construction master keys and 2 control keys). See Section 08 06 05 – Key Schedule.
- Construction Cylinders: Provide construction cores.

o Permanent Keying:

- University installs permanent cores.

- o Keying System:
  - University Facility Services Campus Key Coordinator designs keying system.
  - Contractor:

    General: **Submit** proposed keying system to Architect for review and written approval by Trustees, and copy of Best Access (Stanley Security Solutions) Purchase Order Number to Architect for Trustees Records.

    Closeout Submittal: Submit three hard copies and one electronic copy of final keying schedule.

    Products: Key locks and cores at factory and maintain permanent records of information.

    Execution: After submittal and approval of keying system by Trustees, submit manufacturer's Purchase Order Number for Trustees to order cores and keys. Manufacturer shall deliver permanent keys, control keys and cylinder cores to Trustees Representative.

    Coordinate installation of permanent cores by University Lock Shop with Trustees Representative.
- o Keys:
  - Material: Nickel-silver. Stamp keys "Do Not Duplicate."
  - Quantity: Cylinder Keys (3 per core); and Extra Blank Keys (1 per core or lock).

Strikes:

Electric Strikes:

- o Campus Preferred Manufacturers:
  - Folger Adam Security Inc.
  - Securitron

Operating Trim:

- o Campus Preferred Manufacturers:
  - Don-Jo Manufacturing
  - Forms & Surfaces
  - Triangle Brass Manufacturing Company, Inc.

Accessories for Pairs of Doors:

- o Campus Preferred Manufacturers:
  - Coordinators:

    Don-Jo Manufacturing

    Hager Companies

    Ives: H.B. Ives

    Door Controls Internationals

- Removable Mullions:

  Von Duprin, Division of Ingersol-Rand

  Corbin Russwin Architectural Hardware, Division of Yale Security Inc.

  Note: "Key Removable" when needed.

- Astragals:

  National Guard Products, Inc.

  Pemko Manufacturing Company, Inc.

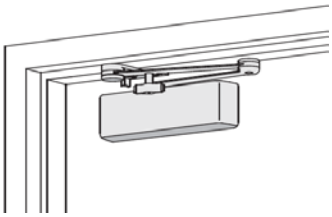
  Reese Enterprises, Inc.

Closers:

- Campus Preferred Manufacturers:
  - Surface-Mounted Closers:

    LCN, Division of Ingersol-Rand, 4040 Series, or 4110 Series (4111 fits doors 28"-54" and thus provides greater adjustment for 36" doors), **mounting: parallel arm only**; on in-swing door, need a track.

    Corbin Russwin, DC6200 Series.



  - Concealed Floor Closers: Not preferred because replacement is expensive and difficult.
  - Electromechanical Closers:

    LCN, Division of Ingersol-Rand, 4041 Series
  - Closer Holder Release Devices: Note preferred because of wear and tear on top hinge.

    Corbin Russwin Architectural Hardware, Division of Yale Security Inc.

    Rixson-Firemark, Inc., Division of Yale Security Inc.
  - Overhead Stops: Not allowed because pull hinges out causing door to sag, and damages door jambs.

Protective Trim Units:

- Campus Preferred Manufacturers:
  - Metal Protective Trim Units:

    Don-Jo Manufacturing

    IPC Door and Wall Protection Systems, Inc.

    Triangle Brass Manufacturing Company, Inc.

Stops and Holders:

- Campus Preferred Manufacturers:
  - Metal Protective Trim Units:

    Don-Jo Manufacturing

Ives: H.B. Ives

Norton Door Controls, Division of Yale Security Inc.

Rixson-Firemark, Inc., Division of Yale Security Inc.

Triangle Brass Manufacturing Company, Inc.

Door Gasketing:

- Campus Preferred Manufacturers:
  - Door Gasketing:

    National Guard Products, Inc.

    Pemko Manufacturing Company, Inc.
  - Door Bottoms:

    National Guard Products, Inc.

    Pemko Manufacturing Company, Inc.

Thresholds:

- Campus Preferred Manufacturers:
  - Thresholds: Meet ADA Access requirements.

    National Guard Products, Inc.

    Pemko Manufacturing Company, Inc.

    Rixson-Firemark, Inc., Division of Yale Security Inc.

Division 09 – FINISHES

09 20 00 PLASTER AND GYPSUM BOARD

09 29 00 Gypsum Board

Campus Standard:

- 5/8-inch, Type X.

Campus Preference:

- 5/8-inch, Fire-Rated Mold-Resistant Board (XP Gypsum Board panels) complying with ASTM C 1396, Type X

09 30 00 TILING

09 30 13 Ceramic Tiling

Campus Standard:

- Grout: Sanded.
- Execution: Seal grout (as soon as possible) after grouting is completed. *Purpose: To prevent permanent stains from being imbedded in grout.*

09 60 00 FLOORING

General Comments:

Campus Standard:

- Maintenance Instructions: Provide Manufacturer's detailed floor finishing and maintenance instructions for each type of flooring – concrete, ceramic tile, carpeting, linoleum, vinyl composition tile, hardwood, terrazzo, etc.

09 68 00 Carpeting

Campus Standard:

- Carpet System must meet or exceed the current VOC limits of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program.
- Maintenance Instructions: Provide Manufacturer's detailed floor finishing and maintenance instructions.

09 90 00 PAINTING AND COATING

09 91 00 Painting

General:

- Submittals:
- Close-out Submittals:
  - Samples for University Paint Shop: Submit two painted samples, 6 inches by 6 inches illustrating each color and system used on the project.

- o Extra Materials: University has first right of refusal for left-over paint.

Products:

General Notes to Design Team

Recycled Point for Interior Surfaces: *The use of recycled paint for interior surfaces is not supported by the Campus Standards for technical and quality control reasons. The Campus Standard is based on the Green Seal's Standard GS-11 requirements, and the products listed below meet these requirements. Recycled paint, as offered by Kelly-Moore, is made from Kelly-Moore paint returned by contractors. Kelly-Moore sorts by sheen and mixes the paint to provide 14 standard colors. However, none are an off-white normally used in offices, and the darker colors are not acceptable. MSDS are not provided, and the products are not guaranteed to be Low VOC product.*

Website: http://www.greenseal.org/certification/environmental.cfm

- o Campus Standard:
  - Painting and Coating Systems must not exceed the current VOC and chemical component limits of the Green Seal's Standard GS-11 requirements.
- o Campus Preference:
  - Manufacturers and Systems:

    Sherwin-Williams (Exterior Surfaces):

    SuperPaint® Exterior Latex Satin A89 Series

    SuperPaint® Exterior Latex Flat A80 Series

    Dunn-Edwards Paints (Interior Surfaces):

    ECOSHIELD™ Low-Odor / Zero-VOC Interior Acrylic Semi-Gloss Paint

    ULTRA-GRIP® Acrylic Multi-Purpose Primer

    ECOSHIELD™ Low-Odor / Zero-VOC Interior Latex Low Sheen Paint

    Sherwin-Williams (Interior Surfaces):

    Harmony® Interior Latex Semi-Gloss B10 Series

    Harmony® Interior Latex Eg-Shel B9 Series

    Harmony® Interior Latex Primer B11W900

    PPG Industries (Metal Surfaces):

    Pitt-Tech® Satin Industrial Enamels 90-474 Series (Acrylic)

Division 10 – SPECIALTIES

10 10 00 INFORMATION SPECIALTIES

10 11 00 Visual Display Surfaces

Markerboards:

- Campus Standards:
  - Porcelain steel magnetic white markerboards; 28 gage porcelain enameled steel surface; 50 year manufacturer's warranty.

10 20 00 INTERIOR SPECIALTIES

10 21 00 Compartments and Cubicles

Toilet Compartments:

- Campus Standards:
  - Doors, panels and pilasters: 1-inch thick High Density Polyethylene (HDPE) resins.
  - Hardware: Continuous mounting brackets, pilaster shoe, slide latch, "U" shaped pull handle.

10 28 00 Toilet, Bath, and Laundry Accessories

Toilet Accessories:

- Closeout Submittal - Keys: Provide manufacturer name and model numbers for keys and coordinate closeout submittal with Section 08 06 05 – Key Schedule.
- Campus Standards:
  - Keys: Provide 2 keys per dispenser. Keyed to match CAT-74 key.
  - Toilet Tissue Dispenser:

    Surface-mounted type; roll-in-reserve dispenser with hinged front secured with tumbler lockset; two standard-core tissue rolls, up to 5-1/4 diameter (1800 sheets); extra roll automatically drops in place with bottom roll is depleted.

    Example: Bobrick Contura B-4288.

    Installation in Handicapped Accessible Stalls: Mount sufficient distance from hand rails to allow access to dispenser for refilling.
  - Sanitary Napkin Disposal:

    Surface-mounted type; stainless-steel; seamless exposed walls with self-closing top cover with continuous hinge; locking bottom panel; removable reusable receptacle.

    Example: Bobrick Contura B-270.

    Installation in Handicapped Accessible Stalls: Mount sufficient distance from hand rails to allow access to dispenser for refilling.

- Seat-Cover Dispenser:

  Surface-mounted type; stainless-steel unit with concealed opening at bottom for filling; 250-seat-cover capacity, minimum.

  Example: Bobrick Contura B-4221.

  Installation: 18 inches, minimum above top of flush valve.

  Note to Architect: If place too close to the flush valve, dispenser, which is loaded from the bottom, cannot be refilled.

  Installation in Handicapped Accessible Stalls: Mount sufficient distance from hand rails to allow access to dispenser for refilling.

- Combination Seat-Cover Disposal / Toilet Tissue Dispenser / Sanitary Napkin Disposal, or Combination Seat-Cover Disposal / Toilet Tissue Dispenser:

  Note to Architect: Not allowed. *The process to fill them is much more laborious and requires that a custodian have two keys at once to open the unit; he/she must pull out filled dispenser from one side to fill the opposite side and often results in toilet tissue falling in the toilet. Often the spindles may become obsolete and difficult to replace. Over time, the doors to the waste disposal become damaged and don't close or open properly. They become unsightly and we end up mounting the surface mounted dispensers next to the combination units. Units are difficult to repair and parts are difficult to come by.*

- Soap Dispenser:

  Surface-mounted type: AeroFoam Soap Dispenser.

  Example: DEB SBS soap dispenser.

  Installation: Mount sufficient distance from mirror edges to allow access to dispenser for refilling. *Note to Architect: Key cores are typically located on the side of the dispenser.*

- Sanitary Napkin Vendor:

  All-welded construction; seamless door with returned edges and secured by tumbler lockset; identification reading "Napkins" and "Tampons," brand-name advertising not allowed; 30 napkins and 20 tampons capacity, minimum; double-coin operation, 50 cents.

  Example: Bobrick B-3500x2.

- Paper Towel Dispenser:

  Surface-mounted type: roll pull towel dispenser; translucent plastic, 12¾ inches wide by 10¼ inches deep by 16½ inches high.

  Example: Kimberly-Clark IN-SIGHT, Model #KIM09990.

  Note to Architect: Campus prefers hand dryers over paper towel dispensers. Only specify paper towel dispensers if required for a lab or other special need.

- Electric Hand Dryers

  Touch free surface mounted.

  Example: Dyson Airblade AB02

10 40 00 SAFETY SPECIALTIES

10 43 00 Emergency Aid Specialties

10 43 21 - Accessibility Evacuation Chair:

- **Sample Specification Section:** Available from Facilities Planning & Capital Projects. Contact: Joel Neel @ 805-756-2193; Email: jneel@calpoly.edu
- Campus Standards:
  - Manufacturer:

    Garaventa Accessibility
    POB 1769
    Blain, WA 98231-1769
    Phone: 800-663-6556
    Fax: 604-594-9915
    Email: productinfo@evacutrac.com
    Web: www.evacutrac.com
    Contact: Mike Morisset

    Distributor: McKinley Equipment Corporation
    17611 Armstrong Avenue, Irvin, CA 92614
    Phone: 949-261-9222
    Fax: 949-250-7301

  - Model:

    Garaventa Accessibility - Model Evacu-Trac CD7.

    No known equal.

- Not Recommended:
  - Manufacturer and Model:

    Ferno
    70 Weil Way
    Wilmington, OH 45177

    EZ Glide™ Evacuation Stair Chair

    Reasons: Capacity and speed control -- Person's weight capacity is limited to 200 pounds with one person assisting, verses 300 pounds with Garaventa. No breaks to stop chair on stairs, verses speed control of 1.13 feet per second with Garaventa.

Division 11 – EQUIPMENT

11 50 00 EDUCATION AND SCIENTIFIC EQUIPMENT

11 52 00 Audio-Visual Equipment

Project Screens: _____

Projectors: _____

Players and Recorders: _____

11 53 00 Laboratory Equipment

Laboratory Fume Hoods: _____

Division 12 – FURNISHINGS

12 30 00 CASEWORK

Locks for Drawers and Doors:

- Campus Standards: Provide 2 keys per room of differently keyed drawers and doors where non-State keys are used.
- Closeout Submittal - Keys: Provide manufacturer name and model numbers for keys and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

12 50 00 FURNITURE

Locks for Drawers and Doors:

- Campus Standards: Provide 2 keys per lock.
- Closeout Submittal - Keys: Provide manufacturer name and model numbers for keys and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

Division 13 – SPECIAL CONSTRUCTION

Division 14 – CONVEYING EQUIPMENT

14 20 00 ELEVATORS

14 24 00 Hydraulic Elevators Campus Standard

General

o References:

- ANSI A17.1 Safety Code for elevators, Dumbwaiters and Escalators, and Moving Walks.
- ANSI C1 / NFPA 70 National Electric Code
- ANSI A17.2 Practice for the Inspection of Elevators, Escalators, and Moving Walks.
- AWS D1.1 Structural Welding Code.
- CCR Title 24 California Code of Regulations Title 24, Part 7, Elevator Safety Regulations, and Part 2 regulations for elevators accessible to persons with disabilities and ambulance gurney access.
- ADAAC Americans with Disabilities Act Accessibility Guidelines.
- CBC California Building Code

System Description:

o Design Requirements:

- Signal Equipment: Use non-proprietary and universally maintainable controls and software. Equipment and software necessary for long-term maintenance shall be available for purchase by any licensed elevator maintenance organization. (Examples include Car control station and in-car position indicators, Hall push-button stations, Lanterns and gongs, Hall position indicators, etc.)
- Special Features: Access for persons with disabilities, Fire emergency service, Medical emergency service, Earthquake requirements, and Emergency exit service.

Closeout Submittals:

o Maintenance Tools:

- Provide complete list of specialty tools required for general maintenance, including programmable and diagnostic tools.

Quality Assurance:

o Installer Qualifications:

- Elevator manufacturer installers, or firm with written approval from manufacturer and with five years, minimum of successful experience installing elevators similar to those required for the Project.

Maintenance:

o Elevator Maintenance Period:

- Maintain complete elevator installation for 12 months, minimum beginning at start of warranty period per Section _____ - _____.
  - Provide monthly systematic examination, adjustment and lubrication of elevator equipment. Repair or replace worn electrical and mechanical parts using parts produced by elevator equipment manufacturer.

    Exception: Greater frequency required if problems occur with elevator operation.
- Perform work during non-peak traffic periods.
- Provide 24-hour emergency call-back service with 2-hour response if the elevator is empty, and 1-hour response time for trapped occupants.
- Parts: Locally maintain an adequate stock of parts for replacement and emergency purposes.
- Maintenance Personnel: Qualified and approved by elevator manufacturer, and with 5 years, minimum experience.
- Maintenance Logs: Prepare logs of each visit and submit to University within 72 hours after visit.
-

o Extended Elevator Maintenance Proposal:

- Submit proposal to extend maintenance by three years.
  - Include stipulated sum with premiums due annually.

Products:

o Manufacturers:

- Elevator:
  - Capable of producing premium quality commercial hydraulic elevators and accessories to provide a complete installation.
  - Experience: Five years, minimum.
  - Option: Manufacturer shall either manufacture the major components, or shall maintain a service facility within California with complete service parts for a period of 20 years, minimum after completion of project.

o Fabrication:

- Doors:
  - Power operated hollow metal doors with track, rollers and frame; two-point suspension, nonmetallic sheaves; 3-inch diameter, minimum for car doors and 2-1/2-inch diameter for hoistway doors.
  - Finish: Stainless steel.

- Hoistway Entrances:
  - Formed metal with struts, hanger headers, fascia plates, toe guards and Underwriters' Laboratory labels.
  - Finish: Match doors.
  - Entrance Protection: Provide infrared door detectors, complying with ADA and applicable codes.
- Car Finishes:
  - Front Returns: Stainless steel with inset buttons, swing return panels.
  - Pads: Provide wall attachment buttons with protective pads.
- Operating Fixtures and Signals:
  - Comply with ADA.
  - Car Control Station: Provide service cabinet with built-in, hands-free communications via touch-button for automatic dialing from elevator car, and automatic answering for calling from outside. Provide door hold-open button.
  - Hall Call Buttons: Provide illuminated mechanical hall buttons.
  - In-Car Position Indicator: Provide above elevator hoistway entrance or above control panel for cars serving more than two stops.
  - Lanterns: Provide wall mounted lanterns at center opening doors, above each hoistway entrance and jamb mounted lanterns at side opening doors with audible signal, one for up-travel, two for down-travel.
- Miscellaneous Items:
  - Battery Operated Emergency Lighting: Provide in car.
  - Two-Speed Fan: Provide in car.
  - Other Items: Provide as required by applicable codes.
- Special Features:
  - Access for Persons with Disabilities: Comply with CCR Title 24, and ADAAG.
  - Fire Emergency Service:

    Provide control circuits to comply with CBC.

    Comply with CCR Title 24.

    Provide three-position "on-off-bypass" key switch at ground floor.

    Provide instructions for operation in ground floor cabinet.

    Connect elevators to smoke detectors in lobbies.
  - Medical Emergency Operation: Comply with CCR Title 24.
  - Earthquake Requirements: Comply with applicable codes.
  - Emergency Exit Service: Provide system to lower elevators to next lower floor level, or to Ground Floor, and doors to open without assistance in power outage.

- Finishes:
  - Exposed-to-View Surfaces in Car, Machine Room and Hoistway Entrances:
    - Stainless Steel: Number 4 finish (satin directional polish).
    - Baked Enamel: Clean, degrease zinc-coated metal surface; one coat zinc oxide primer sprayed and baked; two coats semi-gloss enamel sprayed and baked.

14 28 00 Elevator Equipment and Controls

Elevator Controls:

- Campus Standard: Open protocol, non-proprietary, specified with trouble shooting and operational software, and serviceable by all licensed elevator contractors.
  - Manufacturer: Motion Control Engineering. http://www.mceinc.com/.

Elevator Keys:

- Campus Standard: Provide 3 keys, installing 1 in elevator pit.
- Closeout Submittal - Keys: Provide manufacturer name and model numbers for keys and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

Division 21 – FIRE SUPPRESSION

21 00 00 FIRE SUPPRESSION

21 05 00 Common Work Results for Fire Suppression

Meters and Gages: Refer to CSU Building Metering Guide. Website:

http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf

21 09 00 Instrumentation and Control for Fire Suppression

Products:

- o Campus Standards:
  - Conduit: ¾-inch, minimum.

21 13 00 Fire Suppression Sprinkler Systems

Products:

- o Campus Preference:
  - Dry-Pipe Sprinkler Systems: Use where water could damage equipment in room.
- o Campus Standards:
  - Alarm Devices: Water-Motor Operated Alarm, Electrically Operated Alarm, Water-Flow Indicator, Valve Supervisory Switch, and Indicator-Post Supervisory Switch.

Division 22 – PLUMBING

22 00 00 PLUMBING

22 01 00 Operation and Maintenance of Plumbing

22 05 00 Common Work Results for Plumbing

General-Duty Valves:

Campus Requirements:

- **Isolation Valves**: Provide sufficient number of valves for ease of service, and to reduce inconvenience to users due to outages and draining of systems for minor repairs.
- **Relief valves**: Daylight to a conspicuous location. Plumb to sewer.

Identification for Plumbing Piping and Equipment:

Campus Requirements:

- **Identification Charts**: Location should be reviewed and approved by Project Manager in consultation with Facility Services.
- **Piping Service**:
  - Identification Tags: Provide with abbreviated legend on 1st line and pipe size on 2nd line. Locate to be visible from exposed points of observation. Where 2 or more pipes run parallel, place printed legend and other markers in same relative location.
- **Valves Service**:
  - Identification Tags: Provide with abbreviated legend on 1st line and valve service chart number on 2nd line.
  - Identification Charts: Provide two (2) satin finished extruded aluminum frames with rigid clear plastic glazing; 8-1/2 x 11 inches, minimum for each chart. In addition, provide electronic copy of each chart.

Keys for Cabinets and Padlocks:

- Campus Standards:
  - Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
  - Padlocks: Coordinate with Section 08 06 05 – Key Schedule.
- Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

22 06 00 Schedules for Plumbing

Piping and Pumps:

Piping:

- **Campus Standard**: U.S.-manufactured.

22 10 00 PLUMBING PIPING AND PUMPS

Campus Requirements:

- **Drain Lines**: Daylight to a conspicuous location. Plumb to sewer.
- **Hammer Arrestors**: Install in a maintenance-accessible location for.

22 30 00 PLUMBING EQUIPMENT

22 35 00 Domestic Water Heat Exchangers

Tube Bundles:

- Campus Standard: Cupronickel Alloy. (Note: Standard grade copper tube bundles corrode within 3-5 years.)

Summary:

- Related Sections: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

22 40 00 PLUMBING FIXTURES

22 41 00 Residential Plumbing Fixtures

Lavatories and Sinks:

Lavatory:

- Campus Preferred Manufacturer and Models: Zurn: http://www.zurn.com/
  - Lavatory – Wall Hung: Zurn Z5361, 20" by 18", high back.

  - Lavatory – Countertop: Zurn Z5120 – Series, 19" round, vitreous china, self-rimming front overflow design.

Faucets, Supplies, and Trim:

Faucets:

- Campus Preferred Manufacturer and Model: Moen CA83005 Non-mixing Electronic Faucet
  - **F (0.5 GPM Vandal Resistant Flow).**

http://www.moen.com/search?search_scope=0&search_terms=CA8305

Mechanical Trap Primers:

- Campus Standard: Reduce or eliminate use.

22 42 00 Commercial Plumbing Fixtures

Water Closets, Urinals:

Water Closets:

- Campus Standard: 1.28 GPF, or optional 1.6 GPF toilets.
- Campus Preferred Manufacturer and Models:

  - **Toilet Fixtures: American Standard FloWise™ Collection. http://www.americanstandard-us.com/searchResults.aspx?c=71**

    - **Toilet – Wall Hung: Afwall FloWise™ Elongated Toilet, 1.28 GPF, high efficiency flushometer valve toilet, vitreous china, EverClean™ surface.**
    - **Toilet – Floor-Mounted: Madera FloWise™ Elongated Toilet, 1.28 GPF, high efficiency flushometer valve toilet, vitreous china, EverClean™ surface.**

    - **Toilet – Floor-Mounted – ADA Height: Madera FloWise™ Elongated 16-½" Toilet, 1.28 GPF, high efficiency flushometer valve toilet, vitreous china, EverClean™ surface.**

  - Toilet Seat: American Standard Heavy-Duty Commercial Toilet Seat with EverClean™ surface; or Zurn Z5955SS-EL, Commercial Heavy Duty; Elongated, Standard White, Open Front Toilet Seat Less Cover with Stainless Steel Check Hinge. http://www.americanstandard-us.com/searchResults.aspx?d=1&t=23
  - Flush Valves - Toilets (with infrared sensors): Zurn ZTS6200EV high efficiency flushometer valve

    - Campus no longer installs Flush Valves - Toilets without infrared sensors.

- **Not Recommended:**

  - **Toilet: Zurn Z5615 Series, Zurn Z5655 Series, and Zurn Z5665 Series 1.28 GPF Elongated vitreous china toilet. The toilet bowls are too shallow for proper water scouring when flushed.**

Urinals:

- Campus Preferred Manufacturer and Models: Zurn 0.125 gpf and Sensor Activated Flush Valve.

  - Z5798 SERIES with ZER6000AV-CPM AquaSense® Battery Powered Flush Valves & Kit - 1/8 gallons per flush (gpf), pressure compensating internal flow regulator, Vitreous china, ¾" top spud, 2" I.P.S. outlet flange and rubber gasket with integral trap, 14" extended rim height for handicap compliance.
  - Flush Valves – Urinals (without infrared sensors): Z6001AV and Z6002AV.

Lavatories and Sinks:

Lavatory Faucets:

- Campus Standard: Sensor Activated Faucets 0.5 gpm Aerators. Campus prefers to avoid use of tempering valves on lavatory banks.

Faucets, Supplies, and Trim:

Mechanical Trap Primers:

- Campus Standard: Reduce or eliminate use.

Trap Adapters:

- Campus Standard: Use when waste line has a tubular trap. Purpose is to allow for easier maintenance.
- Campus Preferred Manufacturer and Model: Arrowhead Brass Products, #6001A, 1-1/2" M.I.P. x 1-1/2" Tube Size – Brass Nut, Brass Ferrule with stop. Male in Female UPC-1003.2. http://www.arrowheadbrass.com/products/

Flushometers:

Flush Valves:

- Campus Standard: Zurn.

22 47 00 Drinking Fountains and Water Coolers

Water-Station Water Coolers:

- **Note to Designer**: Consider using Water Cooler.
- **Manufacturer and Models**:
  - Oasis P8SBF

    http://www.oasiscoolers.com/commercial/bottle-fillers/versafiller.aspx

Division 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 00 HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

GENERAL COMMENTS:

Economizers:

Evaluate life cycle costs for using economizers on units smaller than 75,000 Btuh, especially on 24/7 loads.

24-Hour Cooling:

Provide dedicated HVAC equipment/systems to spaces requiring 24-hour cooling (allowing unoccupied parts of the building to be shut down).

- Types of Spaces: Review program to determine spaces requiring 24-hour cooling (such as main data frame rooms, server rooms, telephone equipment rooms, elevator equipment rooms, labs and other areas containing special equipment).
- Equipment Function: Based upon critical functions of equipment, evaluate and analyze cooling options and redundancy -- DX Units *verses* Central Plant Chilled Water *verses* Hybrid CHW/DX units.

Equipment Access:

Provide clear access to equipment for inspection and maintenance.

- Access Panels: Provide adequate, unobstructed access to equipment and ceiling access panels.
- Volume/Balancing Dampers: Locate access panels within 18 inches of service point.
- Pumps in Mechanical Rooms: Orient pumps with motor end towards center of room, and pump end towards wall (making sure suction strainer is accessible).
- Building Isolation Valves: Valves need to be raised, accessible and housed in a covered box, flush with ground level.

23 05 00 Common Work Results for HVAC

Meters and Gages for HVAC Piping:

CSU Requirements: Refer to CSU Building Metering Guide. Website: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf

Campus Requirements:

- **Intent**: Metering to meet the performance-based LEED™ NC/EB Energy & Atmosphere Credit 5 – Measurement & Verification standards for ongoing accountability and optimization of building energy and water consumption performance over time.
  - **Note to Engineer: Refer to and coordinate with Section 25 00 00 – Integrated Automation.**

- **Metering Equipment**: Allow Campus the ability to identify problems and achieve improved system performance. Select meters for future connection to a remote-read automated metering network.

- **Flow Meters:**

  - Campus Standard: EMCO Sono-Trak™ Transit Time Ultrasonic Flow Meter. Model: ST-30.
  - Function: Non-invasive flow measurement with a transmitter with 2-line backlit display with 4-button keypad. Connect to Campus Energy Management System (EMS) by Siemens.
    - Execution: Locate on straight run of pipe with no flow interruptions such as valves or direction change. Installed location shall typically have straight uninterrupted pipe for 10 diameters upstream and 5 diameters downstream. Consult manufacturer's installation instructions for specific installation requirements and other piping configurations.
    - Website: http://www.emcoflow.com/em_prods/sono_trak.aspx

Keys for Cabinets and Padlocks:

- Campus Standards:
  - Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
  - Padlocks: Coordinate with Section 08 06 05 – Key Schedule.
- Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

23 05 53.13 Identification for Plumbing and HVAC Equipment:

Volume/Balancing Dampers:

- Plan Notations: Clearly identify on plans.
- Field Identification: Provide visible, accessible identification. Example: Bright-colored streamers.

Property ID Labels for Equipment:

- **Sample Specification Section:** Available from Facilities Planning & Capital Projects. Contact: Joel Neel @ 805-756-2193; Email: jneel@calpoly.edu
- Purpose: Maintenance tracking.
- Submittals:
  - List of Equipment for Property ID Labels:

    Submit list of equipment for Property ID Labels, including location, function, equipment manufacturer's name, and model and serial numbers for verification by Engineer.

After acceptance by Engineer: Submit hard and electronic copies for assignment of bar-coding identification numbers by Campus Facility Services.

- Samples:

  Submit two Property ID Labels.

o Closeout Submittals:

- Project Record Documents: Record actual locations of labeled items; include bar-code numbers, and provide as-built electronic copy of list of equipment with location, function, equipment manufacturer's name, and model and serial numbers.

o Pre-Installation Meetings:

- Convene minimum two weeks prior to commencing work of this section.

Labels:

o Description: Property ID Labels.

- Material: Anodized Aluminum.
- Size: 2 x 0.875 inches.
- Attachment: Adhesive backed.
- Message:

  Printed identification:

  First Line: "Cal Poly S.L.O. MEP"

  Second Line: "Facility Services"

  Bar code: Code numbers shall be provided by the University Facility Services via the Trustees Representative.

23 06 00 Schedules for HVAC

HVAC Piping and Pumps: [Hydronic Pump]

Flex Connectors / Expansion Joints:

o Campus Standard: Stainless steel T321 bellows type expansion joint with guide rods/travel stops.

o Campus Preferred Manufacturer: DME Incorporated model 551R fixed flange bellows type pump connector, type 321 stainless steel, ANSI 150 lb flanges with raised face, integral tie rod travel limits. Rated for operating pressure of 150 psi @ 800 degrees F.

- Website: http://www.dmeexpansionjoints.com/pump-connectors.htm

Summary:

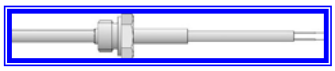
o Related Sections: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 09 00 Instrumentation and Controls for HVAC

23 09 13 Instrumentation and Control for HVAC: [Devices – Actuators and operators, Sensors and Transmitters, Control valves, Control dampers]

Temperature Sensors:

Resistance Temperature Detectors (RTD's):



- o Campus Standard: Siemens 1000 Ohm Platinum RTD, Model Number PTM6.2P1K.
  - Exception: Thermistors are required in some zone applications such as VAV boxes, and may only be used in those areas.
- o Function: Use for air handlers, Hot Water (HW) and Chilled Water (CHW). Do not install in piping tee. Connect to Campus Energy Management System (EMS) by Siemens.

Differential Pressure Sensors:

Resistance Temperature Detectors (RTD's):

- o Campus Standard: Emerson Process Management, Rosemount Model #1151 Pressure Transmitter. Connect to campus Energy Management System (EMS) by Siemens. Specify pressure range for 150% of maximum expected differential pressure.
- o Function: Measure differential pressure for monitoring and control of variable speed pumps.
- o Website: http://www.emersonprocess.com/rosemount/Products/Pressure/m1151.html

Motor Controls:

Variable Frequency Drives (VFD's):

- o Campus Standard: ABB ACH550. Enclosure: UL (NEMA) Type 12. Integral disconnect. No bypass. No known equal.
- o Function: Connect to Campus Energy Management System (EMS) by Siemens as a Field Level Network (FLN) device to provide direct communication (not hardwired start/stop/status). *Proof through drive and via current switches.*

23 09 23 Direct-Digital Control System (Energy Management) for HVAC:

Campus Requirements:

- o **Room Numbering Standard**: Siemens shall confirm room numbering with Campus Project Manager prior to initiating work.
  - **Note to Designer**: Campus has a Room Numbering Standard that must be used on all documents developed for a project. The Architect shall submit the floor plans showing the proposed room numbers to the Project Manager for review and approval. It is critical that the room numbering scheme be established and finalized before Siemens begins creating the point database, as room numbers are integrated into the point names in the Energy

Management System. Renumbering of rooms late in the design process can create significant rework by Siemens. .

Acceptable Control Contractor:

- Campus Standard: Siemens Apogee (no substitutions).

System Description:

- Connect to: Existing Campus Energy Management System by Siemens.
- Function: Control system 100 % DDC (Direct Digital Control). Modular Stand-along DDCP (Direct Digital Control Panel) capable of future BAS (Building Automation System) architecture with low/medium speed communication networks. BAS architecture to consist of communication network, user workstations, modular design DDCP with addressable and modifiable points from user workstations, or from master DDCP user interface panels; and be expandable for addition of hardware and software without removal of existing DDCP, sensors, actuators, and communication networks. Support and be capable of additional workstations, to systems maximum node capacity. System intelligence to allow user workstation(s) to program controls, perform analysis on field data, and generate maintenance and operational reports; and provide permanent program and data storage.
- Communication: Connect control panels to Campus EMS network via Ethernet. Provide each panel with an adjacent 2-port Ethernet face plate. Coordinate with Campus IT for available ports and IP addressing.
  - Note: Ethernet cable length (from Ethernet switch in IT closet) shall be 328 feet (100 meters), maximum.
- Field Panels:
  - Campus Standard: Siemens Apogee PXC Modular, flemible Direct Digital Control (DDC) supervisory field panel, and Siemens Apogee IX-I/O power and communication modules. **No substitutions allowed.**

Figure 1. PXC Modular.

TX-I/O Product Range

  - Application Specific Controllers: Field level network devices (VAV boxes, fume hoods, unit ventilators, air conditioning units, heat pumps, etc.) shall be controlled by a TEC (Terminal Equipment Controller) using the appropriate application.
  - Control Valve and Damper Actuators: Actuators shall be electronic.
    - Note: Pneumatic Actuators are Not Permitted.

23 09 93 Sequence of Operation for HVAC Controls:

Campus Requirements:

- **General**:
  - Control sequences are generally worded for direct acting type of control. Controls shall be direct or reverse acting to match the fail position of the actuator or device.

- EMS graphics for building shall include two dynamic link buttons—one will list sequence of operation in layman's terms, and the other, a legend, will list the point ID and corresponding definition.
- Setpoints and offsets shall be field adjustable at the controller for electronic controllers via PC communications port and from an operator's work station for DDC systems.
- Controls may use Proportional+Integral or Proportional+Integral+Derivative functions to maintain offsets specified, except as noted. Proportional control may be used for space temperature control and level control. Proportional+Integral+Derivative control shall not be used for flow control.
- Label function of all control panel alarms switches, indicators, and manual control devices. Label units of analog indicators.

o **Alarms**:

- Safety limit alarms shall be manually reset at sensor location. Other alarms may be automatically reset when measured value returns to its normal range or setpoint.
- Provide separate discrete inputs for each safety limit control loop to annunciate alarm conditions at workstations.
- Analog inputs shall have low/high alarm limits assigned to indicate non-normal operating conditions. Alarm limit values shall be adjustable by operator. Unless noted otherwise, use the following alarm limit values:

Water/liquid system temperature:	± 3°F from setpoint for 1 minute
Water/liquid system pressure:	± 10 PSIG from setpoint for 1 minute
Water/liquid system flow:	± 10% from setpoint for 1 minute
Water/liquid level:	± 10% from setpoint for 1 minute
Water/liquid pH/conductivity:	± 10% from setpoint for 1 minute
Air system temperature:	± 3°F from setpoint for 3 minutes
Air system flow:	± 10% from setpoint for 1 minute
Space temperature:	± 1°F from setpoint for 5 minutes
Space pressure:	± 0.01" W.C. from setpoint for 1 minute

- Alarms shall be logged into an alarm event database and shall be annunciated at designated work stations. Type of annunciation shall vary with alarm level type. (Level 1, 2, or 3. Refer to definitions.) Provide software variable to easily change level type for each alarm point.

o **Control Sequence**: Perform as follows.

o **General Unit Operations**:

- Lead/Lag Device Operation:

  The lead device is defined as the device which starts before any other system devices and stops after all other devices have stopped. The lag device(s) start after the lead device and stop before the lead device. If multiple lag devices exist, the first lag device shall start first, followed by the second, third, etc. Stopping shall occur in reverse order.

The device(s) shall be switched between lead and lag based on runtime. The device with the lowest runtime shall become the lead device when all devices are stopped. The device with the highest runtime shall become the lag device if all devices are operating. If the lead device runs continuously for 1 month, the lag device with the lowest runtime shall be started and the lead device shall be stopped. This lag device shall then become the lead.

On a failure of the lead device as measured by feedback instrumentation (e.g. a pressure switch across a pump, flow switch, current switch, or a motor starter contact), the lag device with the lowest runtime shall become the lead and started. The original lead device shall be disabled and a critical alarm shall be generated.

The operator shall have the ability to override operation through software in the control system.

- Variable Frequency Drive (VFD) Powered Equipment:

  Variable Frequency Drives (VFD) shall start at the minimum speed setting and shall ramp to the control point. Unless otherwise noted, the VFD shall ramp up and down full scale over 15 seconds. The VFD shall not be allowed to operate at less than 15 Hz. If an electrical disconnect is connected between the VFD and the equipment, the VFD shall not be allowed to operate if the disconnect is open.

- **Domestic and Industrial Hot Water System**:
  - Domestic and industrial water temperature shall be maintained at 120ºF, field adjustable by immersion thermostat modulating fail closed control valve(s) in water supply.
  - Provide single control valve as indicated on drawings.
- **Building Hot Water System**:
  - General:

    Hot water at 180°F will be supplied, via underground piping, from the campus central utility plant.

    Note: Building isolation valves need to be raised, accessible and housed in a covered box, flush with ground level.

    The existing outside air temperature (OAT) sensor for the BAS shall be used to measure OAT. When OAT is great than 60ºF, all building hot water valves shall close and hot water pumps shall be locked out.

    Building hot water pumps are in series with campus central plant hot water pumps. The following sequence assumes that the central plant pumps are designed to provide approximately 10 psi pressure differential at the building interface. The building hot water pumps, as described by the following sequence, shall operate only when this pressure difference cannot maintain adequate flow through the hot water coils in the system.

  - Heating Water Pumps:

    Refer to flow diagram.

    Hot water pump(s) shall be started and stopped automatically through building automation system.

When more than one pump is provided:

BAS shall equalize run times on pumps.

Provide software switch with override to select operating pump. Whenever operating pump fails as proven by LAN communication with VFD, standby pump shall start after 30 second time delay and failed pump shall be de-energized.

Pressure differential sensor/transmitter shall be installed across the hot water supply and return piping at a location representative of the furthest heating coil.

The following start-stop and pump speed control sequence is designed to minimize pump speed and energy consumption while assuring that the flow requirements are met for system coils. Setpoints and timing intervals shall be field-adjustable.

Normal pump VFD modulation: The control system shall monitor the required position of each hot water coil control valve in the system, as determined by the signal to the valve, and select the valve that is second most open. When building hot water pump is operating, the control system shall modulate the pump speed so that, if possible within the limits of the pump capacity, the second most open hot water valve in the system is between 90% and 95% open.

Pump Start: If the building hot water pump is not operating, and if any hot water valve is open more than 95%, the hot water pump shall be started.

Pump Shut Down: If the following 2 conditions exist for longer than 15 minutes, the pump shall be stopped: 1) The pump is at its minimum speed, and 2) The second most open hot water valve is less than 40% open, or as determined by the controls contractor to prevent pump short cycling.

- **Building Chilled Water System**:
  - General:

    Chilled water at 40ºF will be supplied via underground piping from the campus central utility plant.

    Note: Building isolation valves need to be raised, accessible and housed in a covered box, flush with ground level.

    Each building shall have its own OAT sensor. When OAT is below 50ºF, building chilled water valves shall close and chilled water pumps shall be locked out.

    Building chilled water pumps are in series with campus central plant chilled water pumps. The following sequence assumes that the central plant pumps are designed to provide approximately 6 to 8 psi pressure differential at chilled water coil. The building chilled water pumps, as described by the following sequence, shall operate only when this pressure difference cannot maintain adequate flow through the chilled water coils in the system.

  - Chilled Water Pumps:

    Refer to control diagrams.

    Hot water pump(s) shall be started and stopped automatically through building automation system.

When more than one pump is provided:

BAS shall equalize run times on pumps.

Provide software switch with override to select operating pump. Whenever operating pump fails as proven by LAN communication with VFD, standby pump shall start after 30 second time delay and failed pump shall be de-energized.

Pressure differential sensor/transmitter shall be installed across the chilled water supply and return piping in a location representative of the furthest cooling coil in order to monitor system.

The following start-stop and pump speed control sequence is designed to minimize pump speed and energy consumption while assuring that the flow requirements are met for system coils. Setpoints and timing intervals shall be field-adjustable.

Normal pump VFD modulation: The control system shall monitor the required position of each water hot coil control valve in the system, as determined by the signal to the valve, and select the valve that is second most open. When building chilled water pump is operating, the control system shall modulate the pump speed so that, if possible within the limits of the pump capacity, the second most open hot water valve in the system is between 90% and 95% open.

Pump Start: If the building chilled water pump is not operating, and if any chilled water valve is open more than 95%, the chilled water pump shall be started.

Pump Shut Down: If the following 2 conditions exist for longer than 15 minutes, the pump shall be stopped: 1) The pump is at its minimum speed, and 2) The second most open chilled water valve is less than 40% open, or as determined by the controls contractor to prevent pump short cycling.

- **Reheat Coils**:
  - Space thermostat shall modulate control valve (FO) to each coil to maintain space setpoint temperature.
- **Air Terminal Devices**:
  - General:

    Space temperature and ventilation control shall be DDC with electric actuation.

    Control Contractor shall furnish unit controls and actuators to air terminal device manufacturer for factory installation and adjustment.

    System shall be capable of remote setpoint change of the following parameters through the DDC panels and remote PC:

    Space temperature.

    Maximum and minimum flow rate for each supply and exhaust air valve.

    Space temperature setpoint shall be capable of adjustment between 55°F and 85°F with a throttling range of 10°F between full heating and full cooling.

Where heating and cooling devices are operated in sequence, each device shall have a separate space temperature setpoint. Cooling setpoint shall always be greater than the heating setpoint, with an adjustable deadband between.

Reheat coil control valves in laboratory spaces shall be normally closed. Those in non-laboratory spaces shall be normally open.

- Variable Volume Supply With Reheat - (Sequence 1):

  Supply air valve shall be pressure independent.

  Space temperature sensor shall modulate in sequence supply air valve and reheat coil control valve to maintain space temperature setpoints. On a drop in space temperature below cooling setpoint, supply air valve shall modulate from maximum to minimum air flow quantities as scheduled. On a continued drop in space temperature below heating setpoint, reheat coil control valve shall modulate open to maintain space setpoint temperature. On a rise in space temperature, the reverse shall occur.

- Constant Volume Reheat With Supply / Exhaust Air Tracking - (Sequence 2):

  Supply and exhaust air valve shall be pressure independent.

  Air flow sensors shall measure both supply and exhaust air flow rates. Air flow sensor shall modulate electric actuator on supply air valve to maintain constant volume air flow rate as scheduled. Exhaust air valve shall modulate in response to supply air valve to maintain scheduled cfm differential between measured supply and exhaust air flows.

  Where multiple supply and/or exhaust air valves are required to meet air flow requirements, associated air valves shall be modulated in parallel from the same control signal.

  Space temperature sensor shall modulate reheat coil control valve to maintain space temperature setpoint. Where reheat coils are not provided, this requirement does not apply.

- Variable Volume Supply With Cooling Only (No Reheat) - (Sequence 3):

  Supply air valve shall be pressure independent.

  Space temperature sensor shall modulate supply air valve to maintain space temperature setpoints. On a drop in space temperature below cooling setpoint, supply air valve shall modulate from maximum to minimum air flow quantities as scheduled. On a continued drop in space temperature below cooling setpoint, control valve shall maintain minimum position. On a rise in space temperature, the reverse shall occur.

- Constant Volume Reheat - (Sequence 4):

  Supply air valve shall be pressure independent.

  Air flow sensor shall measure supply air flow rate. Air flow sensor shall modulate electric actuator on supply air valve to maintain constant volume air flow rate as scheduled.

  When space temperature falls below heating setpoint, space temperature sensor shall modulate reheat coil control valve to maintain space temperature setpoint.

- **Air Handling Unit (AHU #):** [Note: Use where AHU provides heating, cooling and ventilation]:

  - General:

    Space temperature and ventilation control shall be DDC with electric actuation.

    System is designed as single duct, variable volume system.

    System is designed for minimum and maximum outside air with an economizer control.

    System fans consist of field built-up air handling unit supply fan and return fan.

  - Unit Operating Mode:

    In addition to the normal operating modes, system shall be provided with an emergency smoke control operating mode.

  - Unit Operation:

    Unit operation shall be automatic and activated through building automation system.

    During occupied cycle, unit supply and return fans shall operate continuously with outside air and relief air dampers open to their minimum positions and return air damper open fully, unless overridden by economizer or discharge air temperature controls.

    Unit discharge air temperature controller to operate as indicated under Unit Discharge Air Temperature Control.

  - Interlocking:

    Return fan shall be interlocked with supply fan so that return fan operates whenever supply fan operates. Return fan shall start before supply fan is allowed to start.

    Before each supply and return fan is allowed to start, respective fan discharge and return dampers shall be fully opened and be proven by end switches. Whenever fans stop, outside air and relief dampers shall close fully and return damper shall open fully.

    See humidifier sequence for humidifier lockout.

    If unit is shut down for any reason, a BAS Level 3 alarm shall alert the system operator that cooling for Elevator Machine Room is not available.

  - System Air Volume Control:

    Supply and return fan volume control will be accomplished using variable frequency drive(s). Arrange controls so that fans will start on low speed. On failure of fan volume control signal, fans shall go to low speed and stop. Speed setpoint signal input to VFD shall be communicated from Siemens field panel via FLN. Provide alarm indication to BAS for VFD fault indication.

    Provide static pressure sensing stations in supply duct where indicated on drawings. Pressure controller shall modulate supply fan VFD to maintain static pressure setpoint. Static pressure setpoint shall be reset to maintain the second most open VAV box between 90% and 95% open.

Supply and return fans shall be provided with flow stations to measure cfm of supply air, return air, and outside air.

Return Fan Speed Control: Modulate the return fan speed to track the supply fan volume less an amount equal to the calculated sum of building exhaust minus the differential necessary to maintain building pressurization.

For air handlers serving spaces such as gymnasiums, auditoriums, and theaters, provide a high quality CO2 sensor in the return air duct and configure controls to reset supply volume to maintain a maximum 800 ppm CO2 in the building return air.

- Unit Discharge Air Temperature Control:

  Unit discharge air controller shall modulate control valve on cooling coil to maintain discharge air temperature setpoint.

  Cooling coil control valve shall be locked in closed position whenever outside air temperature is below 60°F.

  Cooling coil control valve shall be closed whenever unit supply fan is not operating.

- Mixed Air / Economizer Control:

  Provide dry-bulb type economizer control.

  For outdoor air temperature below return air temperature, an air temperature sensor in the mixed air plenum shall modulate outside air damper to maintain mixed air temperature setpoint.

  When outside air dry-bulb temperature rises above return air temperature, control shall override mixed air control and open outside air damper to its minimum position as determined by the TAB contractor.

- Miscellaneous:

  Provide high static pressure limit switch located in unit discharge to shutdown unit supply fan when pressure exceeds high limit. Indicate alarm to BAS.

  Provide low static pressure limit switch located in inlet duct of return fan. Shutdown return fan when pressure falls below the low limit of negative pressure.

  Provide minimum position controller for outside air dampers.

o **Air Handling Unit (AHU #):** [Note: Use where AHU provides heating and ventilation, only]:

- General:

  System is designed as ventilation, heating only, single duct, [variable] *****[OR]***** [constant] volume system.

  System fans consist of modular air handling unit with supply fan.

- Unit Operating Mode:

  System shall operate with two modes; occupied and unoccupied cycle.

  In addition to the normal operating modes, system shall be provided with an emergency smoke control operating mode.

- Unit Operation:

  Unit operation shall be automatic and activated through building automation system.

  Building Automation System (BAS) will program time initiated functions.

- Interlocking:

  Return fan shall be interlocked with supply fan so that return fan operates whenever supply fan operates. Return fan shall start before supply fan is allowed to start.

  Before each supply and return fan is allowed to start, outside air damper shall be fully opened and be proven by end switches. Whenever fans stop, outside air dampers shall close.

- System Air Volume Control:

  During occupied mode, the supply fan continues to run, or is commanded on , which will open the outside air damper and, after fully open, a damper auxiliary switch starts the supply fan.

  During unoccupied mode, the supply fan stops. The outside air damper is fully closed.

- Unit Discharge Air Temperature Control:

  Unit discharge air controller shall modulate control valve on hot water coil to maintain discharge air temperature setpoint.

  Heating coil control valve shall be locked in closed position whenever outside air temperature is above 65°F. The BAS shall monitor all of the space temperatures shown on the plans for rooms served by this AHU.

o **Smoke / Fire Alarm Mode**:

- Smoke Detectors:

  Duct-mounted Smoke detectors will be furnished, installed, and wired to Fire Alarm Control Panel (FACP).

  The fire alarm system shall be interfaced to the air handling unit supply fan starter control circuit to shut down unit fan when Fire Alarm System is in alarm condition.

  Duct smoke detectors will be provided for all air handling units over 2000 cfm.

- Combination Fire / Smoke Dampers (Duct Mains and Occupancy Separation Walls):

  This specification applies to fire/smoke dampers located in ducts penetrating occupancy separation walls.

  Duct-mounted fire/smoke dampers will be provided under Section 23 33 00 – Air Duct Accessories.

  Provide interlock through FACP between fire damper and air handling unit fans serving respective system. Unit fan shall not be allowed to start until all system fire/smoke dampers have been opened.

Upon initiation of fire alarm mode control sequence, all AHU supply and return fans shall stop and their smoke/isolation dampers shall close, and then all combination fire/smoke dampers throughout the building shall close.

Fire alarm mode control sequence shall be terminated upon reset of fire alarm control panel. Fire alarm control panel will provide signal to BAS indicating panel has been reset. Following the fire alarm panel reset, air handling unit supply and return fans shall be automatically restarted through the BAS and other fire alarm control sequences shall revert back to normal operating sequences.

- **Return Fans**:
  - Return fan shall be electrically interlocked with associated air handling unit..
- **General Exhaust Fans (EF #)**:
  - General exhaust fans shall be started and stopped by the DDC system, based on the building occupancy schedule, or interlocked with the air handler associated with the same zone.
- **Restroom Exhaust Fans (EF #)**:
  - Restroom exhaust fans shall be started and stopped by the DDC system, based on the building occupancy schedule
- **Exhaust Fans (EF #)**:
  - Fume hood exhaust fans operate continuously, and are capable of being started and stopped by the DDC control system.

23 20 00 HVAC PIPING AND PUMPS

23 21 00 Hydronic Piping and Pumps

Hydronic Piping: [Underground, Aboveground, Ground-Loop Heat-Pump] _____

Hydronic Pumps: [In-Line Centrifugal Hydronic; Base-mounted, Centrifugal Hydronic; Vertical-Mounted, Double-Suction Centrifugal Hydronic; Vertical-Turbine Hydronic] ____

Summary:

- Related Sections: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 25 00 HVAC Water Treatment

Hydronic System:

Campus Requirements:

- **Water Treatment for Hydronic System**: Coordinate with Project Manager to obtain current vendor's product specifications for Contractor requirements on treatment for Hydronic System.
- **Campus Standard**: Water Treatment is provided by a vendor. Specifications shall include requirement for Contractor to treat the Hydronic System in accordance with the vendor's product specifications within a limited number of days after the system is charged. The specifications shall include flushing, passivation, treatment with a cleaner and scale inhibitor, and circulation through a temporary 20 micron, maximum filter set.

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 40 00 HVAC Air Cleaning Devices

23 41 00 Particulate Air Filtration

Campus Standard: Provide Merv 13 air filters, with extended surface for long life, and plastic reinforced frames to resist degradation due to coastal moisture. Specify filters with low pressure drop.

23 50 00 Central Heating Equipment

23 54 00 Furnaces

Campus Standard: Specify high efficiency (>90%) condensing furnace, with long life stainless steel heat exchanger.

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 60 00 Central Cooling Equipment

Campus Preferred Manufacturers: Carrier, York, or Trane.

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 70 00 Central HVAC Equipment

23 73 00 Indoor Central-Station Air-Handling Units

Campus Preferred Manufacturers: Trane, or Pace.

Heating and Cooling Coils:

4-Pipe verses 2-Pipe Interfaces:

- Campus strongly prefers to have separate heating and cooling coils. However, if coils serve both heating and cooling in a 2-pipe configuration, control and isolation valves shall prevent water flow from one closed loop system to the other using positive isolation switchover valves (such as motorized ball valves).

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

23 74 00 Packaged Outdoor HVAC Equipment

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

Thermostats:

- **7-day Programmable:**
  - Thermostats shall retain program and time settings during power failure without use of backup batteries.
  - If possible, thermostats shall be tied to Siemens Energy Management System (EMS), or be BacNET compatible.
  - Package or split air conditioning units shall have a minimum SEER of 17.0.

23 75 00 Custom-Packaged Outdoor HVAC Equipment

Summary:

- **Related Sections**: Section 23 05 53.13 – Identification for Plumbing and HVAC Equipment.

Unit Construction:

- **General**: Consider Campus preferences and proximity to coastal inland location.
  - Prefer Heavy-Duty enclosures, hardware, hinges, latches and gaskets. Goal is longevity, leak proof, and easy servicing.
  - Consider Copper and copper coils for longevity.
- **Products**:
  - Campus Preferred Manufacturers: Trane or Pace.
  - Unit Base – Fabricated from heavy-duty structural steel. Sized to provide floor height to accommodate cooling coil drain trap height. Weld steel solid at connection points. Size perimeter steel to allow for rigging and handling, and provide removable lifting lugs.
  - Unit Floor – Fabricated 16 gauge, minimum galvanized steel plate welded to structural members. Not acceptable - drive screw attachment. Seal floor joints and seams with acrylic latex sealant (ASTM C834-76 (1981), or polyurethane sealant, ASTM C-920, Type s, Grade NS, Class 25, USDA approved. Insulated floor and base drain pans to have same thermal and acoustical performance as per unit housing. Support insulation with 20 gauge, minimum galvanized steel liner with joints sealed to provide continuous vapor barrier.
  - Unit Housing – Fabricated of 2-inch thick, double wall, self-supporting with internal support structure or supported by structural frame work, modular panel type construction. Outer panel face 16 gauge G90 galvanized steel, minimum, and inner panel face 20 gauge G90 galvanized steel, minimum. Sealed inside and outside panel joints and seams with gasket and caulking to prevent air and water vapor leakage. Standing seam water-tight joints and sloped 1/8-inch per foot roof.
  - Access Doors – 24-inch by 72-inch access door with ¼-inch thick wire glass window, 12-inch by 12-inch, minimum, in each unit section. Thermal break construction to comply with Unit Housing. Door hardware includes corrosion resistant metal hinges, or continuous piano hinge, with 2 handles, minimum operable for either side of stainless steel, or aluminum alloy.

Division 24 – *Reserved for Future*

Division 25 – INTEGRATED AUTOMATION

25 00 00 INTEGRATED AUTOMATION

25 05 00 Schedules for Integrated Automation

CSU Building Metering Standards

Purpose:

- Performance evaluation and benchmarking of a building.
- Billing purposes.
- Measurement and verification of a building or building systems.
- Initiate demand side management programs.

Reference:

- "CSU Building Metering Guide"
  - "The purpose of this Guide is to assist CSU campuses in properly metering of utilities and other services at each building in the Campus." This Guide covers what utilities and services must or should be metered, what devices can be used for metering, and how these devices are to be commissioned and calibrated to ensure accurate data.
  - HVAC power shall be separately metered from lighting and plug loads.
  - Website: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf

LEED™ Energy & Atmosphere
Credit 5 – Measurement & Verification

NC – To provide ongoing accountability of building energy consumption over time.

EB - To allow for building system improvement over the building's life, proper metering and record-keeping will alert facility staff to possible deficiencies or other problems with the system so issues can be addressed and remedied.

Campus Requirement: Provide separate meters for domestic, special systems, and irrigation water.

Division 26 – ELECTRICAL

26 00 00 ELECTRICAL

Fire Ignition from Arc Flash:

- Campus Standard: Comply with NFPA 70E – Standard for Electrical Safety in the Workplace and IEEE 1584-2002 – Guide for Performing Arc Flash Hazard Calculations. Perform a Flash Hazard Analysis to determine the Flash Protection Boundary, incident energy exposure level, and personal protection equipment and clothing within the boundary. Specify Arc Flash Labeling and posting locations required by NEC.

26 05 00 Common Work Results for Electrical

Campus Standard:

- **Conductors:** 14 AWG and larger shall be stranded.
- **Armored Cable:** _____
- **Medium Voltage Distribution Cables:** 15KV rated.
- **Equipment Disconnects:**
  - "Heavy Duty" type, and fused disconnect switch. Equipment disconnect circuit breakers are not acceptable.
  - Conduit for Equipment Connections (equipment disconnect to equipment): Use Liquidtight Flexible Metal Conduit (Type LFMC).
- **Enclosures:** Provide a liquidtight sealing hub such as a Myers Hub for conduit entry into NEMA 3R, 4 and 12 enclosures.
  - Exception: Entering on the bottom into NEMA 3R enclosure.
- **Permitted with restrictions:**
  - Flexible Metal Conduit (Type FMC): For use in concealed locations only. Not permitted in installations requiring over 20 feet between accessible boxes, etc.
  - Rigid Nonmetallic Conduit (Type RNC) Schedule 40: For use below grade and inside poured concrete applications only. Not permitted where exposed to sunlight. Schedule 80 for applications where exposed, but use is discouraged.
  - Electrical Metallic Tubing (Type EMT): Not permitted in wet or outside locations. Permitted in exposed surface installations for labs, workshops, or similar occupancies 10 feet and above finished floor (AFF).
- **Not allowed:**
  - Armored Cable (Type AC).
  - Flat Cable Assemblies (Type FC)

LEED™ Energy & Atmosphere
Credit 5 – Measurement & Verification

NC – To provide ongoing accountability of building energy consumption over time.

EB - To allow for building system improvement over the building's life, proper metering and record-keeping will alert facility staff to possible deficiencies or other problems with the system so issues can be addressed and remedied.

Campus Requirement: Provide separate meters for domestic, special systems, and irrigation water.

- Flat Conductor Cable (Type FCC)
- Metal-Clad Cable (Type MC)
- Mineral-Insulated, Metal-Sheathed Cable (Type MI)
- Nonmetallic-Sheathed Cable (Type NM, NMC and NMS)
- Service-Entrance Cable (Types SE and USE)
- Underground Feeder and Branch-Circuit Cable (Type UF)
- High Density Polyethylene Conduit (Type HDPE)
- Nonmetallic Underground Conduit with Conductors (Type NUCC)
- Liquidtight Flexible Nonmetallic Conduit (Type LFNC)
- Electrical Nonmetallic Tubing (Type ENT)

Keys for Cabinets and Padlocks:

o Campus Standards:

- Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
- Padlocks: Coordinate need for and location of padlocks with Section 08 06 05 – Key Schedule.

o Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

26 05 33 Raceway and Boxes for Electrical Systems

Surface-Mounted Wire and Cable Management:

o **Purpose:** Wall mounted raceway for power and telecommunications.

o **Note:** Raceway shall have adequate volume behind jacks to allow required bend radius and cable pathway.

o **Campus Preference:**

- Manufacturer and Model: The Wiremold Company, Model - 4000 Designer Series Raceway.

  Website: http://www.wiremold.com

26 05 53 Identification for Electrical Systems

Identification Labels for Outlet Utilization Devices:

- **Purpose:** To label feeds to equipment disconnects, receptacles, etc. for maintenance and servicing of equipment.
- **Labels:** Permanently label device with panel and circuit feed identification.

Property Identification Labels for Equipment:

- **Sample Specification Section:** Available from Facilities Planning & Capital Projects. Contact: Joel Neel @ 805-756-2193; Email: jneel@calpoly.edu
- Purpose: Maintenance tracking.
- Submittals:
  - List of Equipment for Property ID Labels:

    Submit list of equipment for Property ID Labels, including location, function, equipment manufacturer's name, and model and serial numbers for verification by Engineer.

    After acceptance by Engineer: Submit hard and electronic copies for assignment of bar-coding identification numbers by Campus Facility Services.
  - Samples:

    Submit two Property ID Labels.
- Closeout Submittals:
  - Project Record Documents: Record actual locations of labeled items; include bar-code numbers, and provide as-built electronic copy of list of equipment with location, function, equipment manufacturer's name, and model and serial numbers.
- Pre-Installation Meetings:
  - Convene minimum two weeks prior to commencing work of this section.
- **Labels:**
  - Description: Property ID Labels.
    - Material: Anodized Aluminum.
    - Size: 2 x 0.875 inches.
    - Attachment: Adhesive backed.
    - Message:

      Printed identification:

      First Line: "Cal Poly S.L.O. MEP"

      Second Line: "Facility Services"

      Bar code: Code numbers shall be provided by the University Facility Services via the Trustee Representative.

26 06 00 Schedules for Electrical

Manufacturers:

- o Campus Standard: Campus prefers Square D.

06 09 00 Instrumentation and Control for Electrical Systems

Supervisory Control and Data Acquisition (SCADA):

- o Campus Standard:
  - General: Campus uses a SCADA system. Remote terminal units (RTUs) shall match the existing system.
  - Electric Meters**:** Square D Power Logic, Model PM820U, connected via Modbus plus to existing SCADA metering network, configured to match existing.
    - **Note to Engineer: Refer to and coordinate with Section 25 00 00 – Integrated Automation.**

26 10 00 MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION

26 11 00 Substations

Unit Substations:

- o Campus Standard
  - **Transformers:** Oil-filled transformers; outdoor pad mounted, or enclosed vault or room.

    Transformers shall be compliant with EPACT 2005.

    Pad-mounted Transformers**:** Provide radial feed bushings with individual high voltage selector switches and transformer primary cut out; use 200A load break bushings with no exposed high voltage terminations. Install on a transformer vault.
  - **Secondaries:** 600 Volt secondary main switch boards, switch boards, meter boards, panels and load centers located inside building.
  - **Not allowed:** Dry type medium voltage substations and outdoor secondary switchgear.
- o Submittals:
  - Submit documentation for General Electrician(s) performing high voltage work.
- o Qualifications for Installer: Installer shall be an employee of the Electrical Contractor (C10), have current certification by the California Department of Industrial Relations' Division of Apprenticeship Standards as a General Electrician, and have 5 years minimum verifiable experience performing high voltage terminations.

Summary:

- o **Related Sections**: Section 26 05 53.13 – Identification for Electrical Equipment.

26 13 00 Medium-Voltage Switchgear

Switchgear:

- Campus Standard: Canada Power Products Inc. http://www.canadapowerproducts.com/. Provide individual feed from switchgear for load over 100KVA transformer capacity added to campus distribution system.
- Provide three-phase, gang operated, 15kV, 60 Hz, dead front, single side access pad mounted sectionalizing switchgear, consisting of a single self-supporting outdoor enclosure, SF-6 insulated, vacuum interrupter switches and remote terminal unit (RTU) for SCADA control. Accessory components shall be completely factory-assembled and operationally checked. Interrupter switches and fuses shall be enclosed within an inner grounded steel compartment for electrical isolation and protection from contamination. Switch terminals shall be equipped with bushings rated 600 amp continuous. Fuse terminals and bus terminals shall be equipped with bushing wells rated 200 amp continuous to provide for elbow connection. Bushings and bushing wells shall be mounted on walls of inner compartment and shall extend into termination compartments. Termination compartments shall be provided as follows: one for each 3-phase switch, one for each three-phase set of fuses, and one for each 3-phase set of bus terminals.
- Each piece of switchgear shall have a maximum of three motorized switch ways and a maximum of three building feeder ways.
- New switchgear shall be installed on top of a pad mounted transformer vault to facilitate pulling and racking of medium voltage cable.

General:

- Related Sections: Section 26 05 53.13 – Identification for Electrical Equipment.

26 18 00 Medium-Voltage Circuit Protection Devices

Campus Standard:

- Coordination Study: Provide an Electrical Engineering Coordination Study to the first existing protective distribution device, minimum.

General:

- Related Sections: Section 26 05 53.13 – Identification for Electrical Equipment.
- Submittals: Submit Electrical Engineering Coordination Study.

Execution:

- Field Quality Control: Perform Electrical Engineering Coordination Study to insure new equipment coordinates with existing Campus equipment and selectivity on protective relays performs as engineered.
- Adjusting: Adjust protective relays in accordance with recommendations in Electrical Engineering Coordination Study.

26 18 29 Medium-Voltage Enclosed Bus

Service to Building and Lab Equipment:

- Campus Standard: Campus prefers bus ducts.

26 20 00 LOW-VOLTAGE ELECTRICAL DISTRIBUTION

26 24 00 Switchboards and Panelboards

Future Circuits:

- Campus Standard: Provide 20 percent space and load capacity at switchboards and panelboards for future circuits. Show locations on drawings.
  - Flush-Mounted Panelboards: Stub ¾-inch conduit per 5 spaces or spare circuits into first accessible space (and through fire walls).
  - Main Switchboards, Switchboards, Meterboards, Panelboards and Loadcenters (600V and under): Install in interior locations of the buildings. No equipment may be located outside.

26 27 00 Low-Voltage Distribution Equipment

26 27 26 Wiring Devices

Convenience Receptacles:

- Group II Equipment: Coordinate location, voltage and loads for circuits. Campus users typically move-in with more equipment than disclosed during programming and design so providing additional convenience receptacles should be discussed with Project Manager.

26 30 00 FACILITY ELECTRICAL POWER GENERATING AND STORING EQUIPMENT

26 32 00 Packaged Generator Assemblies

Emergency Generator:

- Campus Standard: The use of diesel generators greater than 50 hp is discouraged because of required APCD Permitting and Ongoing Emissions Source Testing. Consider the use of natural gas or propane fueled generators to reduce environmental impacts.
- If back-up power is supplied to the Telecommunication Rooms, then the lights and air conditioning should be tied to the back-up power. Coordinate with Telecommunications Engineer and Division 27 – Communications.

Summary:

- Related Sections: Section 26 05 53.13 – Identification for Electrical Equipment

26 50 00 LIGHTING

26 51 00 Interior Lighting

Lighting Design:

- Campus Room Standards:

  Telecommunication Rooms – Provide 50 foot-candles, 36 inches above the floor. Consider location of cable trays and racks in designing the lighting to meet the requirements. Telecom installers spend several hours working in the spaces to connect patch panels and cabling; labeling patch panels, and racks; and testing cables. If back-up power is supplied to the Telecommunication Rooms, then the lights and air conditioning should be tied to the back-up power. Coordinate with Telecommunications Engineer and Division 27 – Communications.

- CSU Sustainability Standard: Reduce number and/or wattage, wherever possible, to provide minimum, but adequate lighting levels consistent with the needs of instructional programs and state-mandated standards for the efficient and effective use of space. Lighting systems shall be of the latest energy saving technology. Purely decorative lighting is not allowed.
- Campus Sustainability Standard: Utilize energy efficient measures where possible following the recommended illumination levels of Illuminating Engineering Society of North America (IESNA).
- Examples: Maximize daylight penetration, provide task lighting to reduce ambient lighting, incorporate automatic lighting controls such as occupancy sensors, utilize fluorescent T-5 and T-8 lamps with electronic ballasts housed in high coefficient of utilization (CU) fixtures, etc.

  Consider Integrated Classroom Lighting System (ICLS) and Integrated Office Lighting System (IOLS) as developed by California Lighting Technology Center at UC Davis. Website:

  http://cltc.ucdavis.edu/images/images/Downloads/green%20lighting%20%E2%80%93%20getting%20beyond%20just%20cfls%20smaller.pdf
- Fixture Selection: Consider future supportability by manufacturer for replacement and parts in selecting uncommon lighting fixtures. Utilize Plug-and-replace wiring to make replacement and repairs easier and faster.
  - o High-Bay Spaces: Utilize T-5 or T-8 lamps rather than HPS.

Lighting Controls:

- o Campus Standard: Watt Stopper.
  - Website: http://www.wattstopper.com/
- o Design Considerations: Utilize for daylighting controls and occupancy sensors.
  - Classrooms, offices and conference rooms: Utilize control options that ensure required lighting levels by zone with dimming controllers. Provide dual technology occupancy sensors, and manual dimming and on/off controls switches.

    Example for Classrooms: 3 rows of 2500K T8 Lamps with 2 indirect for high level and 1 direct dimmable, blackboard fixture, occupancy sensor with 1 hour “quiet time” option, teacher-friendly control panel.

    Example for Offices: Task lighting combined with lower ambient light levels; 3, 6 and 9 watt desktop and under cabinet, and single power supply for a total of 21 watts. Consider the use of passive infrared sensors for small offices.
  - Restrooms: Consider the use of ultrasonic ceiling sensors.
  - Corridors: Programmable time clocks do not provide for after hours users. Consider the use of an easily accessible override panel or timer to turn on lights, or ultrasonic ceiling sensors.
  - Stairwells: Bi-level fluorescent lighting system. (Example: www.lamarlighting.com/occusmart)

26 52 00 Emergency Lighting

Power:

- Campus Standard: Provide emergency power via a central battery bank or generator. Consider use of a standby inverter, such as Myers Powers Products Emergency Lighting Inverters (micro-processor controlled, battery-based, centralized lighting power system). Website: www.myerspowerproducts.com
  - **Strongly Discouraged**. Individual backup battery fixtures (costly to service and experience high failure rates. UPS systems (high energy consumption and maintenance costs).

26 56 00 Exterior Lighting

Lighting Design:

- CSU Standard: Outside lighting on building exteriors and campus grounds shall be levels necessary to provide security and safety to promote confidence within the campus community. Purely decorative lighting is not allowed.

Lighting Controls:

- Campus Standard: Campus prefers control by photocell, astronomical clock, or Siemens Energy Management System (EMS) and a central photocell.
  - Note: Manual Time Clocks are not acceptable. Maintaining and updating them is time intensive.

Keys for Lighting Panels and Switches:

- Campus Standards:
  - Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
  - Padlocks: Coordinate with Section 08 06 05 – Key Schedule.
- Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

Division 27 – COMMUNICATIONS

CAMPUS DESIGN REQUIREMENTS FOR TELECOMMUNICATIONS:

CSU Design Standards

CSU Telecommunications Infrastructure Planning (TIP) Standard.

Note: TIP recommendations are to be implemented as the Campus minimum standards.

Website: http://www.calstate.edu/cpdc/ae/gsf/TIP_Guidelines/index.shtml

BICSI Telecommunications Distribution Methods Manual (TDMM), 11th Edition.

Website: http://www.bicsi.org/content/index.aspx?file=tdmpubs.htm

Design Engineer Qualifications

BICSI Registered Communications Distribution Designer (RCDD).

Contractor Submittals

In addition to review and acceptance by the Architect and Engineer, the Design Plans and later Construction Submittals, including Shop Drawings, shall be reviewed and approved by the Campus Communication Services Representative. Architect shall deliver copies to the Trustees Representative for forwarding onto the Campus Communication Services Representative. Construction work may not commence until approval of the submittals by the Campus Communication Services Representative.

Quality Control

Campus Communications Inspector

The work shall require Special Inspection by the Campus Communications Inspector, and shall be scheduled in advance through the Trustees Inspector.

Campus has had concerns in the past with unclear specifications and below standard installations. Telecommunications work is highly specialized and requires additional care and adherence to standards to provide trouble-free service to the Campus. Just as with other project work, the Trustees will withhold payment for work not completed to specifications. The Contractor shall be responsible to schedule inspections and insure that work is not covered before it is approved. Covered work will be required to be uncovered for inspection. Work not installed to CSU design requirements, Campus Standards and specifications will be removed, and replaced with work complying, and then re-inspected. Determination as to the acceptance of the work shall be by the Campus Communications Inspector. The specifications need to clearly include these requirements.

Moisture Intrusion

Piping

The telecom rooms and surrounding walls shall not contain floor drains, plumbing cleanouts, waste lines, wet standpipes, storm drain lines, roof drain lines, etc. Incoming Outside Plant (OSP) conduits shall be weather stopped. Coordinate with MEP Engineer.

Fire Sprinklers

Use dry pipe if fire sprinklers are required to prevent damage to telecom equipment from leaking pipes.

Work by Others

Scheduling

The Telecommunications System requires work to be performed by others to meet the full project completion deadline. The Contractor shall be responsible for working with Campus Telecommunication Services to schedule and coordinate the installation of equipment to insure an operating system by the project completion deadline. Telecom work needs to be performed concurrently with Contractor work on the project, and sufficient time allowed for installation and testing. The Consultants need to work with the Trustees Representative and Campus Telecommunication Services to understand the sequence for turn-over of completed spaces and durations of Campus telecom work. The specifications need to clearly include these requirements.

Telecommunication Spaces:

Refers to specific rooms or spaces dedicated to telecommunications services only. Telecommunication rooms shall open off a corridor or to the building exterior, and shall not be used to access other rooms. The three main categories of spaces are: (1) Service Entrance (room), (2) Equipment Room, and (3) Telecommunications Rooms. These spaces have a distinct function, but are all very inter-dependent, and shall be provided in university projects. A brief description and requirements for each of these "spaces" is listed below.

Service Entrance (Room):

Description:

- Room where outside cables are terminated and interconnected with backbone cables.
- Provides facilities and supporting hardware for large splice containers, cable termination mountings and possibly copper cable electrical protectors.
- If this is a stand-alone space, it is not expected to house any network or telecommunications equipment.

Design Requirements:

- Location:
  - Locate on a lower level and within fifty (50) feet of an outside wall.
  - Provide space with direct access to the inter-building (entrance) conduit.
  - Situate to provide a direct pathway to the equipment room or backbone (riser) distribution spaces.
  - Do not locate in, or directly adjacent to the building's electrical service entrance, transformer room or mechanical room.
- Size:
  - Stand-alone Service Entrance Room: Provide 5 feet by 7 feet, minimum for a 10,000 square feet or smaller building. Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, patch panels, blocks, etc. See TIP for additional detailed space information.

- Doors and Door Hardware:
  - Doors shall open outward.
  - Doors shall be secured with a 112-series key lock.
  - Coordinate key lock with Architect and work in Section 08 21 00 – Door Hardware.
- Environment:
  - Stand-alone Service Entrance Room: No special air handling required. Provide environment same as for a standard office of equivalent size. Air conditioning needs to be independently controlled.
  - Coordinate with Mechanical Engineer and work of Division 23 – Heating, Ventilating and Air Conditioning.
- Grounding:
  - Route building ground cable to the Service Entrance (Room) to connect telecommunications master grounding bar.
- Electrical:
  - Provide 2 dedicated 20 amp circuits.
  - Coordinate with Electrical Engineer and work of Division 26 - Electrical.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Equipment Room (Building's Main Telecommunication Room):

Description:

- Centrally located; houses telecommunications network equipment to service users throughout the building.
- Equipment housed in room: Telephone equipment, local area network switches, video distribution equipment, and cable interconnect and cross-connect hardware.

Design Requirements:

- Location:
  - Locate near Service Entrance Room.
  - Provide access from outside the building to allow for installation of large equipment cabinets (36" wide by 96" tall).
  - Multi-story Buildings: Stack and locate Equipment Room and Telecommunication Rooms near the center of the building; within 290 feet, maximum cable pathway distance to furthermost user outlet. The average cable pathway distance shall be 150 feet or less.
  - Plumbing Pipes & Fixtures: Do not place water or drainage pipes directly over, or near Equipment Room. (Coordinate with Mechanical Engineer and work of Division 22 – Plumbing.)
  - Electrical & Equipment Interference: Do not place Equipment Room adjacent to potential sources of electrical interference, such as electrical power supply transformers, motors, generators or elevator equipment. (Coordinate with Electrical Engineer and work of Division 26 – Electrical.)

- Size:
  - When Combined With Service Entrance Room: Provide an additional 200 square feet, minimum.
  - Stand-alone Room: Provide 10 feet by 15 feet, minimum.
  - Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, patch panels, blocks, etc.
  - See TIP for additional detailed space information and other design factors that could increase room size requirements.
- Finishes: Keep space opened from floor to ceiling. Do not provide a false ceiling.
- Structural Loading: Provide floor loading of 100 pounds per square foot (distributed loading), minimum. (Coordinate with Structural Engineer.)
- Doors and Door Hardware:
  - Doors shall open outward.
  - Doors shall be secured with a 112-series key lock. (Coordinate key lock with Section 08 21 00 – Door Hardware.)
- Environment:
  - Provide positive airflow and cooling, even when the main building systems are shut down. Air conditioning needs to be independently controlled.
  - Consider separate air handlers or stand-alone cooling systems, thermostatically controlled and designed to operate 24 hours per day, 365 days a year.
  - If served by an auxiliary power supply, connect air handling systems to backup power generation system.
  - Coordinate with Mechanical Engineer and work of Division 23 – Heating, Ventilating and Air Conditioning.
    - Provide air changes to exhaust fumes from UPS batteries (hydrogen gas) to meet indoor air quality standards.
- Grounding:
  - Route building ground cable to the Service Entrance (Room) to connect telecommunications master grounding bar.
- Electrical:
  - Provide 225 amp, 208V Panel, possible new transformer.
  - Provide 30-minute battery backup system (uninterruptible) power with capacity to support 3 times the planned capacity.
  - Coordinate with Electrical Engineer and work in Division 26 - Electrical.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Telecommunications Room:

Description:

- Supports cable and equipment between the Equipment Room (building main telecommunications room) and User (Station) Locations.
- Space to terminate the cables from station outlets and backbone (riser) systems and house the local area network equipment, phone equipment, cable cross-connects and video distribution equipment.

Design Requirements:

- Location:
  - Multi-story Buildings: Stack and locate Equipment Room and Telecommunication Rooms near the center of the building; within 290 feet, maximum cable pathway distance to furthermost user outlet. The average cable pathway distance shall be 150 feet or less.
  - Dedicated Room: Room shall not be shared with electrical, janitorial, fire alarms, security systems or storage.
  - Overhead Obstructions: Eliminate.
  - Damage or Interference from Other Sources:
    - Plumbing Pipes & Fixtures: Do not place water or drainage pipes directly over, or near Telecommunications Room. (Coordinate with Mechanical Engineer and work of Division 22 – Plumbing.)
    - Electrical & Equipment Interference: Do not place Telecommunications Room adjacent to potential sources of electrical interference, such as electrical power supply transformers, motors, generators or elevator equipment. (Coordinate with Division 26 – Electrical.)
    - Dust, Airborne Contaminants and Physical Hazards: Do not place Telecommunications Room where potential for dust, contaminants or physical hazard may occur.
- Size:
  - Room: Provide 8 feet by 10 feet, minimum.
  - Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, patch panels, blocks, etc.
  - See TIP for additional detailed space information and other design factors that could increase room size requirements.
- Finishes:
  - Keep space opened from floor to ceiling. Do not provide a false ceiling.
  - Provide sealed concrete or tiled floor; carpeting not allowed.
  - (Coordinate with Division 9 – Finishes.)
- Doors and Door Hardware:
  - Doors shall open outward.
  - Doors shall be secured with a 112-series key lock. (Coordinate key lock with Section 08 21 00 – Door Hardware.)
- Environment:
  - Provide positive airflow and cooling, even when the main building systems are shut down. Provide environment same as for a standard office of equivalent size. Air conditioning needs to be independently controlled.
  - Consider separate air handlers or stand-alone cooling systems, thermostatically controlled and designed to operate 24 hours per day, 365 days a year.
  - Coordinate with Mechanical Engineer and work of Division 23 – Heating, Ventilating and Air Conditioning.
- Lighting: Provide 50 foot-candles at 36 inches above the floor. Consider location of cable trays and racks in designing the lighting to meet the requirements. Telecom installers spend several hours working in the spaces to connect patch panels and

cabling; labeling patch panels, and racks; and testing cables. Coordinate with Electrical Engineer and Section 26 51 00 – Interior Lighting.

- Electrical:
  - Provide 100 amp, 208V Panel, possible new transformer.
  - Provide 30-minute battery backup system (uninterruptible) power with capacity to support 3 times the planned capacity.
  - Coordinate with Division 26 - Electrical.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Telecommunications Pathway "Spaces" for Interbuilding Distribution System: See Division 33 – Utilities. Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, etc.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Telecommunications Pathway "Spaces" for Intrabuilding Backbone:

Description:

- Horizontal and vertical pathways in building distribution system.
- Used for placement of telecommunications media between Service Entrance Room, Equipment Room and Individual Telecommunication Room(s).

Design Requirements:

- Vertical Backbone (riser) Conduits: Provide three conduits, minimum. Refer to TIP Standards for other design factors that could increase the number of conduits.
- Pull Boxes: Provide in conduit runs 100 feet or greater, and where there are more than 2 – 90 degree bends. Cable Slack: Provide one complete wrap inside pull box.
- Size:
  - Backbone Conduits and Sleeves: 4-inch, minimum.
  - Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, patch panels, blocks, etc.
- Cable Fill: 40 percent, maximum.
- **Prohibited:** Using Telecommunications Pathways for other purposes, such as Fire Alarm, Security Alarm, Building System Controls, Security Camera Power, and Video Signals.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Horizontal Pathways:

Description:

- Facilities supporting installation and maintenance of cables between Telecommunications Room and Station Outlet Locations.

Design Requirements:

- Cable Tray:
  - Solid bottom, aluminum, NEMA Class Designation 12B (75 pounds per linear foot).
  - 18 inches wide; and 3 inches deep, minimum.
  - Seismic Bracing Standards: Install to prevent horizontal, lateral and vertical movement for Seismic Zone 4.
  - Refer to TIP Standards for additional information.
- Grounding and Bonding: Provide continuous bonding of pathways. Refer to Section 27 05 26 – Grounding and Bonding, and TIP Standards.
- Size: Allow 25%, minimum for future expansion for pathways, wall penetrations, patch panels, blocks, etc.
- Cable Fill: 40 percent, maximum.
- Wall Outlet:
  - Outlet Box: 4 11/16 inch square.
  - Conduit: 1 ¼-inch conduit installed with a total of 180 degrees of bend, maximum.
  - Protective Bushings: Provide at ends of conduit and penetrations.
  - **Prohibited**: Daisy-chained and back-to-back mounting using a common feeder conduit.
- Floor Boxes:
  - Outlet Box: Sized to meet Cat 6 standards.
    Note: Depending on the configuration, floor boxes are usually too small for the required services, and services end up being dropped from the ceiling or provided by another means. Engineer needs to confirm the amount of services allow for the Cat 6 to be installed without compromising the cable signals.
  - Conduit: 1 ¼-inch conduit installed with a total of 180 degrees of bend, maximum.
  - Protective Bushings: Provide at ends of conduit and penetrations.
  - **Prohibited**: Daisy-chained and back-to-back mounting using a common feeder conduit.
- **Prohibited:** Using Telecommunications Pathways for other purposes, such as Fire Alarm, Security Alarm, Building System Controls, Security Camera Power, and Video Signals.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Technology Instructional Spaces:

Description:

- Spaces with a significant amount of network, computing and display hardware to secure and connect to equipment within the room and to the Telecommunications Room.
- **Note:** This is not telecommunications space, but it has critical, functional requirements that may not be listed in other program documents. A Technology Instructional Space is a room with a heavy concentration of computer workstations

where students and the instructor utilize this equipment on a regular basis. This can range from a few high-end computing platforms used for specific applications, to a general use computing lab or a lecture hall with facilities for student access to power and network services.

Design Requirements:

- Location:
  - Phone Outlet: Locate near an exit door.
- Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, etc.
- Refer to TIP Standards for other design requirements.
- Environment:
  - Provide air handling capacity to accommodate heat generated by network, computer and display hardware.
  - Coordinate with Mechanical Engineer and work of Division 23 – Heating, Ventilating and Air Conditioning.
- Electrical:
  - Provide 1-20 amp dedicated circuit per 4 workstations.
  - Provide 1-20 amp dedicated circuit per 2 printers.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

Office, Classroom and Laboratory Spaces:

Description:

- Offices: Provide two 3-port telecommunications outlets, on opposite walls near electrical outlets.
- Larger Offices and Open Suites: Provide one 3-port telecommunications outlets per 75 square feet, minimum, but no less than one outlet for every two electrical outlet.
- Classrooms and Labs:
  - Provide one phone outlet near an exit door.
  - Provide additional telecommunications outlets in every classroom and lab.
  -
  - See TIP for additional classroom and laboratory design factors.
- Size: Allow 25%, minimum for future expansion for infrastructure, pathways, wall penetrations, etc.

Installation Requirements:

- Comply with BICSI TDMM, 11th Edition.

27 00 00 COMMUNICATIONS

27 05 00 Common Work Results for Communications

27 05 26 Grounding and Bonding:

Sample Specification Section: Available from Facilities Planning & Capital Projects. Contact: Joel Neel @ 805-756-2193; Email: jneel@calpoly.edu.

Design Standards:

- **Grounding**: Ground **all** equipment racks, ladder racks, pathways and penetrations to the Telecommunications Main Grounding Bus Bar (TMGB). Proper grounding of telecommunications related infrastructure requires a very specific design prepared in coordination with (but separate from) the overall electrical grounding system within a building. Refer to TIP Standards – Telecommunications Grounding System, Page 3-11.
- **Telecommunications Bonding Backbone (TBB)**:
  - Standard: TIA/EIA 607.

Performance Requirements:

- **Grounding System Resistance**:
  - 5 ohms, maximum per NEC.

Quality Assurance:

- **Comply with**:
  - Grounding, Bonding and Electrical Protection Chapter of the TIP Standards (Latest version), BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

Wire:

- **Material**: Stranded copper.
- **Grounding Conductor**: Copper conductor insulated (white and gray).
- **Bonding Conductor**: Copper conductor bare and insulated (green).

Mechanical Connections:

- **Product Description**: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

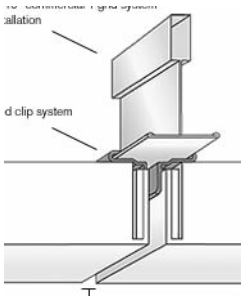
Installation:

- Install in accordance with TIP Standards, BICSI TDM Manual, TIA/EIA 607, and NFPA 70.
- Cables and bus bars: Identify and label per Section 27 05 53 – Identification for Communications System.
- Permanently attach equipment and grounding conductors prior to energizing equipment.

Field Quality Control:

- **Test**:
  - In accordance with TIP Standards, BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

27 05 28 Pathways for Communications System



Design Standards:

- **Pathways**: Each pathway must be continuous, accessible, viable and usable after completion of the construction. Provide entry and exit points for each section of pathway. Pay special attention to fire-rated and plenum ceilings where hold down clips are used on acoustical tiles making access difficult without damaging the ceiling tiles.
- **Telephone Termination Backboards**:
  - Provide fire retardant treated; ¾ inch thick, 8-foot high plywood on all walls in the telecom rooms, starting 4-inches above floor.
  - Paint: Intumescent Systems:

    Benjamin Moore & Company:

    Primer: Moorcraft Super Spec Alkyd Enamel Undercoater & Primer Sealer (C245).

    1st and 2nd Coats: 200 Latex Fire Retardant Coating (M59).

    Contego International, Inc. and Zinsser Company, Inc.

    Primer: Zinsser Bulls Eye 1-2-3, Kilz Premium.

    1st and 2nd Coats: Contego Intumescent Latex (Thin Film).

    Color: White.

27 05 28.36 – Cable Trays for Communications Systems:

- **Metal Ladder-Type Cable Tray**:
  - Manufacturers:

    Chatsworth Products, Inc., Model Telco-Style Cable Runway (Phone: 800-834-4969; Website: www.chatsworth.com)

    Cooper B-Line, Inc., Model Two-Side Rail System (Phone 618-654-2184; Website: www.g-line.com)

    Substitutions: Section 00 63 00 – Clarification and Modification Forms] *****[OR]***** Section 00 63 25 – Substitution Request Form (During Construction).
  - Project Description:

    NEMA VE 1, Class 12C ladder type tray.

    Material: Steel.

    Inside Width: 12 inches, minimum.

    Inside Depth: 1½ inches.

    Straight Section Rung Spacing: 12 inches on center.

    Furnish manufacturer's accessories, including wall support brackets, connectors, hold-down clamps, grounding clamps, bonding jumpers, and color – gray.

27 05 53 Identification for Communications

Campus Standards:

- **Labeling**: Nomenclature and location shall follow Campus requirements exactly.

Products:

- **Manufacturers**:
  - Anthony-Lee Associates, Inc. (Phone: 800-275-8911; Website: www.anthony-lee.com)
  - Impact, Inc. (Phone: 877-549-7600)
  - Sharpmark USA (Phone: 407-321-7394;
  - Other acceptable labeling systems:

    Systems provided by manufacturer with equipment, such as protectors, termination blocks, punch down block, racks, and modular patch panels, specified in Section 27 13 43 – Communications Services Cabling
- **Nameplates**:
  - General: Engraved laminated plastic nameplate fastened with adhesive. Size: ½ inch high letters. Color: Black lettering on yellow background. Legend: Cable trays, existing and new.
  - Message:

    WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!
- **Labels**:
  - General: Size as required for message. Color: Black lettering on white background. Mechanically produced labels. Text Size: ½ inch high letters, minimum, except as approved by Trustees. Legend: Refer to Schedules and drawings.
  - Message: Refer to Schedules and drawings.
- **Cable Markers**:
  - Wrap-Around Type: Vinyl or polyester. Self-laminating, wrap-round style with clear portion wraps around cable and laminates legend. Use before or after termination. Size: Length to completely wrap around cable and laminate legend. Width to allow 1/8 inch space between edges and text.
  - Split sleeve Type: Heat shrink polyolefin. Slip over open end of cable: full-circle. Use before termination. Size: Length as recommended by Manufacturer. Width to allow 1/8 inch space between edges and text.
  - General: Color: Black lettering on white background. Mechanically produced labels. Test size: ¼ inch high letters, minimum, except as approved by Trustees.
  - Legend: Backbone Cable between Campus Telephone Utility connection and Building Service Entrance. Riser Cable within Building between Main

Data Frame Room#_____ and Telecom Room#_____. Horizontal Cable to each outlet from Main Data Frame Room #_____ and Telecom Room #____.

- Message: Refer to Schedules and drawings.

o **Stencils**:

- General: Clean cut symbols and letters. Size: 1 inch high letters. Colors: Black lettering on white background.
- Stencil and Background Paint by Manufacturers:

  Benjamin Moore & Company (info@benjaminmoore.com)

  Frazee Paint and Wall Covering (mbrower@grazee.com)

  The Sherwin-Williams Company (www.sherwin-williams.com)

  Substitutions: Section 00 63 00 – Clarification and Modification Forms] *****[OR]***** Section 00 63 25 – Substitution Request Form (During Construction).
- Painting Systems:

  Benjamin Moore: Primer – Eco Spec Interior Latex Flat 219; 1st and 2nd Coat, and Stencil lettering – Eco-Spec Latex Semi-Glass 224.

  Frazee Paint: Primer – 066 Envirokote Primer; 1st and 2nd Coat, and Stencil lettering – 032 Envirokote SG.

  Sherwin-Williams: Primer – S-W PrepRite Masonry Primer; 1st and 2nd Coat, and Stencil lettering – S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series.
- Legend: Vault Walls at Ducts for Backbone Cable between Campus Telephone utility connection and Building Service Entrance.

Installation:

o **Rack Labeling Installation**:

- Order of labeling: Labeling and layouts shall be placed in ascending alpha-numerical order.

1
2
3
4

or

1A
1B
1C
1D

- Refer to Schedules for examples. Provide label for each Rack. Place label at top, front of Rack, except if label is obscured from view, place on ladder raceway, centered directly above Rack.
- Examples: **RACK 1, RACK 2, RACK 3,** etc.

- **Patch Panel Labeling Installation**:
  - Center on extreme left and right edges on each Panel where space is available. Do not cover individual Port Labeling areas. Start at top of Rack and label sequentially downward, except do not count the following types of items as "Panels:"

    Horizontal Wire Management at top, bottom and between each Panel and Active Device.

    Active Devices – Hubs Switches, Routers, UPS's, etc.
  - Label: **R**ack # **P**anel #

    Examples: **R1P1, R1P2, R2P2**
- **Patch Panel Port Labeling Installation**:
  - Label each Port.
  - Label (Port to Faceplate in Rooms): Room # and Faceplate / Jack #.
  - Label (Individual Ports): **R**ack # **P**anel # **P**or**t** ##.

    Examples: **R1P1t01, R1P2t02, R2P3Pt18**

27 10 00 STRUCTURED CABLING

Cabling – Voice and Data

There is no differentiation between voice and data on structured cabling. Category 6 cable may be used for either or both. For example, a 4-port communication faceplate may have 3 data and 1 voice.

Related Sections:

07 84 00 Firestopping - Existing and new firestopping at fire rated openings for conduit and cable trays.

Note: Campus Preference for wall and floor penetrations of cabling for telecommunications, fire alarm and security is Specified Technologies Inc., EZ Path Fire Rated Pathways Model Series.

27 11 00 Communications Equipment Room Fittings

27 11 13 Communications Entrance Protection

Protectors (Copper Cable):

- **Manufacturer:**
  - **Not Recommended**: Circa.
- **189 ET1 Building Entrance Terminals:**
  - Steel; five-pin tin/lead alloy plated contact over spring tempered phosphor base metal with an operating temperature of -13 degrees F to 149 degrees F. UL 497 Listed for Primary Protection. 100 pair configurations. 5-pin gas-tube unit protectors. Input Stubs – 710 Style Connector and Output Stubs 66 Style Termination Block.

27 11 16 Communications Cabinets, Racks, Frames and Enclosures

Rack Mounted Fiber Optic Cabinet

- **Description:**
  - Optical fiber enclosure to house fiber pigtails fused to optical cable terminated with SC and ST connectors.
- **Manufacturer:**
  - Panduit – Substitutions are not permitted.

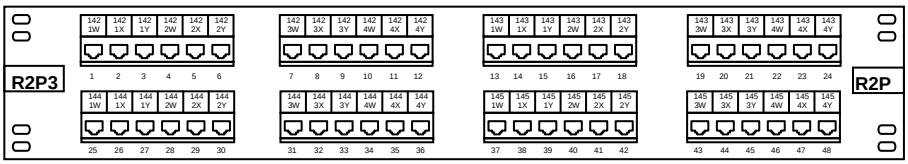
Racks

- **Campus Standards:**
  - Provide 6 inches vertical wire management on both side, front and back of each equipment rack.
  - Provide non-coated racks and star washers. Note: No painted or coated equipment racks and accessories.
  - Racks shall be installed plumb, true and square, otherwise equipment doesn't fit into the racks.
- **Description:**
  - Mounting Brackets for mounting cable tray ladder rack to top of rack. Mill Finish Aluminum and Velcro cable ties.
- **Free-Standing Racks:**
  - Front and Rear channels complying with ANSI/TIA/EIA 568-B.1. Top Cable Trough with waterfall and built-in Path/Horizontal Cable Distribution Separator. EIA Hole Pattern front and rear with 19-inch assembly, vertical patch cord cable management rings, pre-drilled base for floor attachment, and 7-foot (45 rack units).

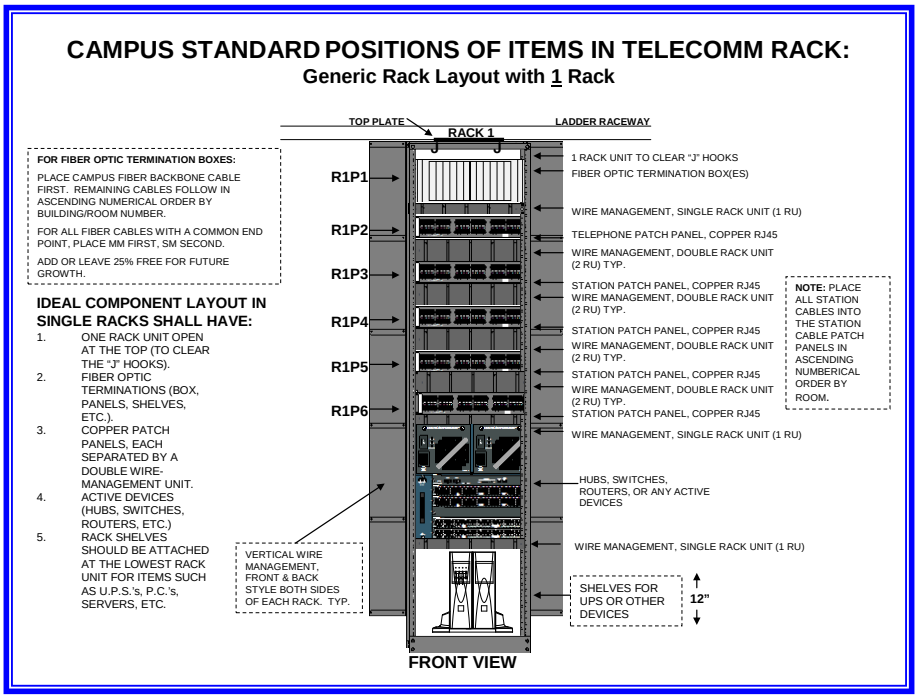
27 11 19 Communications Termination Blocks and Patch Panels

Campus Design Standards

- **Submittals:**
  - Shop Drawings: Patch panel and rack layouts. Campus Telecommunications Representative shall review and approve shop drawings.
- **Patch Panels:**
  - Preferred Manufacturer: AMP.
  - Provide 48 ports.
  - **Note**: 24 ports not allowed.



- Provide two rack units (RU) horizontal wire management above, below and between **all** patch panels. Refer to the "Campus Standard Positions of Items in Telecomm Rack."



Termination Blocks

o **Campus Standards:**

- 66 Block / Rack Patch Panel for voice grade Telecom cabling to equipment racks. **Note:** 110 blocks are no longer used, and are not permitted.

o **Description:**

- Punch Down Block: 66M1-50 Cross Connect Blocks, 50-pair.

Modular Patch Panels

o **Description:**

- Category 6 Horizontal Patch Panels with rack-mounted assembly of terminals and accessory patch cords. 48 ports, 3.5 inches high by 19 inches wide. Comply with ANIS/TIA/EIA 568-B.2-1.

27 13 00 Communications Backbone Cabling

27 13 43 Communications Services Cabling

General:

o **System Description**:

- Comply with TIP Standards. Exception: Terminate Multimode fibers with ST connectors, and singlemode fibers with SC connectors.

- Backbone Cable: Use OSP UTP (Outside Plant, Twisted Pair) and optical fiber backbone cables between Campus Telephone Utility connection and Building Service Entrance. Utilize fusion splices and pigtails, only.

- Coordinate work with Section 07 84 00 – Firestopping.

Products:

o **Backbone Cable**:

- Description:

  OSP UTP Cable: TIA/EIA 568, 150-ohm, twisted-pair cable, pairs sized as per TIP Standards, 24 AWG copper conductor.

  Optical Fiber Cable: UV-Resistant, Flame Retardant Outer Jacket, Gel-free design fully waterblocked using craft-friendly, water-swellable yarns and Tape, 3.0 mm buffer tube, fillers, ripcords, dielectric cable construction and central member, color-coded fibers and buffer tubes, UL Listed (OFNR and FT-4). Prefer Hybrid consisting of Multimode and Single Mode Fibers configured as follows: Multimode Fiber to be 62.5/125 µm (850/1300 nm) fiber type, 3.5/1.0 dB/km maximum attenuation, 200/500 MHz•km minimum OED Bandwidth, 220/ - MHz•km minimum effective Modal Bandwidth, 300/550 m serial gigabit Ethernet distance, and 33/ - m serial 10 gigabit Ethernet distance. Single Mode Fiber to be 1310/1383/1550 nm fiber type, 0.4/0.4/0.3 dB/km maximum attenuation, 5000/ - / - m serial gigabit Ethernet distance, and 10000/40000m serial 10 gigabit Ethernet distance. Contractor's Option is to provide Optical Fiber Cable for Backbone Cables as either "Hybrid" or separate Multimode Fiber and Single Mode Fiber Cables.

- Manufacturer:

  Optical Fiber Cable: Corning Cable Systems – FREEDM Loose Tube Gel-Free Cables. Substitutions must be submitted for Campus approval, and manufacturer must be an ISO 9001 registered company.

Execution:

o **Prohibited**: Sharing pathways and fire-rated penetrations with other than telecommunications cabling.

o **Installation**:

- Install per TIA/EIA 568-B.1, and manufacturer's installation instructions.
- Install following BICSI installation guidelines.
- Cable Slack:

  Telecom Rooms: 1 times perimeter of room; 30 feet, minimum.

  Vaults: 1.5 times perimeter of vault; coil around vault on wall.

27 14 00 Communications Riser Cabling

General:

o **System Description**:

- Comply with TIP Standards. Exception: Terminate Multimode fibers with ST connectors, and singlemode fibers with SC connectors.
- Cable:

  Riser Cable: Use UTP (twisted pair) and optical fiber backbone cables within building between Main Data Frame Room and Telecom Room.

- **Riser Cable**:
  - Description:

    Unshielded Cable: TIA/EIA 568, 150-ohm shielded, twisted-pair cable, 100 pairs, 24 AWG copper conductor.

    Optical Fiber Cable: UV-Resistant, flame retardant outer jacket, gel-free design fully waterblocked using craft-friendly, water-swellable yarns and Tape, 3.0 mm buffer tube, fillers, ripcord, dielectric cable construction and central member, color-coded fibers and buffer tubes, UL Listed (OFNR and FT-4). Prefer Hybrid consisting of Multimode and Single Mode Fibers configured as follows: Multimode Fiber to be 62.5/125 µm (850/1300 nm) fiber type, 3.5/1.0 dB/km maximum attenuation, 200/500 MHz•km minimum OED Bandwidth, 220/ - MHz•km minimum effective Modal Bandwidth, 300/550 m serial gigabit Ethernet distance, and 33/ - m serial 10 gigabit Ethernet distance. Single Mode Fiber to be 1310/1383/1550 nm fiber type, 0.4/0.4/0.3 dB/km maximum attenuation, 5000/ - / - m serial gigabit Ethernet distance, and 10000/40000m serial 10 gigabit Ethernet distance. Contractor's Option is to provide Optical Fiber Cable for Riser Cables as either "Hybrid" or separate Multimode Fiber and Single Mode Fiber Cables.

  - Manufacturer:

    Optical Fiber Cable: Corning Cable Systems – FREEDM Loose Tube Gel-Free Cables. Substitutions must be submitted for Campus approval, and manufacturer must be an ISO 9001 registered company.

- **Cable Strain Relief**: For vertical cable risers.

Execution:

- **Prohibited**: Sharing pathways and fire-rated penetrations with other than telecommunications cabling.
- **Installation**:
  - Install cable strain relief on vertical cable risers.
  - Install per TIA/EIA 568-B.1, and manufacturer's installation instructions.
  - Install following BICSI installation guidelines.
  - Cable Slack:

    Telecom Rooms: 15 feet, minimum; coil in Cable Tray.

27 15 00 Communications Horizontal Cabling

General:

- **System Description**:
  - Comply with TIP Standards. Exception: Terminate Multimode fibers with ST connectors, and singlemode fibers with SC connectors.
  - Horizontal Cable: Use Cat 6 cables to each work area outlet from Main Data Frame Room and Telecom Room(s).

Products:

- **Horizontal Cable**:

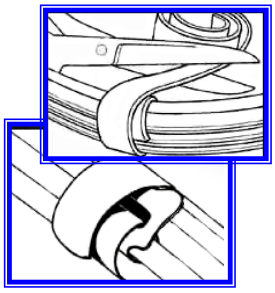
- Description:

  Physical Characteristics: 100-ohm Category 6 unshielded twisted pair (UTP) cable; 023 AWG (0.58 mm), bare copper wire insulated with FEP (plenum) copper conductor, jacketed with flame-retardant PVC, 4 twisted pairs, FEP insulated (Not Allowed: 2x2 and 3x1 construction); plenum rated and NFPA 262, CMP flame rating; complying with ANSI/ICEA S-80-576 and ANSI/TIA/EIA 568-B.2-1; suitable for environment. 0.022-inch (0.56 mm) maximum conductor diameter, 0.22-inch (5.6 mm) cable diameter, 28 lb./kft. (41.3 kg/km) nominal cable weight, 25 lb. (110 N) maximum installation tension, 400 N minimum ultimate breaking strength per ASTM D 4695, 1.0-inch (25.4 mm) minimum bend radius at minus 20 degrees Celsius without jacket or insulation cracking. Cable color is blue and pair color coding is as follows:

Pairs	Colors		Code
Pair 1	White/Blue;	Blue	W-BL; BL
Pair 2	White/Orange;	Orange	W-O; O
Pair 3	White/Green;	Green	W-G; G
Pair 4	White/Brown	Brown	W-BR; BR

Transmission Characteristics: DC Resistance per ASTM D4566, 9.38 ohms per 100 m maximum at 20 degrees Celsius, 3 percent (when measured at or corrected to 20 degrees Celsius) unbalance between any two conductors of any pair. 4.4 Nf maximum mutual capacitance of any pair at 1 kHz for 100 m of cable, and 330 pF per 100 m maximum capacitance unbalance to ground at 1 kHz of any pair.

- **Cable Management**:
  - Spaces (including Plenum):



Cable Ties: Reusable Hook and Loop fasteners, straps or tape, flexible, fire retardant, plenum rated, meeting UL 94-V2, FAR 2.5 853 A/B, and NEC Section 300-22 paragraph (C) and (D).

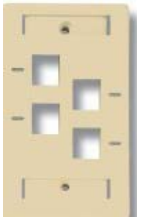
"J"-Hooks: May be used to support small bundles of 3 faceplates or 12 cables, maximum.

"Arlington" Loops: Plenum rated; may be used to support small bundles.

Prohibited: Nylon Cable ties. Connection cable management ties, hooks and loops to suspended ceiling elements.

- **Work Area Outlets**:
  - Description:

    Faceplates shall be UL listed. Match faceplate color used or other utilities in building. Exception: For Faceplates, match surface raceway color, and use stainless steel wall-mounted telephone faceplates. For Voice and Data Jacks, if match is not possible, Campus preference is Almond, then White.



  - Manufacturer:

    Campus Preference:

    Faceplates: AMP, 4-Port (#557502), and 2-Port (compatible with and to be used for Wiremold 4600 Raceway).

    Voice and Data Jacks: AMP, Model 1375055.

    Website: http://www.ampnetconnect.com/product_groups.asp?grp_id=1697

Execution:

- **Prohibited**: Sharing pathways and fire-rated penetrations with other than telecommunications cabling.
- **Installation**:
  - Install per TIA/EIA 568-B.1, and manufacturer's installation instructions.
  - Install following BICSI installation guidelines.
  - Install cabling clear of obstructions:
    - Water, waste and fire sprinkler piping.
    - Suspended ceiling components.

- HVAC units and ducting.
- Building system control cabling.
- Wiring for door bells and door access, and transformers.
- Antenna feed lines.
- Protruding nails, screws, and sharp or rough objects.

- Install cabling with minimum separation:
  - Crossing electrical conduits at 90 degree angle: .....2 inches.
  - Parallel with electrical conduits: .....6 inches.
  - From electronic devices: .....12 inches.
  - From fluorescent lights: .....6 inches.
  - From fluorescent light ballasts: .....12 inches.
  - From hot surfaces above 104 degrees F: .....12 inches.
  - From ceiling tiles: .....6 inches.
- Cable Slack.

  Provide slack loop at building structural seismic joints.

  Telecom Rooms: 15 feet, minimum; dressed in Cable Tray.

  J-boxes at Work Area Outlets: 1 foot, minimum; coil in J-box.
- Leave pathways clear and accessible for maintenance, moves, additions and changes.

o **Field Quality Control**:

- Testing Equipment: Bi-directional fiber tests shall be done using optical power meter and light sources, and OTDR equipment.

  Note: Testing is to demonstrate product capability, and compliance with specification installation and performance requirements. Test instrumentation for fiber optic plant (OTDR = optical time domain reflectometer) is easy to use, but difficult to interpret. For that reason, Campus requires the person doing the testing to have been trained and approved by the testing equipment manufacturer in using the equipment. The testing shall be observed by the Campus Communications Inspector, and results submitted for review and acceptance. If the test data in the opinion of the Campus Communications Inspector indicates improper testing, then the tests shall be redone by a different experienced and qualified tester to the satisfaction of the Campus Communications Inspector. If the test data indicates too great a drop, the length of cable and associated termination shall be replaced and retested. Testing shall be conducted on each fiber optic cable link. The specifications need to reflect these Campus Standards and Requirements.
- Inspect and text optical fiber cables in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.25.
- Inspect and test copper cables and terminations in accordance with TIA/EIA 568.

27 16 00 Communications Connecting Cords, Devices and Adapters

27 16 19 Communications Patch Cords, Station Cords, and Cross Connect Wire

Products:

- **Fiber Optic Pigtails**:
  - Color coded.
  - Size: 6 feet, minimum.

27 30 00 VOICE COMMUNICATIONS

27 31 00 Voice Communications Switching and Routing Equipment

27 32 00 Voice Communications Telephone Sets, Facsimiles and Modem

27 32 13 Telephone Sets

27 32 16 Wireless Transceivers

27 32 23 Elevator Telephones

Coordinate requirements with Section 14 24 00 – Hydraulic Elevators.

27 32 26 Ring-Down Emergency Telephones

Campus Standards:

Code Blue Emergency Telephones:

- **Pedestal Unit:**
  - Code Blue CB 1-s: Vandal resistant, ADA compliant, 12.75 inches diameter by 91.5 inches high.
  - Communication system: Code Blue CB3100, single touch communications device button with automatically dial preprogrammed number that shall simultaneously activate blue strobe light.
  - Website: http://www.codeblue.com/Central/cb01s.html

- **Wall Unit:**
  - Code Blue CB 2-s: Vandal resistant, ADA compliant, stainless steel, wall mounted, 42 inches high by 12 inches wide by 8.75 inches deep.
  - Communication system: Code Blue CB3100, single touch communications device button with automatically dial preprogrammed number that shall simultaneously activate blue strobe light.
  - Website: http://www.codeblue.com/Central/cb02s.html

27 32 29 Facsimiles and Modems

27 32 36 TTY Equipment

Division 28 – ELECTRONIC SAFETY AND SECURITY

28 00 00 ELECTRONIC SAFETY AND SECURITY

28 01 00 Operation and Maintenance of Electronic Safety and Security

Electronic Monitoring and Control:

Fire Alarm Testing:

- o Campus Standard: Provide bypasses for testing signals, dampers, HVAC shutdowns, etc.

28 05 00 Common Work Results for Electronic Safety and Security

28 05 28 Pathways for Electronic Safety and Security

Fire Alarm Cables:

- o Campus Standard: Fire alarm sensor and network cables shall be in conduit.

Keys for Cabinets and Padlocks:

- o Campus Standards:
  - Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
  - Padlocks: Coordinate with Section 08 06 05 – Key Schedule.
- o Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

28 30 00 ELECTRONIC DETECTION AND ALARM

28 31 00 Fire Detection and Alarm

Fire Alarm System:

General:

- o Description:
  - Fire Alarm System: Manufactured by an ISO 9001 certified company and meet requirements of BS EN9001: ANSI/ASQC Q9001-1994.
  - In-place Campus Alarm Central Station System – Provide panel components and programming of panel to work within Campus system. The system requires elephone line communication, and communication formats in Ademco Contact ID, or Radionics Modem IIe.
- o Scope:
  - Basic Performance:

    Alarm, trouble and supervisory signals from all intelligent reporting devices: Encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

    Initiation Device Circuits (IDC): Wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

Notification Appliance Circuits (NAC): Wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

On Style 6 or 7 (Class A) configurations on a single ground fault or open circuit on the system Signaling Line Circuit: Not cause system malfunction, loss of operating power, or the ability to report an alarm.

Alarm signals arriving at the FACP: Not lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

NAC speaker circuits: Arrange such that there is a minimum of one speaker circuit per floor of the building or smoke zone, whichever is greater.

Audio amplifiers and tone generating equipment: Electrically supervised for normal and abnormal conditions.

NAC speaker circuits and control equipment: Arrange such that loss of any 1 speaker circuit will not cause the loss of any other speaker circuit in the system.

2-way telephone communication circuits: Supervised for open and short circuit conditions.

- Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur.

  The system alarm LED on the system display shall flash.

  A local piezo electric signal in the control panel shall sound.

  A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

  Printing and history storage equipment shall long the information associated with each new fire alarm control panel condition, along with time and date of occurrence.

  All system output programs assigned via control-by-event interlock programming to be activated by the particular point in the alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

o Submittals:

- Product data: Submit for each item, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- Shop Drawings: Submit with manufacturer's name(s), model numbers, ratings, power requirements; equipment layout, device arrangement, wiring point-to-point diagrams, and conduit layouts; annunciator layout, configurations and terminations; sections of typical trim members; and attachments to other work.
- Operating and Maintenance Manuals: Include manufacturer's name(s), technical data sheets; wiring diagrams indicating internal wiring for each device and interconnections between the items of equipment; clear, concise description of operation to properly operate the equipment and systems. Submit with shop drawings.
- Certifications for Installation Supervisor and Maintenance Personnel: From major equipment manufacturer certifying personnel are authorized

representatives of the major equipment manufacturer. Include names and addresses in the certification. Submit with shop drawings.

- Comply with Section 01 33 00 – Submittal Procedures.

o Post Contract Maintenance:

- Provide complete maintenance and repair service for fire alarm systems from a factory trained, authorized representative of the major equipment manufacturer for a period of five (5) years after expiration of the guaranty.

Products:

o Main Fire Alarm Control Panel or Network Node

- Purpose: Communicate with and control intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices. Use 2-way telephone communication circuits, supervised for open and short circuit conditions.

- Campus Standard:

  Manufacturer: Notifier by Honeywell International Inc.

  Models: ONYX Series with voice notification capabilities

  Website: http://www.notifier.com/products/controlpanels.htm

  Note: Fire•Lite Alarms by Honeywell will be considered by Campus Facility Services on a case-by-case basis. No other substitutions allowed.

Below are the requirements for alarm equipment to work with the system we have in place today.
****

- Telephone line communications

  - Communication formats: Ademco Contact ID or Radionics Modem IIe

- Operator Control:

  Acknowledge Switch:

  ▫ Upon activation in response to new alarms and/or troubles: Silence local panel piezo electric signal and change alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of switch shall advance LCD display to next alarm or trouble condition.

  ▫ Depression of switch: Silences remote annunciator piezo sounders.

  Alarm Silence Switch:

  ▫ Upon activation: Programmed alarm notification appliances and relays shall return to normal condition after an alarm condition. Notification circuits and relay selection silenceable by switch shall be field programmable with confines of applicable standards. PACP software shall include silence inhibit and auto-silence timers.

  Alarm Activate (Drill) Switch:

- Shall activate notification appliance circuits. Drill function shall latch until panel is silenced or reset.

System Reset Switch:

- Upon activation: Electronically-latched initiating devices, appliances and software zones, plus associated output devices and circuits, shall return to normal condition.

Lamp Test:

- Upon activation: Local system LEDs shall activate, each segment of the liquid crystal display shall light, and panel software revision shall display.

Signal Bypass Switch for Alarm Testing:

- Horns and strobes shall remain silent.
- Dampers shall remain open.

- System Capacity and General Operation:

Control Panel and Network Nodes:

- Provide or be capable of expansion to 636 intelligent / addressable devices.
- Include Form-C alarm, trouble, supervisory, and security relays rated at 2.0 amps @ 30 VDC, minimum.
- Include Four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
- Support 8 additional output modules with 8 circuits each, minimum (64 circuits) for signal, speaker, telephone, or relay. Circuits shall be either Class A (NFPA Style Z), or Class B (NFPA Style Y). {Note to Designer: Coordinate specifications and drawings.}
- Operator Interface Control and Annunciation Panel: Full featured with backlit Liquid Crystal Display (LCD), individual color coded system status LEDs and alphanumeric keypad with easy touch rubber keys for field programming and control of fire alarm system.
- Special Tools, PROM Programmers and PC Based Programmers: Not required to program, configure and expand system in the field.
- Memory ICs: Not required to be replaced to facilitate programming changes.
- Programming of System:
  - Allow programming of an input to activate an output or group of outputs.
  - Support 20 logic equations, minimum, including “and,” “or,” and “not,” or time delay equations for advanced programming.
  - Logic equations shall require a PC with software utility design for programming.
  - Not Allowed: Systems with limited programming (such as general alarm), complicated programming (such as a diode matrix), and requiring a laptop personal computer.
- Features:

- Drift compensation to extend detector accuracy of life, and include a smoothing feature allowing transient noise signals to be filtered out.
- Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
- Maintenance alert, with two levels (maintenance alert / maintenance urgent), to warn of excessive smoke detector dirt and dust accumulation.
- Nine sensitivity levels for alarm to be selected by detector. Alarm level range between 0.5 to 2.35 percent per foot for photoelectric detectors, and 0.5 to 2.5 percent per foot for ionization detectors. Support sensitive advanced detection laser detectors with an alarm level range of 0.03 percent per foot to 1.0 percent per foot. Include nine levels, minimum of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
- Display or print system reports.
- Alarm verification, with counters and trouble indication to alert maintenance personnel with a detector enters verification 20 times.
- PAS pre-signal, meeting NFPA 72 3-8.3 requirements.
- Rapid manual station reporting (under 3 seconds).
- Meet HFPA 72 Chapter 1 requirements for activation of notification circuits within 10 seconds of initiating device activation.
- Periodic detector test, conducted automatically by software.
- Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
- Cross zoning with the capability of counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
- Walk test with a check for two detectors set to same address.
- Control-by-time for non-fire operations, with holiday schedules.
- Day/night automatic adjustment of detector sensitivity.
- Device blink control for sleeping areas.

▫ Coding:

- FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code.
- Panel notification circuits (NAC 1, 2, 3 and 4) shall support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two-stage operation shall allow 20 Pluses Per Minute (PPM) on alarm and 120 PPM after 5 minutes, or when a second device activates. (Canadian Dual Stage is the same as Two-Stage, except will only switch to second stage by activation of Drill Switch 3- or 5-minute timer.)
- Provide coding option to synchronize specific strobe lights designed to accept a specific “sync pulse.”

- Network Communication:
  - Network Architecture: Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

    Protocol shall be based on ARCNET or equivalent. The network shall use a deterministic token-passing method.

    Not acceptable: Collision detection and recovery type protocols; Master, polling computer, central file computer, display controller or other central element (weak link) in the network; cascading of CPUs or master-slave relationships at network level to facilitate network communications.

    Nodes may be an intelligent Fire Alarm Control Panel (FACP), Network Control Station PC (NCS) or Network Control Annunciator (NCA).

    Network shall be capable of expansion to 103 nodes, minimum.

    Failure of a node shall not cause failure of communication degradation of other nodes or change the network communication protocol among surviving nodes located within distance limitations. Each node/panel shall communicate on the network at a baud rate of 312 KBPS (kilo bits per second), minimum.
  - Network node addresses shall be capable of storing Event equations. The event equations shall be used to activate outputs on one network node from inputs on other network nodes.
  - Network shall be capable of communicating via wire or fiber optic medium. A wire network shall include a fail-safe means of isolating nodes in event of complete power loss to a node.
  - Network Repeaters: A network repeater shall be available to increase twisted pair distance capability in 3000-foot increments, minimum. Optionally, a repeater shall be available for fiber optics to increase the wire distance in 10 dB increments, minimum. A mix (hybrid) fiber/wire network repeater shall also be supported.

    Not acceptable: Systems with distance limitations, and no means to regenerate signals.
  - Fiber Optic Network Communication: Network shall support the following:

    Size: 62.5 micrometers / 125 micrometers.

    Type: Multimode, Dual Fiber, and Plenum Rated.

    Distance: 10 dB, maximum total attenuation between network nodes.

    Connector Type: ST.

- Central Microprocessor:
  - State-of-the-art, high speed, 16-bit RISC device capable of communicating with, monitoring and controlling external interfaces.
  - Include an EPROM for system program storage, Flash memory for building-specific program storage, and a “watch doc” timer circuit to detect and report microprocessor failure.

- Capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs).
  - Systems that do not allow t-taps, or have restrictions (for example, in the amount of t-taps, length of t-taps, etc.) are not acceptable.

o System Components

- Programmable Electronic Sounders
- Speakers
- Strobe lights meeting requirements of 2001 CBC and UL 1971, fully synchronized.
- Manual Fire Alarm Stations.
- Conventional Photoelectric Area Smoke Detectors.
- Conventional Ionization Type Area Smoke Detectors
- Duct Smoke Detectors.
- Projected Beam Detectors
- Automatic Conventional Heat Detectors
- Water Flow Indicator
- Sprinkler and Standpipe Valve Supervisory Switches
- Alphanumeric LCD Type Annunciator
- Portable Emergency Telephone Handset Jack
- Fixed Emergency Telephone Handset
- Universal Digital Alarm Communicator Transmitter (UDACT)
- Field Wiring Terminal Blocks.
- Printer
- Video Display Terminal (VDT)

o Equipment and Material:

- New and manufacturer's current model.
- Materials, appliances, equipment and devices: Tested and listed by a nationally recognized approval agency for use as part of a protective signaling system, and meeting the National Fire Alarm Code.
- Fasteners and supports: Adequately sized to support the required load.

o Conduit: Sized to provide 40 percent, maximum fill of interior cross sectional area.

o Wire:

- Initiating Device Circuits and Signaling Line Circuits: New 18 AWG, minimum.
- Notification Appliance Circuits: 14 AWG, minimum.
- Meet local, state and national codes (e.g., NEC Article 760).
- Meet fire alarm system manufacturer recommendations.

- Listed and approved by a recognized testing agency for use with a protective signaling system.
- Wire and Cable not installed in conduit:

  Fire resistance rating suitable for the installation as per NFPA 70 (e.g., FPLR).

  Not be exposed (visible).
- Wire for multiplex communication circuit (SLC):

  Twisted and unshielded, and support 12,500 feet, minimum.

  System designed to permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
- Field Wiring: Electrically supervised for open circuit and ground fault.

o Terminal Boxes, Junction Boxes and Cabinets: UL listed for purpose and use.

- Capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs).

Execution:

o Initiating Circuits: Arranged to serve like categories, such as manual, smoke, and water flow.

o Mixed Category Circuits: Not allowed.

- Exception: Signaling line circuits connected to intelligent reporting devices.

o Fire Control Panel:

- Connect to separate dedicated branch circuit; 20 amperes, maximum.
- Label circuit at main power distribution panel as “FIRE ALARM.”
- Primary wiring: 12 AWG.
- Ground panel.

Division 29 – *Reserved for Future*

Division 30 – *Reserved for Future*

Division 31 – EARTHWORK

31 20 00 EARTH MOVING

31 23 00 Excavation and Fill

31 23 33 Trenching and Backfilling

Campus Standard: Coordinate backfilling with installation of underground duct markers for utilities. Backfill with sand to 12 inches above utility duct. Install duct markers 6 inches below finished surface.

Schedule:

Strom and Sanitary Piping: Cover pipe and bedding with ____ inches

Utilities	Fill Type	Bedding and Cover Thickness, minimum	Compaction, minimum	Underground Duct Markers
Water Utilities				
Sanitary Sewerage Utilities				
Storm Drainage Utilities				
Natural-Gas Distribution Utilities				
Hydronic Utilities			95%	
Electrical Utilities				
Communication			95%	

31 25 00 Erosion and Sedimentation Controls

Division 32 – EXTERIOR IMPROVEMENTS

Keys for Padlocks:

o Campus Standards:

- Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
- Padlocks: Coordinate with Section 08 06 05 – Key Schedule.

o Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys to, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

32 10 00 BASES, BALLASTS, AND PAVING

32 12 00 Flexible Paving

Porous Paving

Consider use.

32 13 00 Rigid Paving

Portland Cement

Fly Ash: Include in concrete.

Concrete Finish: Stamp location of irrigation sleeves into concrete with a "**L**."

32 16 00 Curbs and Gutters

Regulatory Requirements

Access for Persons with Disabilities: Comply with California Building Code and Americans with Disabilities Act Accessibility Guidelines (ADAAG) for site development, walks, and sidewalks to ensure access for persons with disabilities. Form, shape, and finish curb cuts in accordance with requirements of most restrictive code.

32 80 00 IRRIGATION

CSU Requirements

Conserve water resources, including installing controls to optimize irrigation water, and promoting the use of reclaimed water. Prepare a year-round watering program according to seasonal evapotranspiration data for the region. Decorative fountains should be minimized.

Campus Standard

Irrigation System: Rain Master Irrigation Systems, Inc. (Website: http://www.rainmaster.com). Provide a programmable, automatically controlled underground sprinkler irrigation system for landscape planting. Provide components from manufacturers matching standard irrigation equipment used by University, including heads, valves, piping circuits, controls, and accessories, or approved equal. Provide looped layout with isolation valves.

Coordinate with Trustees Representative to locate inside utility or electrical room accessible to landscape maintenance staff.

32 84 00 Planting Irrigation

Campus Standard – Control System

Irrigation Controller: Rain Master Evolution Radio Controlled. Evapotranspiration (ET)-based controller. Provide new batteries in controllers to retain program in memory during temporary power failures. Provide diagram of numbered valves and respective irrigated areas for inside panel of each controller.

Back-to-Back Enclosures: E.T.S. Controller Assembly: E.T.S. CA4-RM4-48+48/FSAV-200B/DRSO/VMR-RM, stainless steel back-to-back enclosures with two Rain Master Evolution controllers, flow max boards, master valve and flow sensor, dual rain switch option and master relays. (888-438-7435)

Top Entry Enclosure: E.T.S. Controller Assembly: E.T.S. CA6-RM4-18/RSO/MVR-RM, stainless steel top entry enclousure with Rain Master Evolution Controller, flow max board, rain switch option, and master valve relay (for riparian zone only).

Campus Recommendations – Control System

Low Voltage System: Expressly for control of automatic control valves for underground sprinkler systems.

Exterior Control Enclosure: Standard weatherproof enclosure with locking cover; complying with NFPA 70 (National Electrical Code).

Interior Control Enclosure: Standard locking cover, complying with NFPA 70 (National Electrical Code).

Transformer: To convert building service voltage to control voltage of 24 volts.

Circuit Control: Each circuit variable from 5 to 60 minutes; including switch for manual or automatic operation of each circuit.

Timing Device: Adjustable, 24-hour, and -7 or 14-day clocks to operate any time of day and skip any day in a 7- or 14-day period.

Wiring: Solid copper with UL approval for direct burial in ground. Provide one spare control wire along entire wire routing for each controller for each unused station at controller. Loop 36 inches excess wire into each single valve box and into one valve box in each group of volves.

Campus Preferences – Piping and Fittings

Mainline Pipe and Fittings - PVC Plastic Pipe (3 inches and larger): Rigid unplasticized polyvinyl chloride (PVC) 1120, Type 1, Grade 1, NSF-approved pipe, complying with ASTM D 2241. For mainline to control valve connections, use Schedule 80 PVC threaded both ends.

Mainline Pipe and Fittings - PVC Plastic Pipe (smaller than 3 inches): Rigid unplasticized polyvinyl chloride (PVC) 1120, Type 1, Grade 1, NSF-approved pipe, color – white, complying with ASTM D 1785. For mainline to control valve connections, use Schedule 80 PVC threaded both ends.

Lateral Pipe and Fittings (Downstream of Control Valves): Rigid unplasticized polyvinyl chloride (PVC) 1120, Type 1, Grade 1, NSF-approved, color-white, complying with ASTM D 1785. For pipe and fittings, Schedule 40 solvent weld pipe, and Schedule 40, Type 1, PVC Solvent weld fitting conforming to ASTM D 2466 and ASTM D 1784.

Galvanized Steel Pipe and Fittings: Pipe standard weight, seamless or welded, galvanized conforming to ASTM A 53. Fittings galvanized malleable-iron, threaded fittings conforming to ANSI B 16.3.

Copper Pipe and Fittings: Pipe Type L seamless copper water tube, drawn temper, conforming to ASTM B 88. Fittings wrought copper or cast brass, recessed solder joint type fittings conforming to ANSI B 16.22.

Sleeving: Rigid unplasticized polyvinyl chloride (PBC) 1120, Type 1, Grade 1, NSF-approved pipe, extruded from material conforming to ASTM D 1784, color-white. Schedule 40 solvent weld pipe.

Campus Preference

Sprinkler Remote Control Valves (RCV) - Angle Valves: Superior Controls Company, Inc.; Model 950A-DWPRS – Electric Diaphragm Angle Valve. Solid brass construction; 200 PSI rating;
Website:
http://www.bucknersuperior.com/Professionals/Products/AngleValves/950A.aspx

Sprinkler Remote Control Valves (RCV) -Globe Valves: Superior Controls Company, Inc.; Model 950-DWPRS – Pressure Regulating Valve. Solid brass construction; 200 PSI rating. Website: http://www.bucknersuperior.com/Home/NEWSuperior950.aspx

Sprinkler Manual Control Valves (MCV): Nibco Inc., 1516 Middlebury Street, Elkhart, IN 46516-4740, Phone: 574-295-3000, Fax: 574-295-3307. Model T-211-YK – Class 125 Bronze Globe Valves. Furnish two valve keys, 3-foot long with tee handles and key end to fit valves. Website: http://www.nibco.com

Isolation Valves (3-inches and smaller): Nibco Inc., 1516 Middlebury Street, Elkhart, IN 46516-4740, Phone: 574-295-3000, Fax: 574-295-3307. Model T-113-K – 250 PSI CSP Bronze Gate Valve. Screw-in bonnet, non-rising stem, solid wedge, push-on ends with joint restraints, 250 PSI / 17.2 Bar non-shock cold working pressure, conforming to MSS SP-80, size - 2-inches. Website: http://www.nibco.com/assets/PR113KIR.pdf

Isolation Valves (Larger than 3-inches): Comply with Section 33 11 00 – Water Utility Distribution Piping.

Quick Coupling Valves, Valve Keys and Key Lug: Rain Bird International, Inc., POB 37, Glendora, CA 91740-0037, Phone: 626-963-9311, Fax: 626-852-7343.

Quick Coupling Valves: Rain Bird Model 33DLRC. ¾-inch (20/27). Heavy-duty, brass construction, two-piece body design, stainless steel internal valve spring, locking rubber cover. Website: http://www.rainbird.com/landscape/products/valves/quickCouplingValves.htm

Locking Cover Keys: Rain Bird Model #2049l. Furnish two cover keys per _____. Website:
http://www.rainbird.com/landscape/products/valves/lockingcoverkey.htm

Valve Keys: Rain Bird Model 33DK. ¾-inch (20/27). Key threads into top of quick-coupling valve to provide water access. Furnish two valve keys per quick coupling valve.
Website: http://www.rainbird.com/landscape/products/valves/valvekeys.htm

Flex Riser - KBI model FR or approved equal (6" length).

Triple-Swing Assemblies - Rainbird SA series, KBI TSA-TT series, or approved equal. 12" length for 4" and 6" pop-up sprinklers, and 18" length for 12" pop-up sprinklers. Match sprinkler inlet size.

Sprinkler Heads - Pop-up height: 4" minimum height for turf sprinklers; 12" minimum height for shrub sprinklers.

32 90 00 PLANTING

32 91 00 Planting Preparation

Mulch - Keep 2" minimum from bark of plant.

Herbicide

Post-emergence (existing weeds): "Roundup" or approve equal.

Pre-emergence (non turf areas, prior to seed germination): "Ronstar" or approved equal.

Post-emergence (turf areas): "Ortho Weed-B-Gon" or approved equal.

Deep Root Planters

Use for trees planted within 7½ feet of paving or curbing, or in tree wells.

Deep root planters shall be DeepRoot Corporation Model "UB 18-2" for 15 gallon trees, Model "UB 24-2" for 24" box trees, or approved equal (high-density polyethylene).

Division 33 – UTILITIES

Keys for Padlocks:

- o Campus Standards:
  - Cabinets and Equipment: Provide 2 keys per panel. Coordinate with Section 08 06 05 – Key Schedule.
  - Padlocks: Coordinate with Section 08 06 05 – Key Schedule.
- o Closeout Submittal: Provide panel keys separated and labeled. Provide location, room number, quantity, manufacturer name and model numbers of keys to, and coordinate closeout submittal with Section 08 06 05 – Key Schedule.

33 10 00 WATER UTILITIES

33 11 00 Water Utility Distribution Piping

General

Products: Comply with AWWA Standards.

Pipe materials 3" size and larger: Use AWWA-C900 ductile iron pipe, unless otherwise approved in advance by the Trustee.

Pipe materials 1" to 3" size: Use Schedule 80 PVC pipe and fittings.

Valves – Gate and Check

Campus Standards:

Use valves designed for a working pressure of 150 psi, minimum.

No check valves below grade.

Resilient Wedge Valves: Ductile iron, encapsulated with rubber with 2" square operating nut. Body and bonnet coated with fusion bonded epoxy both interior and exterior, complying with AWWA C-550, and NSF 61 approved.

Campus Preferred Manufacturers and Models:

Resilient Wedge Gate Valve

Clow: http://www.clowvalve.com/products/index.php

Mueller: http://www.muellercompany.com/water/products/default.aspx?catid=18

Service Fittings

PVC Mains smaller than 2" in diameter: Acceptable products as manufactured by Mueller Company, Decatur, Illinois.

Tapping Sleeves

PVC Mains smaller than 2" in diameter: Acceptable products as manufactured by Mueller Company, Decatur, Illinois.

Sleeve Type Coupling for existing water mains, furnished with outlet flanged to American 125 standard (ASA series 15) boltless type:

Campus Preferred Manufacturers:

Clow Corporation, Corona, California.

Existing Cast Iron Mains: Model C1 series, complying with AWWA Class A.

Existing Asbestos Cement Mains: Model CA for Class 150 and Class 200.

Romac Industries, Inc.: http://www.romac.com

Valve Boxes

Campus Preferred Manufacturer:

Boxes: Christy Concrete Products <http://www.christyconcrete.com/>

Valves 3" and larger: Alhambra Foundry Company, Alhambra, California.

Valves 6" and Smaller: Model A-3004.

Valves 8" and Larger: Model 3005.

Valves 2-1/2"" and Smaller: Brooks Products, Inc., El Monte, California.

Underground Pipe Markers

Campus Standard:

Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service" in large letters.

33 12 00 Water Utility Distribution Equipment

Meters and Gages: *General Notes to Design Team*

CSU Metering Requirements: Refer to CSU Building Metering Guide: Website: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf

Campus Requirements:

- **Intent**: Metering for performance evaluation, benchmarking, measurement, verification and optimization of consumption performance over time.
- **Metering Equipment**: Allow Campus the ability to identify problems and achieve improved system performance. Select meters for future connection to a remote-read automated metering network. Domestic water and landscape irrigation shall be separately metered. Water meters shall measure usage with an accuracy of +/- 1.5% over the range of flow rates expected for the particular application; use a pulse or other output for automated remote reading capability (AMR), and connect to Siemens Apogee system (for data collection and trending).
  - Preferred manufacturer: Sensus – website: http://na.sensus.com/

33 13 00 Disinfecting of Water Utility Distribution

Campus Standard: Comply with ANSI/AWWA C651-05 Standard for Disinfecting Water Mains

33 50 00 FUEL DISTRIBUTION UTILITIES

33 51 00 Natural-Gas Distribution

Underground Pipe Markers

Campus Standard:

Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service" in large letters.

General Notes to Design Team

***CSU Metering Requirements**: Refer to CSU Building Metering Guide: Webstie: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf*

***Metering Requirements**: Campus Metering Requirements are intended to meet the performance-based LEED™ NC/EB Energy & Atmosphere Credit 5 – Measurement & Verification standards for ongoing accountability and optimization of building energy and water consumption performance over time. Metering equipment is intended to allow Campus the ability to identify problems and achieve improved system performance. Select meters for future connection to a remote-read automated metering network. Domestic water and landscape irrigation shall be separately metered.*

33 60 00 HYDRONIC AND STEAM ENERGY UTILITIES

33 61 00 Hydronic Energy Distribution

Campus Standard:

- Underground Pipe Markers: Trace wire, magnetic detectable conductor, brightly colored plastic covering, imprinted with "Hydronic Service" in large letters

33 70 00 ELECTRICAL UTILITIES

33 71 00 Electrical Utility Transmission and Distribution

33 71 16 Electrical Utility Poles _____

33 71 19 Electrical Underground Ducts and Manholes

- Campus Standard:
  - Provide spare capped conduits to main electrical room for future use. Verify number of spares with Project Manager.
  - Underground Pipe Markers: Trace wire, magnetic detectable conductor, brightly colored plastic covering, imprinted with "Electrical Service" in large letters.

33 71 73 Electrical Utility Services

33 71 73.33 Electric Meters

General Notes to Design Team

***CSU Metering Requirements**: Refer to CSU Building Metering Guide: Website: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf*

***Metering Requirements**: Campus Metering Requirements are intended to meet the performance-based LEED™ NC/EB Energy & Atmosphere Credit 5 – Measurement & Verification standards for ongoing accountability and optimization of building energy and water consumption performance over time. Metering equipment is intended to*

allow Campus the ability to identify problems and achieve improved system performance. Select meters for future connection to a remote-read automated metering network. Domestic water and landscape irrigation shall be separately metered.

33 72 00 Utility Substations

General Notes to Design Team

***CSU Metering Requirements**: Refer to CSU Building Metering Guide: Webstie: http://www.calstate.edu/cpdc/ae/gsf/documents/CSU_Metering_Guide.pdf*

***Metering Requirements**: Campus Metering Requirements are intended to meet the performance-based LEED™ NC/EB Energy & Atmosphere Credit 5 – Measurement & Verification standards for ongoing accountability and optimization of building energy and water consumption performance over time. Metering equipment is intended to allow Campus the ability to identify problems and achieve improved system performance. Select meters for future connection to a remote-read automated metering network. Domestic water and landscape irrigation shall be separately metered.*

33 80 00 COMMUNICATIONS UTILITIES

33 81 00 Communications Structures

33 81 26 Communications Underground Ducts, Manholes, and Handholes

General: Coordinate Telecommunications Pathway Spaces -- Interbuilding Distribution System with Division 27 – Communications.

Description: Utility vaults and conduits that interconnect campus buildings.

Design Requirements:

- o Location:
  - Situate utility vaults to allow conduit to enter building with 2- 90 degree bends, maximum.
  - Provide four- conduits, minimum (allowing for 2 spares, minimum) to interconnect campus to building.
  - Conduits shall enter the Service Entrance Space either:
    1) Directly from the outside, perpendicular to the outer wall at a level above 8 feet, **or**
    2) Through the floor, parallel with the outer wall (keeping the conduit bend radius greater than 48 inches).
- o Materials & Sizes:
  - Utility Vault: Provide 5 feet wide by 7 feet long by 7 feet high.
  - Vault Covers:
    Note to Designer: Consider using cover that is lifted utilizing a cam as made by Neenah Foundry Company, phone: 800-558-5075, website: http://www.neenahfoundry.com/literature/NFCatalog14/NFC-4598%20CamLift%20SellSheet.pdf
  - Conduit: 4-inch, minimum Schedule 40 PVC.

- Underground Duct Markers:
  - Trace wire, magnetic detectable conductor, brightly colored plastic covering, imprinted with “Telecom Service” in large letters.

Division 34 – TRANSPORTATION

Division 35 – WATERWAY AND MARINE

Division 36 – *Reserved for Future*

Division 37 – *Reserved for Future*

Division 38 – *Reserved for Future*

Division 39 – *Reserved for Future*