



# Ivy Tech Building Standards

## Systems Standards

**February 1, 2015**

SCHMIDT



ASSOCIATES

*Strategy • Design • Construction*

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# Security Standards

Security and safety should be aspects of any Ivy Tech project. The Ivy Tech security department should be involved in the design process. The results should be used to evaluate and refine security plans.

Concepts for safety and security should include the following:

## Site Design

1. A vehicle barrier should be planned to protect the main entrance of the building from the land leading to the vehicle turnaround and drop-off location in front. Reinforced bollards would be acceptable. Avoid a straight drive lane to main door.
2. Visitor parking should be placed in front of the main entrance. Signs should be used to direct persons to visitor parking and identify main entrance. Raised sidewalks and landscape bump-outs or islands should be planned in the student parking lots to reduce pedestrian and vehicle conflict and to slow speeds. The proper placement of landscaping bump-outs or islands will enhance the use of portable barriers for traffic control during peak use times.
3. Student parking areas should be designed for natural surveillance from the main building. The lighting and landscape planting plans shall be designed to avoid producing barriers to visual accessibility, prevent hiding spots, and enhances natural surveillance.
4. Signage should be well placed at vehicle entrances to direct vehicle traffic into the campus and in the parking areas.
5. Install emergency phones or call boxes in key locations.
6. Avoid the placement of utility boxes, trees, walls, and other devices in locations that will facilitate climbing to access the roof.
7. Consider the ability to fence and secure U-Shaped courtyards, receiving areas, and other dead space. Meet all life safety requirements.

## Entrances

1. Avoid tall plants near exterior doors to avoid hiding locations.
2. Building entrances shall be well marked and illuminated.
3. Main entrance vestibules provide a passive approach to screening and controlling visitors and students.
4. Exterior doors should be designed for electronic access control and monitoring.

## Interior

1. It is recommended that the design team review building and HVAC plans to identify safe rooms within the facility. These rooms should be structurally safe and provide reasonable protection from physical damage due to storms.

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2. Avoid the use of glass block at main entrances. Opaque glazing reduces natural surveillance. Transparent glazing materials enhance visual coverage of the entrance.
3. Assembly occupancies should have multiple means of egress for escape from critical incidents. Consider additional exiting above code minimums in multiple locations around the room.
4. Classrooms and Labs with large storefront systems should have emergency exit capabilities to another space/corridor in addition to the main room entrance.
5. Cameras are needed to provide uniform coverage of the exterior spaces, entrances, and interior hallways. An effective camera system provides constant supervision. It also provides documentation of activities and events for management use.
6. Large assembly areas should be designed for other uses. It is desired that these spaces have constant supervised activities to prevent them from being isolated.
7. In spaces where groups of students or faculty and students gather, rooms shall have visual access to provide natural surveillance and to protect against allegations of improper behavior.
8. The cafeteria/commons area should be furnished with small tables to reduce group sizes and to increase movement space. This helps to avoid conflicts and it facilitates community use activities.
9. Locate staff offices near student toilet areas which also increases the perception of supervision.
10. Toilet rooms should avoid doors and use a maze entrance.
11. Restrooms should not be placed near exits or stairs.
12. Custodial and other building services storage rooms should use automatic door closure arms and self-locking mechanisms to prevent improper access and use by students. Toxic cleaning materials should be carefully controlled in these areas.

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# System Standards

## Documenting Deviations

1. Identified deviations of Standards must be submitted at each Design Phase Deliverable SD, DD, CD
  - a. “Marked up” Standards sheets must be provided for:
    - 1) Architectural Interior
    - 2) Architectural Exterior
    - 3) Mechanical
    - 4) Electrical
    - 5) Plumbing
    - 6) Telecomm
    - 7) Security systems
    - 8) Space standards

## General

1. The Architect shall assist the College in investigating various building materials and finishes. Coordinate these recommendations with the College’s requirements with regard to chemical exposure, flexibility, durability, and cleanability. Architect shall reference Building Space Standards for finish materials in each type of space.
2. Buildings constructed for Ivy Tech are intended to be 75 year buildings.
  - a. This applies to exterior and interior systems. Names of building and the College may change over time. When incorporating the college or building name into the facility, consider the future cost of removing or replacing prior to designing the project. For example, special consideration shall be given to casting names in limestone, terrazzo or other permanent materials and should be minimized.

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## 04 20 00 - Masonry

### Exterior Masonry Walls

1. Walls shall be brick, limestone, or stone with either a metal stud or CMU backup. Finished architectural or tinted precast concrete panels and metal panel may also be used if approved by Owner. Non-tinted concrete panels will not be approved. Elevations, including reveals, visual details, and design must be reviewed by Ivy Tech Facilities State Planning and approved in design. Materials shall be durable and low maintenance.
2. E.I.F.S. is not allowed unless approved in writing by the College.
3. The College prefers that brick and block be laid with a running bond pattern unless otherwise required.
4. The minimum brick grade is FBX.
5. Provide concave tooled masonry joints.
6. No colored mortar is allowed except where matching existing conditions. Consult with Owner if colored mortar is desired. Provide Owner stock of colored mortar for attic stock.
7. Standard, utility, or medium size brick permitted.
8. Glazed ceramic brick or tile requires College approval.
9. Cavity Wall Assemblies: Exterior walls shall be constructed with cavity wall insulation whether CMU or metal stud backup is used. Generally, provide the following cavity wall assemblies, modified as required to suit specific design conditions.
10. Interior Exposed CMU: Exterior cladding, air space, continuous rigid insulation to meet state energy requirements, code compliant air barrier, and 8 inch (minimum) block. .
11. Provide weeps using vinyl tubes. Other type weeps (wicks) are not acceptable. Provide weeps over lintels and relieving angles where though wall flashing has been installed. Provide cavity wall vents at the top and bottom of exterior masonry walls. Provide manufacturer's standard colors for cavity vents.
12. Cavity drainage material shall be provided.
13. Steel lintels shall be hot dipped galvanized with flashings and end dams.
14. Specify installer shall have a minimum of 5 years of experience.
15. Field Constructed Mock-Up is required. (Architect to specify and review mockup)
16. A single source of responsibility is required for masonry units.

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**Interior Masonry Partitions**

1. Masonry is the preferred material for use in central service areas including but not limited to boiler rooms, main electrical rooms, receiving areas, loading docks. Reference specific requirements provided in the appropriate space standards.
17. Masonry is the preferred material for use in technology labs or industrial labs. Example labs include Welding, HVAC, Machine Tool, Automotive, Hydraulics, Pneumatics, and Electronics. Reference specific requirements provided in the appropriate space standards.
18. Grooved and split faced architectural concrete masonry units shall not be used as a primary surface. Both are allowed as an accent material.
19. Where corners are exposed, provide bullnose masonry units.
20. Masonry or metal stud and gypsum board partitions may be used in corridors. Architect shall consider corridor abuse, flexibility, and cost in determining appropriate materials.
21. Where direct lighting is provided on a wall surface, special considerations need to be made to the finish of that wall to provide a smooth surface and address specifically with the Owner.

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## 05 00 00 - Metals

1. Structural Steel
  - a. Surveys shall be performed by Registered Professional Surveyor.
  - b. A Pre-Construction Conference shall be held for Quality Assurance.
  - c. AISC certifications for steel fabricators and/or installers (erectors) shall be considered for complex fabrications or erections only. This is not a base requirement for typical steel construction.
2. Steel Decking
  - a. Metal desk shall to be specified 2 gauges heavier than indicated by tables or calculations.
  - b. Acoustical metal roof deck shall be used in occupied areas where metal deck is exposed, and it shall only be used after approval of the College.

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## 07 00 00 – Thermal and Moisture Protection

1. Where wall assembly has been approved, provide an air/vapor barrier as defined by code requirements. Vapor barrier shall be provided on the warm side of the insulation system and meet state code requirements and energy goals.
  - a. Cavity wall insulation shall be continuous to meet state energy code.
  - b. Cavity wall insulation shall be rigid extruded polystyrene or mineral fiber board. Expanded polystyrene and polyisocyanurate insulations are not acceptable.
  - c. Insulation R-values shall be aged R-values.
2. Interior blanket or batt insulation shall be glass or mineral fiber.
3. Seal all concrete flatwork and brick paving units against moisture penetration.
4. Sheet waterproofing shall be utilized on exterior of below-grade walls where occupied space is on interior of wall.
5. On Water Repellents: Use on exterior brick is not allowed.
6. Provide appropriate water drainage in exterior wall systems including cavity drainage material to prevent mortar build-up and drainage blockage in cavity.

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# 07 30 00 – Steep Slope Roofs

## Roof – General

1. Roof shall be Type 1 and U.L. Class A.
2. Coordinate with Owner's Insurance require for uplift rating and other requirements. If minimum, meet current Indiana Building Code requirements and UL 580 or UL 1897.
3. Insulation: Insulation shall be polyisocyanurate or extruded polystyrene and shall be provided in a thickness to meet or exceed current energy code requirements. Stagger joints of multiple layers of roof board insulation at all locations. Expanded polystyrene (Bead board) and mineral fiber board insulations are not acceptable. Mechanical fastening to concrete decks is not acceptable.
4. Provide vapor barrier in roof assembly in proper location.
5. Roof expansion joints shall be by the roofing membrane manufacturer.
6. Roof flashing shall be 12-inches (nominal), above finished roof.
7. Install all counterflashings within reglets. Roof flashing into a wall shall utilize a two-piece metal assembly with flashing receiver and counterflashing. The flashing receiver shall be installed within the masonry bed joint.
8. Design permanent roof tie-off hooks for Contractor and Owner use.

## Steep Slope Roofs (slopes greater than 4" per foot)

1. Steep slope roofing materials shall be asphalt shingles or standing seam metal.
2. Asphalt shingles shall meet the following requirements:
  - a. Laminated shingle minimum 425 pounds per square.
  - b. Minimum 20 year warranty.
  - c. Extra Material: 2% of each type/color/texture shingle, in unbroken bundles is required.
  - d. A mock-up is required for all shingle colors specified.
3. Standing seam metal roofs shall meet the following requirements:
  - a. Exposed fasteners are not allowed. All systems should be concealed fasteners. Concealed fastening clip shall be two-piece type that maintains panel above deck and allows for expansion and contraction of metal panels without buckling or deformation of panels. Panels shall be specified to be fastened at one point only along run of panel as determined by manufacturer.
  - b. Metal roof system shall meet ASTM 1592 uplift requirements.
  - c. System shall meet ASTM E 1680 for air infiltration at minimum of 0.06 cfm/sq. ft at test pressure difference of negative 1.57 lbf/sq. ft.
  - d. System shall meet ASTM E 1646 for water penetration at minimum test pressure difference of 2.86 lbf/sq. ft.

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- e. System shall meet Severe Hail resistance requirements.
  - f. System shall meet combustion characteristics of ASTM E 136.
  - g. Include metal bar-type, seam-mounted (do not penetrate metal roof system) snow guards at all entrances and pedestrian walk ways and at locations where ice and snow could damage landscaping near building. Adhered plastic-type snow guards are not acceptable.
  - h. Provide minimum 22 gauge Galvalume-coated steel with high-Performance organic finish:  
Fluoropolymer Two-Coat System (minimum): Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.
  - i. Minimum 20 year warranty including paint finish to meet the following requirements:
    - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - j. A mock-up is required for all metal colors specified.
4. New Construction: Steep slope roofs shall have a minimum 4/12 pitch.
5. Provide soffit and ridge ventilation to meet HUD standards. Ventilation through the deck is not allowed. Ridge vent shall be Galvalume-coated steel. Plastic vent is not acceptable.
- a. Provide roof drainage through gutters and downspouts. All downspouts should connect to site storm drainage system. Built-in gutters are not allowed. If a higher volume drains to a lower roof, lower roof must be sized to accommodate additional flow. Include gutters and downspouts as required to prevent water run-off over pedestrian traffic ways and entrances and to minimize landscape damage.

### **Roof Maintenance and Repairs**

1. Installer shall be approved in writing by the roofing manufacturer. Installer shall have a minimum of five years experience with the approved system and with similar project types.
2. Special Product Warranty: Manufacturer's total system "No Dollar Limit" agreement including flashing and insulation system endorsed and signed by system manufacturer for warranty period indicated in this standard.
3. All levels of roof shall be accessible. If change in height from one roof level to another exceeds 36 inches, a roof ladder shall be provided.

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# 07 50 00 – Membrane Roofing

## Roof – General

1. Roof shall be Type 1 and U.L. Class A.
2. Coordinate with Owner's Insurance require for uplift rating and other requirements. If minimum, meet current Indiana Building Code requirements and UL 580 or UL 1897.
3. Roof may be mechanically attached or fully adhered. Ballasted membranes are not acceptable.
4. Insulation: Insulation shall be polyisocyanurate or extruded polystyrene and shall be provided in a thickness to meet or exceed current energy code requirements. Stagger joints of multiple layers of roof board insulation at all locations. Expanded polystyrene (Bead board) and mineral fiber board insulations are not acceptable. Mechanical fastening to concrete decks is not acceptable.
5. Cover Board: Provide 1/4 inch thick minimum fiberglass-faced gypsum ("Dens-Deck") cover board or roofing membrane manufacturer's recommended and warranted coverboard that does not contain wood or wood fiber over rigid board insulation.
6. Provide vapor barrier in roof assembly in proper location.
7. Roof expansion joints shall be by the roofing membrane manufacturer.
8. Roof flashing shall be 12-inches (nominal), above finished roof.
9. Install all counterflashings within reglets. Roof flashing into a wall shall utilize a two-piece metal assembly with flashing receiver and counterflashing. The flashing receiver shall be installed within the masonry bed joint.
10. Roof Access: Design at least one roof access through at 3' x 7' door from penthouse area. All roof areas shall be accessible by door or roof hatch with a ships ladder. Vertical walls ladder use requires College approval. Roof hatches and penthouse doors shall be locked and cores shall be coordinated with finished hardware specification.
11. Design permanent roof tie-off hooks for Contractor and Owner use.

## Membrane Roofing

1. Preferred low-slope roofing material shall be TPO or PVC roof system. Option to include a modified bituminous roof system for high roof traffic projects.
2. Roof membrane shall meet the following requirements:
  - a. Thickness: Minimum 60 mil, scrim reinforced.
  - b. Seams shall be heat welded.
  - c. System shall be fully-adhered or in-seam mechanically attached. Ballasted roof systems are not allowed.

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- a. Color: Color of roof to be evaluated with building location. Consider heating days versus cooling days when building is located in northern half of state.
  - d. Minimum warranty: 15 years.
3. Provide positive drainage to roof drains. The slope shall not be less than 1/4-inch per foot. Where water is channeled along a roof saddle, a minimum resultant slope of 1/4-inch per foot must be maintained. Dimension the saddles on the roof plan to ensure the minimum slope is met.
  4. If a higher volume drains to a lower roof, lower roof must be sized to accommodate additional flow.
  5. The roof shall be sloped primarily by use of the building steel as opposed to tapered insulation, however, make use of tapered insulation at roof saddles between drains.
  6. Metal bar terminations shall be required at parapets.
  7. Provide 2' x 2' walk pads at roof hatches and door access points and from roof access points to any roof top equipment.
  8. Subject to code requirements, provide access to the roof from the interior only.
  9. Use minimum 36" X 36" access hatches with ship type ladders in lieu of exterior wall ladders. It is preferred to provide access through a penthouse door. All roof levels and areas must have access. Consider access by maintenance personnel with tools or equipment.
  10. Provide minimum 0.050 prefinished aluminum or galvanized steel flashing, edge trim, fascias, and copings that meet Code-required ANSI/SPRI ES 1 testing with anodized or fluorocarbon painted finish in color as selected by Architect.
  11. Group penetrations together within a single curbed area, minimum 12 inches above finished roof. Place no penetrations within the valleys.
  12. Any units located on the roof shall be set on continuous curbs. Roofing shall not extend under any equipment. All units shall be a minimum of 12 inches above finished roof. All equipment shall be screened from view from the ground level.
  13. Low slope roofs shall be internally drained. Reference plumbing standards. Allow access to roof drain lines inside the building for maintenance.
  14. Provide parapets with copings (not gravel stops) at all locations except for minor penthouses where gutter and one-way sloped roof is the most economical solution. Parapets shall be a minimum of 12 inches vertical height above the roof membrane to meet roofing system warranty requirements.

### **Roof Maintenance and Repairs**

1. Installer shall be approved in writing by the roofing manufacturer. Installer shall have a minimum of five years experience with the approved system and with similar project types.

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2. Special Product Warranty: Manufacturer’s total system “No Dollar Limit” agreement including flashing and insulation system endorse and signed by system manufacturer for warranty period indicated in this standard.
3. All levels of roof shall be accessible. If change in height from one roof level to another exceeds 36 inches, a roof ladder shall be provided.

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# 07 60 00 – Flashing and Sheet Metal

## **Flashing and Sheet Metal**

1. Paint
  - a. Fluoropolymer Paint (similar to Kynar 500) for galvanized steel and aluminum.
  - b. Color shall be selected from manufacturer's standard colors
  - c. If Ivy Tech Green is used, reference Ivy Tech standard colors referenced in Signage standard.
2. Waterproof Membrane
  - a. Top of parapet walls shall have waterproof membrane under wood or metal blocking secured with an anchor.

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## 07 80 00 – Sprayed on Fireproofing

1. Material used for patching existing fireproofing shall be tinted (color) for identification.

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## 07 90 00 – Joint Protection

1. Silicone sealants shall be utilized on exterior of building and urethane sealants shall be utilized on interior of building
2. Acrylic latex sealants may be used at door and window frames on interior of building.
3. Mildew-resistant silicone sealants shall be used in interior locations where water will be regularly present such as restroom and kitchen plumbing and fixtures.

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# 08 10 00 – Doors, Frames, and Hardware

## Material

1. All entrance exterior doors shall be heavy-duty, thermally-broken, aluminum doors with thermally-broken aluminum frames. Entrance systems larger than 150 SF shall be specified as a glazed aluminum curtainwall system for improved structural and thermal performance.
2. Provide galvanized hollow metal frames and insulated hollow metal doors at service entries.
3. Loading dock overhead doors shall be insulated steel roll-up type to allow for mechanical air curtains and shall be motorized.
4. Exterior doors shall be numbered per requirements by the Fire Department and Ivy Tech.

## Mullions

1. Removable with core type locks.
2. Hardware: All hardware must be reviewed with Facility Manager prior to bidding.
3. Door Pulls must be ADA accessible.
4. Continuous hinges are required for exterior doors but are not needed on service doors used infrequently.
5. Door panic devices (non-electric type) shall “dog” down using a lock/core type device.
6. Interior mounted door sweeps are required on exterior doors.
7. Do not provide vertical rods at exterior double doors.
8. Electronic access shall be provided at all exterior entry doors and other select interior doors. As a minimum, provide these doors with rough-ins for card access, electrified control, and door position monitoring. Reference Technology System Standards for other interior doors to receive electronic access control.
9. All hardware shall be provided by Division 8 Section “Door Hardware”, including the electrified hardware. Electrical Contractor shall connect all electrified hardware.
10. Removable cores shall be provided at all doors.

## Size

1. All door leafs shall be standard 3’-0” wide except at loading dock areas where doors shall be 4’-0” wide or other areas as required by program or indicated in the Space Standards.

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**Interior Frames, Doors, and Hardware**

1. Interior doors and frames shall be selected in accordance with the building program requirements. Doors and frames in service areas, high abuses, and high traffic areas shall be hollow metal. Entrances into offices, classroom, light abuse, and special areas shall have hollow metal frames and flush doors.
2. 6 x 30-inch wood vision lites shall be included within classroom doors.
3. 3 x 30-inch vision lites shall be included within office doors.
4. Aluminum storefront systems should be utilized for office areas that serve student needs such as financial aid, dean's office, and other student services.
5. Standards:
  - a. Interior hollow metal frames shall be 16 ga. minimum.
  - b. Exterior hollow metal frames shall be 14 ga. minimum.
  - c. Exterior hollow metal doors shall be 16 ga. minimum.
  - d. For new construction, all hollow metal frames shall have mitered and welded corners.
  - e. For renovations, knock-down frames shall be provided.
6. All doors (including existing doors) must be ADA accessible.

**Interior Hardware**

1. Hardware selections shall be based on the campus hardware standard in order to maintain uniformity. This decision must be reviewed with the College. Door and hardware schedules must also be reviewed by the Campus Facility Director. This review meeting is the responsibility of the Architect to schedule and conduct.
2. Provide a removable mullion at double doors.
3. Concealed vertical rods are acceptable.
4. All hardware shall be provided by General Contractor, including the electrified hardware. Electrical Contractor shall connect all electrified hardware.
5. Electrical gear room shall have panic hardware for emergency exit.
6. Door Hardware Types:
  - a. Classroom – Mortise Lock
  - b. Lab – Mortise Lock
  - c. Assembly Spaces – Mortise Lock
  - d. Other Spaces (high use) – Mortise Lock

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- e. Office – Cylindrical
  - f. Storage – Cylindrical
  - g. Other Spaces (low use) – Cylindrical
7. Typical Mortise – Classroom function with thumbturn and locked indicator.
  8. Typical Office Function – Push Button locking.
  9. Meet ADA requirements.
  10. Coordinate door hardware with access control requirements.

**Steel Doors**

1. Steel doors with all welded frames.

**Flush Wood Doors**

1. Flush Wood Doors: provide “A” Grade doors. All doors shall be “Stain Grade.”
  - a. 5-ply veneer
  - b. WDMA I.S. 1-A requires only running matched grade A veneers with center balance matching.
2. Minimum width or special sizes should be discussed with the campus.
  - a. i.e. Health Occupations (beds moving in and out of the doors), Specialty Equipment, etc. may require special width doors.

**Access Doors – Walls**

1. Full height (steel) access door should be provided in cases of gang restroom.
2. A minimum 24”x24” access door should be provided at all other chases.

**Overhead Coiling Doors – Rated**

1. Electronically operated doors shall be coordinated with power requirements for the door.

**Overhead Coiling Grills**

1. Provide slide bolts at each side rail with locks. Coordinate lock.

**Restroom Doors**

1. It is preferred that public gang restrooms are designed without doors.
  - a. If doors are required for the design, they should be out swinging.
  - b. If doors are included on all gang restrooms on the floor, at least one per floor should have ADA electronic push plate.

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# 08 80 00 – Glazing

## Exterior Glazing

1. One inch insulated glass consisting of two 1/4 inch thick pane with 1/2 inch air space, hermetically sealed.
  - a. Specify low-e coating on third surface.
  - b. Specify argon gas in air space for energy considerations
  - c. Acceptable Tint Colors:
    - 1) Reflective (mirror) glass is not acceptable.
    - 2) Colors/Tints: Manufacturer's standard Gray, Bronze, Green, and Low-E coated glass. All other colors or tints must be approved by the College and must comply with all requirements.
2. Glazing to meet Indiana Energy Code Requirements.

## Windows

1. Windows shall meet the following requirements:
  - a. Material: Aluminum frame with anodized or fluorocarbon paint finish.
  - b. Construction: Thermally broken with subframe.
  - c. Glazing: One inch insulated glass.
  - d. Type: Fixed.
  - e. Size: To the greatest extent possible, standardize window sizes within each building, and within classrooms, to minimize the number of variations.
2. The use of windows is encouraged in classrooms, offices, cafeterias, lounges, and other areas where practical to provide natural light.

## Aluminum Architectural Windows – Fixed

1. Generally, operable windows are not needed. If operable windows are determined to be needed, confirm with College and confirm operable type.
2. Attic Stock: Requirements for attic stock shall be reviewed with the College. Attic stock may include but not limited to: Sash, Glazing beads/stops, Trim, and Panning.
3. Maximum perimeter sealant joint 3/8".
4. Shop drawings shall be approved by the manufacturer prior to submission.
5. Glazing: One inch insulated.
6. Window units shall have dry glazing system.

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**Manufacturer Requirements**

1. Review field dimensions prior to submission.
2. Attend pre-award meeting.
3. Provide on-site training for College's staff (minimum of 1-1/2 hours).
4. Review completed installation prior to Substantial Completion walk-through.
5. Manufacturer's installer-certification shall be submitted with post-bid information.

**Mock-up**

1. Install on-site mock-up as required (review requirements with College). Manufacturer Representative shall attend review.

**Interior Glazing**

1. Labs or Classrooms with large glazing to the hallway:
  - a. Consider access to an adjacent space or storage room without glazing for additional exiting or escape during an emergency.

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## 08 90 00 – Louvers and Vents

### **Louvers – Wall**

1. Color: Selected by Architect from Manufacturer's Standard colors.
2. Coordinate louver type and material and finish with Mechanical Engineer.

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## 09 20 00 – Gypsum Wall Board

1. Metal Stud and Gypsum Board Sound Partitions:
  - a. Masonry or metal stud and gypsum board partitions may be used in corridors. Architect shall consider corridor abuse, flexibility, and cost in determining appropriate materials.
2. Where direct lighting is provided on a wall surface, special considerations need to be made to the finish of that wall to provide a smooth surface and address specifically with the Owner.
3. In Classroom areas, the use of metal studs and drywall may be used between walls where structural reconfiguration is significant to provide maximum flexibility. Acoustic insulation must be used and shall extend to the deck. Extend one side of the gypsum board and full insulation to deck for sound control as required by the project. The perimeter shall have acoustical sealant.
4. In office areas, the use of metal stud and gypsum board with acoustic insulation is acceptable. Extend one side of the gypsum board and full insulation to deck for sound control. The perimeter shall have acoustical sealant. All walls to deck shall be coordinated with plenum spaces.

### Exterior Stud Walls

1. Interior Gypsum Finish: Exterior cladding, air space, continuous rigid insulation to meet state energy code, fluid applied membrane vapor permeable air barrier, ½ inch fiberglass-faced gypsum sheathing, metal studs (depth as required by structural design), and paperless drywall. Nominal wall thickness will vary depending on the depth of metal stud framing. Insulation shall be continuous as required by state energy code. Minimum R-value for exterior walls as required by state energy code. This is a basis and must be verified by each designer for the climate and appropriateness of design condition. Minimum continuous insulation is 3 inches.

### Gypsum Wall Board Interior Partitions

1. All gypsum board shall be 5/8 inch type X.
2. Architect shall specify the use of paperless gypsum board on the interior face of exterior walls or in areas subject to moisture such as kitchens, custodial closets, and restrooms.
3. Tile backer board shall be behind all ceramic wall tiles.
4. Specify abuse/impact resistant gypsum board when utilized in corridors or provide a durable wainscoting option.
5. Outside drywall corners in corridors shall be protected with acrylic wall corner guards with an aluminum retainer. Bottom mounting should be 6" A.F.F. (coordinated with wall base height) and match foot frame height.

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### **Gypsum Sheathing**

1. Minimum thickness – 5/8”

### **Special Walls**

1. Provide special construction needs or details for occupancy and area separation walls, firewalls, and horizontal exits.
2. Seal gaps between deck and tops of walls. Indicate firestopping where required by code.
3. Auditoriums and lecture rooms shall use acoustic wall panels to limit reverberation to 0.5 second panels.

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## 09 30 00 - Tiling

1. Cove Base:
  - a. In rooms with ceramic flooring, the cove base shall be integral with the floor.
2. Extra Material: Furnish quantity of full-size units equal to two percent (2%) of amount installed; composition, color pattern, and size indicated and should include all special forms like bullnose, etc.
3. Installation: Maintain temperatures at not less than 50 degrees F. in tiled areas during installation and for seven days after completion.

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## 09 50 00 - Ceilings

### **Acoustical Panel Ceiling**

1. Extra Material: Two percent (2%) of amount installed for Acoustic Ceiling Units and Exposed Suspension System Components.
2. Size: 24" x 24"
3. Standard is square panel edge.
4. Tegular Ceiling Tile Edges may be used in corridors and other public spaces. Finish any cut edges.
5. Do not use tegular tiles in nursing labs with ceiling mounted curtains.

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## 09 60 00 – Flooring

### **Carpeting**

1. Carpet tile is preferred..
2. Extra Material for carpet tile only: Two percent (2%) of amount installed for each type, color and pattern. Minimum 1 carton per carpet selection.
3. Must be warranted by manufacturer for 10 years from date of substantial completion.
4. Must be minimum 26 ounce yarn system.
5. Provide walk-off carpet tile in vestibules or other entrances.
6. Carpet must have stain resistance in fibers or stain shield applied on surface.
7. Must be able to carry pattern for 5 years beyond substantial completion even if considered a running line at time of order. Must manufacture as a custom for remaining years.

### **Terrazzo/Porcelain Pavers/Quarry Tile**

1. Hard surface flooring materials are preferred in lobbies and main corridors on lower levels. Thinset terrazzo is preferred; however, if thickset is in the current building match existing if budget permits.
2. Provide vinyl wall base with epoxy Terrazzo. If Terrazzo cove base is in the current building match existing if budget permits.
3. Specify a thickness of quarry tile that is appropriate for the loading situation. For maintenance ease, choose a dark joint color.
4. Provide for expansion control in quarry, ceramic, and terrazzo flooring systems.
5. Installer: Installer must be a member of the National Terrazzo and Mosaic Association.
6. Extra Material (Porcelain Pavers/Quarry Tile): Furnish quantity of full-size units equal to two percent (2%) of amount installed; composition, color pattern, and size indicated and should include all special forms like bullnose, etc.

### **Resinous Flooring**

1. Provide integral cover base.
2. Science labs, kitchen and serving area floors shall be resinous flooring.
3. Installation: Maintain temperatures at not less than 50 degrees F. in tiled areas during installation and for seven days after completion.

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**Resilient Tile Flooring**

1. VCT (vinyl composition tile) is preferred for all hallways.
2. If existing wood floor is to be covered with new VCT, first screw down OSB and provide a self-leveling concrete topping (Ardex is an acceptable manufacturer) the over surface prior to VCT glue and tile installation
3. When VCT is put over existing wood floors, with the overlayment of 3/4" OSB indicated, remove an existing board every 2' to allow wood floor expansion.
4. Extra Material: Two percent (2%) of amount installed for each type, color and pattern.
5. Vinyl Composition Tile
  - a. Composition 1 – Asbestos-free; Gage: 1/8"
  - b. Vinyl Wall Base
  - c. Height: 6" in corridors, 4" in other locations
  - d. Thickness: 1/8" gage in rolls of maximum length
  - e. Style: Standard top-set cove with prefitted corners
  - f. Minimum length = 2'-0"
  - g. Finish: Matte
  - h. Color: As selected by Architect with College input. – Dark colors
  - i. Extra Material: Two percent (2%) of amount installed.
6. LVT (luxury vinyl tile) may be used in lieu of VCT if budget permits.

**Walk Off Mats**

1. Do not use recessed mats.
2. Verify if the campus uses a service for mats if walk off tiles are not available.
3. Walk off mats should be used in vestibules. Consider additional walk off carpet beyond the entrance vestibule as well.
4. Provide a minimum of 20'-0" of walk off carpet at entrances. Total dimension includes walk-off carpet in vestibules.

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## 09 90 00 – Painting and Coating

1. Paint by local suppliers is preferred.
2. Color: Walls should have a standard color throughout the building.
3. Each building may have a standard color plus a maximum of three additional colors in the building for accent walls.
4. Painting of any mechanical ductwork must be specified on the finish schedule and assigned to the appropriate bid package.
5. Review paint type selections by room use (i.e. satin, eggshell, etc.) with facility director. Paint shall be specified to comply with state VOC requirements.

### **Polyamide Epoxy Coating**

1. Warranty: Five years from date of project Substantial Completion.
2. Color: As selected by Architect from Manufacturer's standard colors.
3. Only for use on painted concrete floor.

### **Aliphatic Polyurethane Coating**

1. Color: As selected by Architect from Manufacturer's standard colors.

**The College prefers that the following finish materials and products NOT be included in their projects:**

- a. Multi color paint
- b. Acrylic wall coating

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## 10 11 00 - Visual Display Units

1. Preference for marker board paint.
  - a. Wall requires a Level 5 finish.
  - b. Verify prep and primer requirements with wall surface.
2. Warranty: 50 years on markerboard from date of project Substantial Completion.
3. Mount the bottom at 36" AFF.
4. Box type trays.
5. Basis of Design for Marker Board Paint: MDC

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## 10 14 00 – Signage

1. Room signage should be provided and should be coordinated with the Owner's final room names and numbering system.
2. Provide directories at main entries and elevator lobbies that can be updated regularly. They must be lockable.
3. Provide exterior door numbers
4. Names of building and the College may change over time. When incorporating the college or building name into the facility, consider the future cost of removing or replacing prior to designing the project. For example, special consideration shall be given to casting names in limestone, terrazzo or other permanent materials and should be minimized.
5. Color usage:
  - a. Green: Pantone 342 C (4 color process – 100C 0M 69Y 43K)
  - b. Black: Pantone black (4 color process – 0C 0M 0Y 0K)
  - c. Gray: 50% Pantone black (4 color process – 0C 0M 0Y 50K)

### **Plaques**

1. Coordinate size, material, finish, and information on plaque with College.

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# 10 21 13 – Toilet Compartments and Accessories

## **Partitions**

1. Color: Selected by Architect from Manufacturer's Standard colors.
2. Hardware: Solid stainless steel hardware.
3. Partitions: floor mounted, overhead braced with continuous wall angle.
4. Toilet partitions should be dark in color so as not to show marks and vandalism.
5. Toilet partitions shall have full continuous hinge.

## **Toilet Accessories**

1. Many accessories that are owner furnished and owner installed are referenced in the space standards.
2. The construction project (drawings) should identify locations and **MUST** indicate all required wall supports/blocking, etc.

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## 10 44 13 – Fire Extinguisher Cabinets

1. Cabinets shall be fully recessed with flat panel doors.
2. Signage designating the locations should be included in the construction contract.
3. Contractor will also provide the fire extinguisher cabinets and the extinguisher.
4. Coordinate with Owner and Owner's insurance the locations of Fire Extinguisher Cabinets in design beyond the code requirements. Additional fire extinguishers beyond code requirements may be required by Ivy Tech insurance. Consider locations with combustible activities.

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# 10 51 00 - Lockers

## **Student Lockers**

1. In general, students that are on campus all day may be using lockers. Verify if and where they are required. Work with each campus to define their use and locking requirements. Please note that the lockers may be assigned by semester or they may available for anyone's use via a padlock.
2. **Locker Locations**
  - a. Six Tier Metal Lockers
    - 1) Testing Center
  - b. Single Tier Metal Lockers
    - 1) Culinary
    - 2) Advanced Manufacturing
    - 3) Vocational Labs
  - c. Other Locations: Single Tier metal locker

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## 12 24 00 – Roller Window Shades

1. Provide roller shades (i.e. Mecho or Draper) as the standard for exterior window covering.
2. Roller shades should be manual except in public commons areas, tall ceiling areas, or other locations requiring electric shades.

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## 12 30 00 - Casework

1. All casework shall be wood or plastic laminate as coordinated with College. Reference space standards.
2. Coordinate hardware requirements with College.

### **Countertops (Non-Science Labs)**

1. Color to be selected by Architect from Manufacturer's standard colors.
2. 3 mm PVC edging.
3. 3/4" marine grade plywood as a substitute
4. Utilize melamine on inside of cabinets and drawers only.

### **Countertops (Science labs)**

1. Epoxy resin with epoxy resin sinks.
2. Color: Black or Green.

### **Countertops (Bio Tech)**

1. Metal counters and cabinets.
2. Epoxy resin countertops.
3. Color = Black or Green.

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## 12 61 00 – Fixed Audience Seating

1. Every seat should be the same size at 22” minimum each
2. Extra materials:
  - a. Three extra chairs of each size
  - b. Fabric: Three square yards
  - c. Seat and Back Assemblies: Four extra full-size seat units and four extra full-size back units of each size.

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# 14 20 00 - Elevators

## Passenger Elevator

1. Preference is Holeless hydraulic elevator for less than 5 stops. Elevators over 5 stops can be traction elevators.
2. Certification: Elevator Contractor shall have a licensed Electrical Contractor to install all electrical power.
3. Interior wall finish to be stainless steel wall panels.
4. Hooks and Protection Pads shall be included.
5. Maintenance Service: 12-months from date of project Substantial Completion.
6. At minimum, one elevators shall be large enough to accommodate a hospital gurney.
7. Minimum Capacity: 3,500 lbs.

## Service Elevators

1. Preference is Holeless hydraulic elevator for less than 5 stops. Elevators over 5 stops can be traction elevators.
2. Hooks and Protection Pads shall be included.
3. Maintenance Service: 12-months from date of project Substantial Completion.
4. Controlled Access System shall be tied into the elevators on each floor – coordinate with security system.
5. Minimum Capacity: 4,500 lbs.

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## 14 40 00 - Lifts

### **Stages or Elevated Platforms**

1. ADA Access via a ramp or lift is required from the House floor or adjacent corridor.
2. Ramps are preferable. If a ramp is not provided, ensure a man-lift is accommodated.

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# 21 00 00 - Fire Protection

## Abbreviations

NFPA National Fire Protection Association

## General

1. Elevator Machine Rooms are to have two-hour separation and be protected with smoke detection as accepted by the Fire Authority.
2. Yard equipment storage area(s) shall be separated from the balance of the building with fire rated construction as accepted by the Fire Authority.
3. Hazard classification shall be light hazard and ordinary hazard. Group 1.
4. The system shall comply with applicable federal standards, N.F.P.A. Bulletin No. 13 Installation of Sprinkler Systems, local State Board of Insurance and Fire Marshall.
5. Wet sprinkler lines must be designed into conditioned zones. Pay attention to vestibules, foyers, etc and ensure space above the ceiling is conditioned to eliminate piping freezing.
6. Generally, zoning for sprinkler system will comply as follows: Public Area, Food Preparation Areas, Dry-Pipe System, By Floor and by building wing so that zoning is limited to 40,000 sf/zone. All zoning shall be approved by the Local Fire Authority.
7. All unused fire hose cabinets and associated piping valving must be removed and the open area must be in-filled to match the adjacent wall. Coordinate with architectural.

## Type

1. Areas required by code or program shall be protected with a wet-pipe sprinkler system
2. Dry-pipe sprinkler systems shall be avoided unless the building conditions will require it.
3. Yard equipment storage areas attached to the building shall be protected with a dry-pipe system.
4. Dry-pipe systems will include a tank-type air compressor complete with a low pressure and loss of power sensor connected to the Building Automation System.
5. Each dry-pipe system to have trouble alarm and pressure switch for flow.
6. Main Technology Room(s) shall be reviewed with the College as to the type of protection required and/or desired. Rooms that store archived/special items shall also be reviewed.
  - a. If a gas system is used, Inergen is a possible system.

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**Locations:**

1. Finished ceiling: recessed type heads with flush cover caps to avoid vandalism by students.
2. Exposed structure ceilings: upright type sprinkler with a natural brass finish.
3. Walk-in Freezers and Exterior Storage Sheds Connected to Building: Dry pediment heads.
4. Storage Rooms, Boiler Rooms, Mechanical Rooms, Open Ceiling: Use basket type guards.

**Placement:**

1. Sprinkler Heads are to be installed in the center of ceiling tile in lay-in type ceilings.
2. All other sprinkler heads to be spaced as required by the Code for the required coverage; however, no device shall be less than 6" from a ceiling grid or bulkhead.

**Distribution / Maintenance**

1. Sprinkler system piping material shall be Schedule 40 black steel less than 2" diameter joined with screwed, flanged, welded or victaulic joints. Lightwall pipe is not acceptable.
2. Sprinkler piping greater than 2" diameter can be Schedule 10 black steel. Lightwall pipe is not acceptable.
3. All drains for sprinkler system shall drain through outside wall at grade where practical. If not possible, provide floor drain at the drain down locations.
4. Inspection test piping to be discharged at one location only.
5. Drains are to be routed to a manifold header for single discharge to exterior where practical.
6. Provide spare heads and wrench as required in wall mounted cabinet located near the fire service main.

**Fire Service / Fire Department Connection**

1. Fire service main to be located in Mechanical Room unless otherwise accepted by the College and Fire Department.
2. Fire Department connection will be located as directed on plans by Fire Department Fire Marshal as approved by the Fire Authority. The Architect/Engineer must coordinate review with the local Fire Authority.
3. Try to locate fire department connection within view of a security camera.
4. Post indicator valves shall be supervised.
5. If required by the local FD, provide a flush mounted 'knox box', located as directed.

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6. The requirement of a fire pump shall be verified during Schematic Design.
7. The fire pump shall be electric and connected to natural gas emergency generator if required by the Fire Authority.

### **Quality Assurance**

1. Installer shall have been in the Fire Protection business doing work of similar size for at least five years.
2. All fire protection components and equipment shall be manufactured in the United States.
3. Coordinate pipe specifications with use.
4. Shop Drawings shall include complete hydraulic calculations, certified by a registered engineer and reviewed and stamped by the Fire Marshal, the College's Insurance Underwriter and other local authority have jurisdiction.
5. Plans shall include: Floor Plans, flow test data used for the design of the system, vital area protected, detailed schematic of the sprinkler risers, complete schedule of products.
6. All devices, systems, and materials shall be listed by UL for its intended use.
7. A/E to coordinate water source with Mechanical Contractor sections and local Water Utility requirements.
8. Coordinate design criteria with building use and plans.
9. Warranty: Contractor shall provide emergency repair service for the system within 24 hours of a request by the College during Construction.

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# 22 05 00 - Common Work Results from Plumbing

## General

1. The plumbing system design should take into consideration the type of facility, program, project type and site considerations. Project requirements and program are to be reviewed and verified with the College.
2. All plumbing systems shall be designed and installed in accordance with the current Edition of the Uniform Plumbing Code published by the Building Officials and Code Administrations as modified and adopted by the Indiana Fire Prevention and Building Safety Commission.
3. No roof drains or restrooms shall be located above or routed through elevator equipment rooms, data spaces telecommunications rooms, or electrical rooms.

## Abbreviations

GF	Ground Fault Interrupter
RO	Reverse Osmosis
DI	De-Ionized

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Issue Date: February 1, 2015

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## 22 11 16 - Domestic Water Piping

1. The incoming water service shall enter the building in the mechanical/boiler room through two parallel installed reduced-pressure-principle backflow preventers (lead free).
2. After the backflow preventers, domestic water to the water heater shall be provided with a rough-in for a water softener, including a floor drain.
3. Raw cold water shall be provided for all water closets, urinals, lavatories, hose bibbs, and wall hydrants.
4. Cold, hot and hot water return piping shall be routed above ceilings. No underfloor slab piping unless approved by the College.
5. Shut-off valves shall be provided at all branch lines where required for proper operation of piping and equipment, including valves in all branch lines where necessary to isolate sections of piping and at each fixture. Ensure isolation valve locations have been reviewed with the College to ensure there are enough for appropriate maintenance.
6. Walk-in plumbing chases shall be provided where practical (especially with restrooms containing 4 or more fixtures back-to-back). If not, a minimum of 24" shall be provided in all chases (or as approved by the College).
7. The water supply system shall be designed to provide a minimum of 45 psi at the most remote outlet during normal operation and not to exceed 75 psi.
8. If water main pressure exceeds 80 psi, it is required to install a pressure reducing valve.
9. All domestic piping, including cold, hot and hot water return piping shall be insulated.
10. Entire systems shall be tested and disinfected with a hypochlorite solution.
11. Water hammer arrestors shall be provided on both hot and cold water lines servicing fixtures and equipment with quick closure valves.
12. Each toilet room must have an isolation valve for each room.
13. Unions are required at all solenoid valves.

### Domestic Underground Piping

#### Nominal Size Range

Minimum Diameter:	1/4	1-1/2	3	14	24	30
Maximum Diameter:	2½	2½"	12"	20	24	64

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**Design**

Working Pressure PSIG:	125	125	150	150	150	150
Working Temperature Fahrenheit:	250	250	350	250	200	150
Pressure Class:	350	350	350	250	200	150

1. The minimum burial depth of exterior domestic water lines will be 5'-0"
2. Ductile Iron Mechanical Joint: AWWA C151 with Mechanical Joint Bell and plain spigot end, cast iron pipe, centrifugally cast with asphaltum coating. Class as noted in schedule. Pipe to be marked and carry nominal weights and dimensions as required by state and local codes. As manufactured by James B. Clow & Sons; American Cast Iron Pipe; Alabama Pipe, U.S. Pipe & Foundry.
3. Mechanical Joint: AWWA C111 ductile or grey-iron, standard pattern, same class as noted for pipe.
4. Mechanical Joint: AWWA C111 ductile or grey-iron glands, rubber gasket and steel bolts. Reinforce joint at hydrants, fitting or valves with heavy wrought iron clamps and wrought iron rods in accordance with standard details of National Board of Fire Underwriters. Apply heavy coat of bituminous solution to assembly.
5. Acceptable PVC materials may be used outside of the building perimeter if approved by the College. A locator wire shall be applied to the pipe as required.

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## 22 11 23 – Plumbing Pumps

1. Domestic booster pump system shall be tested at 0%, 25%, 50%, 75%, and 100% of full load capacity at scheduled suction and discharge pressure.
2. All plumbing pumps shall be factory assembled, wired, and tested, prior to shipment.
3. An inline single stage wet rotor type circulation pump shall be provided on the main system 120°F hot water recirculating lines.
4. Circulation pump shall be sized to overcome pressure drop through thermostatic mixing valve and pressure drop through hot water and hot water return piping.
5. Required sump pumps, sewage ejectors, and lift stations shall be of the duplex design with automatic alternating controls, remote alarms, pilot lights and all required auxiliaries. Pumps and alarms shall be monitored by the building management system.
6. Ejectors and stations shall be of the reverse flow design.

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## 22 13 00 - Sanitary, Storm, and Venting piping Systems

1. Sanitary waste and vent lines above slab within the building shall be Code approved PVC type DWV materials.
2. Sanitary waste and vent lines below slab within the building shall be CISPI/Code approved cast iron DWV pipe and fittings.
3. Horizontal pitch of pipe within the building, above and below slab, will not be less than 1/8" per foot.
4. Cleanouts shall be at fifty foot horizontal intervals, at any change in direction greater than a 45° angle and at the individual fixtures.
5. Vent stacks shall penetrate the roof with a minimum 4-inch diameter and extend to a minimum of 12 inches above the roof surface.
6. All sanitary waste lines below the slab shall be collected together into main drains and exit the building to the sanitary sewer.
7. Cleanouts, the same size as the building drains, shall be brought to exterior grade surface within five feet of the building for each building drain.
8. Storm water lines above or slab shall be Code approved PVC type DWV materials.
9. A cleanout shall be placed at the base of each vertical roof drain conductor.
10. All roof drain sump pans shall be four bolt patterns with under deck clamps and cast iron screen.
11. Horizontal roof drain conductors shall be insulated. Insulation shall meet application and code requirements.
12. At each roof drain, an overflow drain shall be provided.
13. The main roof drain shall be a cast iron dome and body; the overflow shall be of the same material as the main drain but have 2" high overflow collar.
14. Minimum size for roof drain outlets shall be 4" diameter.
15. All storm water lines below the slab shall collect into main drain lines, exit the building, and connect to the new storm sewer system.

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16. As with the sanitary waste line, exterior cleanouts shall be provided where the storm drains leave the building.
17. Floor drains must be provided in all new and renovated restrooms and custodian closets.
18. A floor drain must be incorporated into Mechanical/Boiler Rooms.
19. Walk-in plumbing chases shall be provided where practical (especially with restrooms containing 4 or more fixtures back-to-back). If not, a minimum of 24" shall be provided in all cases.

### **Drainage and Vent Systems**

1. Storm Drain Piping Above Ground, Within Building, PVC Type DWV.
2. Sanitary Drain and Vent Piping Above Ground, Within Building, PVC type DWV.
3. Sanitary Drain and Vent Piping Below Ground, Within Building, Cast Iron DWV.
4. Storm Drain Piping, Below Ground, Within Building, PVC type DWV.
5. In return air plenums use no-hub cast-iron piping.
6. For pressure sewer and storm piping, use pressure rated PVC piping and fittings.

### **Acid Waste and Vent Systems**

1. The type of piping and need for an acid neutralization tank shall be discussed with the College prior to design in case-by-case application.
2. In return air plenums piping shall be PDVF, glass or stainless steel piping.

### **Grease Trap**

1. Provide grease trap as required by the Board of Health and local municipalities.
2. Provide access for grease trap and locate near a vehicle drive or loading area.

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## 22 15 19 – Air Compressors

### **Compressed Air System**

1. Air compressor shall be scroll type. Provide Dryer oil free air and automatic blowdown. Review application with the College.
2. Mount units on vibration isolators which have been anchored to substrate, in accordance with manufacturer's instructions. Location of air compressor shall be reviewed with the College.
3. Install units on 4" high reinforced concrete pad, 4" larger on each side than compressor base.
4. Consider increased acoustical treatment of separating wall partitions and door assemblies to isolate noise.

### **Vacuum Air System**

1. Provide vacuum air systems in bio and dental labs as required by the College.

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## 22 31 00 – Domestic Water Softeners

1. Softeners shall be provided as required and approved by the College.  
Softener shall operate on a sensor control.
2. Softeners shall be fully charged with fresh salt and mineral at Building Substantial Completion.

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## 22 34 00 - Domestic-Water Heaters

1. A gas-fired, or electric, water heater shall serve the building with domestic hot water. A gas-fired water heater shall be hi-efficient for energy conservation.
2. Point-of-Use water heaters may be considered if the building layout, programming requirements, and related efficiencies support the application. Engineer shall review and obtain approval from the College. Utilize a loop system only when practical.
3. A central thermostatic mixing valve shall be installed to provide 120° F hot water (adjustable). A thermostatic mixing valve shall be provided at all emergency shower locations.
4. Thermometers and domestic hot water expansion tank shall be provided.

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## 22 40 00 – Plumbing Fixtures

1. Water closets and Urinals shall be wall-mounted vitreous china with battery operated valves.
2. Lavatories shall be wall-mounted vitreous china with battery operated faucet. Under-counter mounted lavatories only as acceptable by the College. Option shall be a solid surface counter with an integral bowl.
3. Type and style of fixtures and trim for Administrative areas shall be reviewed and approved by the College.
4. Water Closet, Urinals, Lavatory
  - a. Sloan Optima smooth battery powered sensor operated flush valves with manual override lever/button is the recommended Design Standard.
  - b. Sloan Optima EAF-150-ISM, battery powered sensor operation with 0.5 GPM aerator is the recommended design standard.
  - c. Automatic sensors shall be provided on all water closets, urinals and lavatories. Provide battery operated valves. Specified sensor and valve manufacturers shall be approved by the College.
5. Sinks in instructional areas shall be stainless steel, single-compartment, self-rimming sinks with 8" center set faucet with 2 1/2" ADA compliant lever handles or automatic sensor set, as selected by the College.
6. Art room sinks must include a clay trap
7. Hydrants shall be located as required for the ease of maintenance personnel. The wall hydrants shall be recessed; box type with locking covers, freeze proof, loose key operation and shall be provided with an integral vacuum breaker.
  - a. Locations of hydrants:
    - 1) Gang restrooms
    - 2) Mechanical rooms
    - 3) Mechanical courtyards
    - 4) Roof
    - 5) Exterior – every 100 feet.
8. Mop basins with stainless steel guards shall be installed in the janitor's closets. Caulk around mop basin, all fixtures and wall. Provide a dome strainer.
9. A 3/4" spigot and floor drain is desired in each Mechanical and Boiler Room

### Faucets

1. Gooseneck faucets to be used with College approval only. If approved, they shall be the 'swing away' type.

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## 22 47 00 – Drinking Fountains and Water Coolers

1. Provide electric water coolers where approved by the College and as required by code.
2. Install with GFI receptacles.
3. Provide water bottle fillers.
4. Utilize standard mounting heights for adult patrons and per ADA Guidelines.

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Issue Date: February 1, 2015

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# 23 05 00 - Common Work Results for HVAC

## Abbreviations

AHU	Air Handling Unit
ASHRAE	American Society of Heating, Refrigeration, Air Conditioning Engineers
BAS	Building Automation System
BTU	British Thermal Units
CFM	Cubic Feet per Minute
CHW	Chilled Water
CO <sub>2</sub>	Carbon Dioxide
CUH	Cabinet Unit Heater
DDC	Direct Digital Controls
DPT	Differential Pressure Transmitter
FPS	Feet per Second
HVAC	Heating, Ventilation, Air Conditioning
O&M	Operation and Maintenance Manual
VFD	Variable Frequency Drive
VAV	Variable Air Volume
VRF	Variable Refrigerant Flow

## General Requirements

1. It is the intent of the College that an open and analytical approach be applied to HVAC system selections and that the College does not endorse or discourage any particular HVAC system selection.
2. Engineer shall conduct HVAC system analysis and obtain college input.
3. HVAC system selections shall be reviewed with the College at the Schematic Design level to evaluate potential applications and determine final selections for Design Development.
4. Computer generated mechanical load calculations shall be prepared for HVAC systems. HVAC calculations shall be as recommended in the ASHRAE handbooks and other ASHRAE publications. System sizing should be based on ASHRAE 1% cooling and 99.6% or -5 Deg F. heating design conditions whichever is colder.
5. Projects utilizing Green Building Sustainable Design Concepts shall follow ASHRAE Standard 189.1 or Latest Edition.
6. The materials and equipment specified for the mechanical work shall be verified with the College during the design development phase.

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7. Certain projects may require the mechanical systems to accommodate expansion and future additions.
8. Ensure that mechanical equipment is installed per manufacturer's recommendations.
9. Ensure that start-up requirements are provided by factory trained technicians for all major pieces of equipment.
10. Ensure that O&M training requirements by factory trained technicians are as follows and must be video-taped by the manufacturer and provided to the building maintenance staff:
  - a. Air Handling Units – 8 Hours
  - b. Energy Recovery Units – 8 Hours
  - c. Chillers – 16 Hours
  - d. Air Cooled Condensing Units – 8 Hours
  - e. Cooling Towers – 8 Hours
  - f. VRF Systems – 16 Hours
  - g. Boilers – 8 Hours
  - h. Hydronic Pumps – 4 Hours
  - i. Water Treatment – 4 Hours
  - j. Variable Frequency Drives – 8 Hours
  - k. Building Automation System – 40 Hours
11. The Engineer shall investigate the required utilities and possible fuel sources. All necessary information shall be obtained no later than midway through the Design Development Phase and shall be recorded and shared with the College.

### **Design Considerations**

1. The HVAC system shall be designed to comply with the latest recommendations of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE). The system shall bring in adequate amounts of fresh air to meet current ventilation Codes and to avoid a sick building syndrome including exhausting areas where objectionable or unhealthy vapors may develop.
2. Air-side (and water-side) heat recovery and other energy saving techniques shall be used where feasible to achieve cost-effective solutions to meet ASHRAE Ventilation Standards 62.1 and 90.1 or Latest Edition. Air handling equipment shall include the use of economizers for free cooling.
3. Since much of the annual operating hours are spent at part load operation, the design of the HVAC system must provide for efficient part load operations. Performance features including energy use, maintenance, and control performance must be considered while working within limited first cost constraints.
4. Equipment Locations:
  - a. Discuss mechanical system and equipment location during Schematic Design.

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- b. Ground Mechanical courtyard is acceptable.
  - c. If rooftop equipment is provided, preference for equipment to be located in a penthouse (first priority). If located on the roof, a screen wall assembly is required to screen the equipment.
    - 1) Provide rooftop access of mechanical equipment with a full stair and 3' min. door.
    - 2) If equipment is located in a penthouse, provide a 6 foot door or removable louver to allow access to equipment.
    - 3) Whenever possible, provide conventional stairway access to mechanical spaces not located at floor level elevations. Use of ships ladders should be discouraged.
    - 4) Strong consideration should be given for custom units with a service corridor for exposed rooftop equipment.
  - d. Packaged roof mounted equipment, exhaust fans, and related components are to be designed with low silhouettes and clean lines and located where least visible. Roof mounted equipment and components shall be finished in a color to blend with background or as directed by the Architect and/or College designated representative.
5. Maintenance access shall have a high priority. Accessibility shall be reviewed with the College during the Design Development Phase. Locate volume control boxes, valves, meters, gauges, dampers, fans, etc., above lay-in-ceiling or in exposed areas to facilitate maintenance access. Do not hide devices behind walls or plaster ceilings. If access panels are needed, provide panels with hinges and key latch, not closure screws, unless approved by the College. Provide duct access doors where appropriate for fire dampers, etc. Consider catwalk with access ladders, and fall protection access platforms where appropriate and coordinate with structural steel.
  6. Whenever possible, locate coils in the mechanical equipment area in lieu of in a chase or ceiling plenum to avoid leaks into occupied spaces. For equipment mezzanines, locate all equipment that contains coils and condensate drain pans within a curbed waterproof area. Provide the curbed area with a floor drain or a low sump point. The curb shall be minimum 4 inches high. All above ceiling HVAC equipment with a cooling coil must be equipped with a secondary drain pan and proper independent drainage system.
  7. All floor-mounted equipment shall be installed on concrete housekeeping pads.
  8. Noise control, both indoors and outside must be considered, especially with respect to adjoining property. Locate mechanical equipment rooms away from noise sensitive areas and/or provide appropriate acoustical applications/analysis to prevent noise related issues (see sound and vibration control).
  9. The location of frequently used entrances including lobbies and loading docks should be isolated from the main HVAC system to maintain temperature control stability and prevent objectionable fumes/odors from entering interior spaces.
  10. Locate fresh air intakes away from vehicle parking, cooling towers, loading dock(s) and related areas where fumes/odors could be drawn into the air stream.
  11. Provide variable frequency drives on all major pieces of HVAC equipment to conserve energy, control and soft-start motors.

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## **System Considerations**

### **General**

1. The HVAC system to be proposed shall be based on the results of a system analysis, utility investigation, energy analysis, and other considerations described in this standard. The need to plan for reduced loads and energy conservation will require close coordination with Architectural and Electrical disciplines and shall be in compliance with ASHRAE 90.1, or latest edition, standards
2. Building renovation/addition projects or limited structural requirements may dictate system type and shall be reviewed with and approved by the College prior to design.
3. To provide a stable indoor environment, the Engineer shall consider the use of airside economizers with primary air systems. At a minimum, the outdoor air requirement should be based on the ASHRAE Standard 62.1 or Latest Edition with compensation for air evacuated by local exhaust and resulting building pressurization requirements. The use of enthalpy wheels, plate exchanger, heat pipe run-around, or other heat recovery methods should be considered in compliance with ASHRAE 90.1 Standard for energy efficiencies.
4. Pre-conditioning of the outdoor air is recommended by providing filtered/conditioned outdoor air to the inlet side of the main distribution air handler(s), or directly to the space for more precise temperature and humidity control. Use of a primary air unit to deliver outside air is recommended for positive control of the outdoor air requirements. The relief/exhaust air should be returned to the primary air unit for heat recovery purposes where applicable.
5. Air cooled and water cooled variable refrigerant flow systems are to be considered as a potential energy saving mechanical system. These systems shall meet AHRI standard 1230.

### **Humidification**

1. It is not intended that buildings have humidification unless directed by College for site-specific requirements.

### **Sound and Vibration Control**

1. The design must ensure quiet comfort for occupants. Design shall conform to ASHRAE standards.
2. The selection of mechanical equipment and the design of equipment rooms shall provide for acceptable sound and vibration levels in occupied spaces.
3. Sound levels should be reduced but not so low as to produce an environment where normal sounds would be objectionable.
4. Provide vibration isolation at units causing vibration.
  - a. Rooftop equipment and interior units: Isolate the fan and compressor inside the unit.

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- b. Equipment near critical areas: Work with acoustical consultant to limit noise.
5. Provide acoustical separation between mechanical spaces and occupied spaces. It is recommended that a wall of STC 60 be used between mechanical and occupied spaces.
6. The design of HVAC systems shall include provisions for controlling airborne equipment noise, equipment vibration, duct-borne fan noise, duct breakout noise, flow generated noise and duct-borne crosstalk between rooms.

### **Value Engineering Considerations**

1. Any 'Value Engineering' considerations for the Mechanical System shall be reviewed with the College. Evaluations (positive and negative) shall be provided as to the long range impact on efficiency, maintenance, indoor air quality and overall building comfort issues.

### **Equipment Manufacturers**

1. See Bidding Procedures for mechanical equipment bidding requirements.
2. The specifications must be written so that bidders may provide information and pricing on more than one manufacturer. This may be through alternates, line item equipment lists, etc. College does seek to competitively bid manufacturers and may select certain manufacturers to be listed as Base Bid or request line item pricing. The intent is to ensure quality of equipment and reduce inventory costs, simplify maintenance, operation, troubleshooting, and training.
  - a. Engineers shall ensure that specification language will allow for the competitive bidding and assurance of the equipment quality expected by the College.

### **Design Standards Specifications**

1. The College's design standards specifications are to be included in the Project Specifications. The Engineer is to expand the design standards specifications as required to completely define the project in conjunction with the Design Drawings. Deletion from the College's design standard criteria shall not be made unless approved by the College.
2. Depending on the specific project(s) needs, some portions of the design standards criteria details and specifications may not apply. Extensive coordination with the College will be required. The seal of the registered Professional Engineer shall be affixed to each Mechanical Drawing and to the Specification prepared for the proposed project.

### **Construction Phasing**

1. Construction phasing shall be reviewed with the College and coordinated as required.
2. For a project where multiple 'construction' phases are required, the warranty period shall start after the final 'construction' phase of the project is complete (Projects that are phased by the College due to financing do not apply).

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- 1) This **MUST** be included in the Project Specifications:
  - a) Warranty period shall start after the final construction phase of the project is completed. Contractor must maintain the equipment up until end of project (Final Substantial Completion). At a minimum, equipment maintenance shall be provided by the Contractor as recommended by the manufacturer. All filters should be changed as needed but at least every three months. When the contractor inserts a new filter, they must date the filter with a marker. A maintenance log must be provided by the Contractor.

### **Closeout Documents**

1. Ensure that O & M training requirements by factory technician are as outlined in the General Requirements information.

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# **23 05 53 - Identification for HVAC Piping and Equipment**

## **Mechanical Identification**

1. Valve Charts shall be laminated, framed and mounted on the wall at an accessible location.
2. Provide ceiling tags where equipment is concealed above the ceiling.

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Issue Date: February 1, 2015

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# 23 09 00 – Instrumentation and Control for HVAC

## Temperature Control System

1. College shall approve all temperature control selections. Temperature control criteria shall be coordinated with the College.
2. Temperature controls shall be direct digital controls (DDC) unless otherwise approved. The DDC system shall provide control and monitoring functions from a single network location, as directed by the College.
3. DDC system must have web access. Systems shall be open-protocol.
4. Provide an operator's work station where requested by the College.
5. Maintenance scheduling shall be provided within the DDC system.
6. Multiple sensor ports shall be provided throughout the system for enhanced monitoring capability.
7. All annual licensing and upgrade fees must be included.
8. When outdoor air is ducted directly to air handling units, air monitor station(s) shall be provide to control and verify minimum outdoor air flow rate into each unit.
9. Variable frequency drives shall be provided on pumps and air-handling unit fan motors.
10. CO2 sensors shall be utilized for assembly and large group spaces and other spaces as required by Indiana Energy Codes, other applicable codes, and regulations.
11. Locate outside air sensors on north building elevations.
12. Use flat plate sensors for common areas or areas with unsupervised access.
13. Provide digital output relay to operate normally closed dry contact for "critical" HVAC alarm.
14. BAS panels shall be neatly wired, with schematics – no "bird nest".
15. When attic heaters are utilized, the BAS system should show temperature and on/off status.
16. Show on/off status for fume hoods.
17. If applicable, provide a manual "Chiller Drained" status to BAS for air cooled chillers.
18. Use differential pressure transmitters for filters.
19. Provide Discharge air temperature sensors on terminal devices, with the exception of VRF terminals.
20. Provide DPT on condenser water basket strainer.

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21. Use hardwired safeties in addition to software driven.
22. “J” Hooks shall be used above ceilings for all temperature control wiring. Temperature control wiring connections shall terminate in junction box or enclosure.
23. Filters shall be required on VAV controllers that use hotwire or other thermal airflow sensing.
24. Review controls sequencing in detail with the College’s staff (and the Commissioning Agent if used), prior to bidding.

***A critical alarms list must be provided in the bid specification***

1. Freezer Refrigerant alarm. When freezer drops above 10 degrees F.
2. Low heating water supply temperature. When OA is less than 35 degrees F and HW supply temperature drops below 100 degrees F.
3. High chilled water temperature – chilled water system is enabled but CHWS is greater than 50 degrees F.
4. Low building temperature – any space temperature less than 50 degrees F.
5. High building temperature – any space temperature greater than 85 degrees F.
6. AHU status – AHU is energized but fails to operate i.e. freeze stat, no air flow, etc.
7. Chilled water pump failure.
8. Heating water pump failure.
9. Chilled water system fill meter.
10. Heating water system fill meter. Send alarm when over 3 gallons is made up in 24 hours to the system.
11. CHW evaporator discharge temperature greater than 85 degrees F (even if no cooling is required)
12. Electrical power loss (building service). Send one alarm on a loss of power.
13. Low level in glycol makeup tank if provided.
14. Low level in cooling tower basin or indoor sump if provided.
15. Refrigerant alarm and emergency exhaust as required by ASHRAE 15.

**CO2 Sensors**

1. Economizers and CO2 sensors shall be provided for energy savings and air quality control where appropriate for systems serving large group and assembly spaces.
2. Evaluate using CO2 sensors in all classrooms for monitoring purposes only (if approved).

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## **23 11 23 – Gas Piping**

1. Gas piping shall enter the building in the mechanical/boiler room and provide gas to the water heater, boilers, and the kitchen as required.
2. Emergency gas shut-off systems with solenoid valves shall control student desks in each science lab. Gas turrets shall be equipped with integral check valves. Valves shall be contained in a concealed locked box. Emergency mushroom/slap switch with key reset shall be installed at exits where required.
3. Prefer gas service for domestic hot water.
4. Coordinate gas service needs with labs, hot water, and HVAC system needs.
5. Review requirements for gas for science labs and provide emergency gas shut off panels.

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## 23 21 13 – Hydronic Piping

1. Provide drain valves on hydronic mains.
2. Automatic chemical feeders are preferred in lieu of manual shot feeders.
3. Provide hot water control valves on CUH's unless otherwise approved.
4. Provide isolation valves at all mechanical rooms and main branches (review with College).
5. Provide a manual bypass on the make-up water lines with pressure reducing valves.
6. Branch lines to reheat coils shall be Type "L" copper, on 2 1/2" or smaller pipe. Unions shall be provided for control valve and coil removal.

### Heating and Cooling Piping Distribution System

1. Differential pressure sensor locations shall be indicated on drawings and verified on as-builts.
2. Isolation valves shall be provided for removal of each piece of equipment and at each branch take-off from the piping mains. Review with the College, locations of all isolation valves for mechanical and plumbing to ensure adequacy for maintenance.
3. The distribution systems shall have valve connections to each air handler and terminal reheat coil. Each air handler and terminal reheat coil return connection shall have an auto flow device for flow measurement and adjustment.
4. The systems shall be designed for use of 2-way valves for temperature control at air handlers and VAV terminals. 3-way valves may be used at the end of pipe runs to bypass minimum flow required to maintain pump operation. Heating and cooling central systems shall use a separate distribution system, unless approval is given to the use of or extending an existing combined system.
5. All water piping shall be sized for a maximum friction of 2.5' per 100' of pipe. Maximum water velocity shall be 4 FPS for 2-1/2" and smaller pipe. Maximum velocity for larger pipe shall be 7 FPS.
6. All water piping systems shall have vents at all high points and drains at all low points.
7. Provide thermometers and gages at all devices that normally have a change in temperature and/or pressure. Types of thermometers and gauges shall be reviewed with and approved by the College.
8. Provide stainless steel strainers in all closed system pump suction lines.
9. Differential pressure transmitter locations shall be noted on the drawings and verified on the as-builts.
10. Provide complete condensate piping for the cooling systems. Condensate piping shall connect to plumbing waste lines per code.

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11. If a sump pump is being used, it must have local audible and visual alarms. The high water alarm shall be connected to the BAS as a critical alarm.
12. Hydronic cooling systems should be an independent piping system from the heating systems. On addition projects that currently utilize a combined heating and cooling piping system, extension of same may be considered if approved by the College.

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## **23 21 23 – Hydronic Pumps**

1. The hot water pumps shall be base-mounted end suction type. Back-up (standby) pumps are recommended.
2. The chilled water pumps shall be base-mounted end suction type. Back-up (standby) pumps are recommended. Consideration shall be given to the use of primary-secondary pumping systems with variable speed control for secondary pipe loop, based on pressure differential sensing. Primary variable pumping shall be considered when applied with the appropriate equipment selections.

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## 23 31 13 – Metal Ducts

1. Air flow measuring stations must be provided in the outdoor air stream for all air handling units.
2. All main duct trunks and main branches shall be galvanized sheet metal. All outdoor air ducts shall be externally insulated for thermal purposes.
3. All fume hood and chemical storage cabinet exhaust ductwork shall be PVC coated with epoxy-coated exhausters (review with College).
4. The proper medium pressure ductwork correction factor shall be used for determination of friction loss due to roughness of the duct liner. Duct velocity shall not exceed 2000 FPM for main trunks and 900 FPM for runouts from main trunk. Engineering calculations for increased velocities must be reviewed with the college and must remain within ASHRAE standards.
5. Use a metal 90 degree elbow at all diffusers when a sideways connection is required (i.e. limited ceiling space).
6. Hose clamps should be used to connect flexible duct to metal duct. Tie-wraps will not be allowed.
7. Static pressure sensor locations shall be noted on drawings and verified on as-builts.
8. No internal glass fiber duct lining (Insulation) unless double wall metal is used to cover the lining. EDPM based elastomeric is acceptable in ductwork and terminal units in lieu of double wall construction. Double walled VAV's are preferred over externally insulated ones.
9. Conditioned air shall be provided in ALL restrooms.
10. Provide dust collection systems in wood shops when required by the College.

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## 23 36 00 – Air Terminal Units

1. For VAV system design, pinch style VAV terminal units or parallel fan-powered style, with reheat coils shall be utilized unless otherwise approved by the College.

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## 23 37 13 – Diffusers, Registers, and Grilles

1. Floor supply diffusers/registers should be avoided. The College shall approve exceptions.
2. Ceiling diffusers and grilles shall be selected to fit into the ceiling system being used. The ceiling device shall have a frame for mounting directly into the ceiling suspension system and shall be of dimensions compatible with the ceiling module or panel size.
3. Wall registers and grilles shall be selected so that style, dimensions, aspect ratios, and locations are compatible with the finish treatment of the space.
4. Air diffusers, registers, and grilles shall be designed to coordinate with the general construction and architectural treatment of the finished spaces. Exposed components shall be given a factory-baked enamel or anodized finish in a color selected by the Architect/College. Air diffusers, registers, and grilles shall be mounted in frames so the devices may be easily removed for maintenance and repair.
5. Air diffusers, registers, and grilles shall be shown on the reflected ceiling plans and wall elevations.
6. All supply diffusers and registers shall have fully adjustable air patterns. Ceiling diffusers shall have round neck connections and full air pattern adjustment.

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## 23 52 00 - Boilers

1. Hi-Efficiency Condensing type boilers shall be considered for energy conservation.
2. Building renovation/addition projects may dictate heating system type and shall be reviewed with and approved by the College prior to design.
3. Use of conventional boilers shall not be used unless approved by the College. If used, consideration shall be given to the use of primary-secondary pumping systems with variable speed control for secondary pipe loop, based on pressure differential sensing.
4. The drainage from the high efficiency condensing boilers is acidic and must be neutralized to prevent pipe corrosion. Plumbing drains associated with the condensate draining shall be addressed to accept same.
5. Install equipment on 4" concrete housekeeping pad as needed and locate with required clearance for servicing.
6. Boiler Vents for condensing boilers shall be double-wall stainless steel and per code
7. Boiler vents for conventional boilers shall be as recommended by the manufacturer and per code.
8. When using condensing boiler design consider a maximum heating supply temperature in the range of 140 - 160°, reset down as outside air temperature increases. For conventional boiler design consider a supply temperature range of 160 – 180. Temperatures shall conform to manufacturer's recommendations.

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## 23 64 00 - Chillers

1. Use of air cooled chillers is recommended unless size dictates use of water cooled. Chiller selections must be optimized for part load conditions. Variable speed chiller design should be utilized. Chiller selections must be approved by the College.
2. Glycol in chilled water system is not to be used unless approved by the College. Split-barrel or condenser applications should be utilized. Glycol systems shall not be connected to makeup water. Provide a glycol makeup unit with pump, low level audible alarm, and dry contact for monitoring by DDC system.
3. The use of water-side heat recovery systems such as heat recovery chillers shall be considered as a source for free hydronic heat, summer reheat, and to reduce the need for simultaneous heating and cooling.

### Cooling/Dehumidification

1. The cooling system shall be designed for adequate temperature and humidity control.
2. A free source of reheat, such as a heat pipe, hot gas reheat, enthalpy wheel, plate exchanger or heat recovery chiller should be provided if justified by a cost/benefit analysis.
4. The College shall approve final chiller selections. Chiller(s) shall provide efficient operation at low load and ambient conditions. Variable speed applications are preferred.
5. Building renovation/addition projects may dictate cooling system type and shall be reviewed with and approved by the College prior to design.
6. R134A and R410A are the preferred refrigerant. R407C is allowed.
7. R123 is not allowed.
8. If using water cooled chiller
  - a. Provide stainless steel sump tank if exposed inside building (cooling tower drain down). Pump and tank packages are preferred.
  - b. Cooling tower preference is for ground mounted (not on the roof).
  - c. Review the access details of the cooling tower platforms, rails, etc. (in detail) with the College to ensure appropriateness for maintenance access.
9. Provide exterior concrete pad for the entire chiller/condenser area, from wall to wall or fence to fence areas.
10. Air Cooled Condensing Units with digital or variable speed scroll compressors shall be considered when used and shall provide energy efficient operation at low load and ambient conditions with a minimum EER rating of 12.0. College shall approve all final selections.
11. Low ambient controls should be specified for all air-cooled condensing units.

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12. Air-cooled units shall be selected at an entering condenser air temperature 5 degrees Fahrenheit higher than the summer design outdoor temperature. Design saturated suction temperature shall be between 35 degrees and 50 degrees F. Final selections shall be based on Region location.
13. Elevator Equipment Rooms and Main Technology Rooms shall have an independent cooling system. System shall be selected with a low ambient package to allow for operation a winter design conditions. Secondary Technology Rooms may be served from the building system if approved by the College, but cannot exceed 80 degrees (see ventilation).

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## 23 72 00 – Air Handling Units

1. Separate and isolated air handling systems shall be provided for technology labs where it would be objectionable to mix air streams with other occupied spaces (i.e. Automotive, Welding, Masonry, HVAC, Electrical, etc. shall be served with separate AHU systems).
  - a. Additional specialty exhaust may be required for welding or other vocational labs.

### Ventilation

1. The use of primary air units shall be considered to meet outdoor air requirements whenever possible with particular attention to indoor air quality and heat recovery. The outdoor air shall be filtered, cooled, heated and dehumidified. The unit shall incorporate a method of heat recovery unless otherwise approved by the College. The pre-conditioned outdoor air shall be delivered directly to the occupied spaces or to the distribution air-handling units. Building renovation projects may dictate introduction of outside air into the space and shall be reviewed with and approved by the College prior to design.
2. Building exhaust ventilation requirements shall be provided by fans located on the roof, plenum or incorporated within the primary air unit. The air shall be exhausted through wall louvers, roof vents, exhausters, or primary air unit as required.
  - a. Provide additional specialized ventilation as required for welding labs and other vocational labs as required.
3. Roof Curbs shall be a minimum of 16” high as measured from the roof surface. (not the deck)
4. Toilet rooms shall be maintained at a negative air pressure relative to the adjacent areas. Minimum exhaust airflow rate shall meet the following criteria:
  - a. 2 CFM per square foot or 75 CFM per plumbing fixture (water closet/urinal) or as dictated by Code, whichever is larger.
5. Use of exhaust fans as back-up cooling for main and secondary technology rooms may be considered if approved by the College.

### Air Distribution System

1. Energy efficient and zonable systems design such as Variable Air Volume and Variable Refrigerant Flow should be first priority considerations, as well as other HVAC systems with comparable efficiencies and zonability qualities. College shall approve all final selections prior to start of design.
2. If space limitations or budget restraints prohibit the use of indoor central equipment, rooftop equipment may be permitted if approved by the College. However, pre-conditioned outdoor air should be supplied either to the rooftop units or directly to the indoor spaces.

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3. The building should be maintained at a slight positive pressure by having the total outdoor air supply exceed the total building continuous occupied mode exhaust. Building pressurization control should maintain the building at a slight positive pressure of 0.05"wc.
4. Provide two sets of MERV8 minimum pleated filters (ahead of the coils) – 2" for first stage (pre-filter) and 4" for second stage on all air handling and energy recovery units.
5. Provide zoning for HVAC in auditoriums, community rooms, administration areas and large gathering areas for separate scheduling use.
6. To discourage the growth of bacteria in the air-handling units and the spread of any bacteria that might develop from spreading through the ductwork, positively sloped drain pans and easily cleaned coils shall be provided. Each air-handling unit casing shall be 2" thick double wall with solid inner liner. Pre-heat coils (if used) shall have integral face and bypass dampers for freeze protection.
7. All drain pans shall be stainless steel.
8. Sound attenuators shall be provided on the supply and return of each air-handling unit.
9. Install floor-mounted air handling units on 4" (min) housekeeping pads. Height shall be coordinated with condensate trap depth requirements
10. Provide factory installed base rail to support all sections of units.
11. Provide lighting in all AHU sections.
12. Maintain a minimum 24" clearance pathway around AHU's when installed next to walls or other equipment, and 36" for chillers. In addition, maintain all access and service requirement distances per manufacturer's recommendations (i.e. coil pull area, tube removal area, etc.).
13. Air handling system(s) shall include economizers for free cooling and eliminate or reduce the need for mechanical cooling.
14. Air handlers must be designed and sized for approx. 10 – 15% additional capacity to accommodate future changes in space use and needs (i.e. typical classroom change to computer lab). Engineer shall review with the College the potential areas where the most likely changes could occur.

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## 23 82 39 – Unit Heaters

1. The entrances/vestibules shall be provided with flush mounted wall or ceiling cabinet heaters capable of maintaining the required temperature at night with the central systems shut off or set-back.
2. All spaces with measurable heat loss shall be provided with heating systems. Generally, unit heaters may be used for service corridors, maintenance areas, sprinkler rooms, etc.
3. Where attic heaters are used, provide temperature and on/off status at BMS.
4. Provide a heat source for all concealed above ceiling spaces that have sprinkler piping.

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# 26 05 00 - Common Work Results for Electrical Systems

## General

1. The electrical systems design will take into consideration the type of facility, program, project type and site considerations. Project requirements and program are to be reviewed and verified with the College prior to start of design and engineering.
2. Verify scope of electrical requirements with college.
3. The potential and/or master planned aspect for future expansion(s) shall be discussed with the College. Services shall be coordinated with the future planning aspect in mind and the related impact.
4. The Engineer shall determine the electrical classifications of various areas of the building.
5. All applicable local and national electrical codes must be followed. Permits and fees shall be taken care of by the contractor.
6. The Contractor shall request a Local inspection on each project with a “rough in” and a final inspection. The College’s staff shall be notified of any violations.
7. A/E shall conduct a short circuit, arc flash hazard, and coordination study. A/E shall use this information to determine the available fault current, incident energy levels, and circuit breaker trip settings for power distribution equipment at specific locations on the buildings power distribution system. These values shall be used to appropriately specify and label power distribution equipment. Follow current NEC code for ground fault protection .
8. Do not leave panelboards containing exposed “LIVE” parts unattended.
9. A/E shall require that all penetrations through fire rated walls, floors and ceilings be sealed with an approved UL fire stop assembly. Installation shall be assigned to a single qualified installer that has been approved by FMG according to FMG 4991, “Approval of Firestop Contractors”.

## Abbreviations

GFCI Ground Fault Current Interrupter

NEC National Electric Code

EMT Electric Metal Tube

MC Metal-Clad Cable

GRC Galvanized Rigid Conduit

SPD Surge Protection Device

HID High Intensity Discharge

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**Demolition**

1. Where existing work is removed, remove associated wiring, cabling, terminations and all obsolete exposed and interfering conduit and work.
2. All existing exposed conduits, surface raceway, and wiring shall be completely removed unless directed otherwise by the Architect.
3. Existing outlet boxes which are being abandoned shall be covered with a blank wall plate to match new device plates specified.
4. All abandoned service entrance conduits entering buildings from underground shall be removed. If this is not feasible all cable shall be removed from these conduits and conduits shall be sealed as to not allow water to leak into the building. Where abandoned service conduits stub up outdoors they must be cut off at grade level and sealed.
5. Interior conduits in slabs that are abandoned shall have all cable removed and shall be sealed. Abandoned conduits shall be removed from all panelboards and distribution panels where possible.
6. First right of refusal shall belong to the Owner. Contractor shall dispose of all materials not kept by Owner.
7. All remaining lights, switches, receptacles, motors, etc., not disturbed in the remodeling shall be checked for proper operation and any circuit opened by the remodeling work shall be properly reconnected.
8. All electrical work to be installed in finished rooms of the existing building shall be installed in a concealed manner where practicable; otherwise shall be installed in surface type, two-piece raceway.
9. During phasing of the Work and/or General Construction Schedule, all systems, including fire alarm, shall remain operational until the new work is completed and operational; at which time the old work is to be removed.

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## 26 05 10 – Cables

1. Minimum wire sizes shall be No. 12 AWG copper for lighting and power circuits and No. 14 AWG copper for 120V motor control and similar control wiring, unless otherwise stipulated
2. Provide wire having NEC 600 volt insulation and of type THHN/THWN for dry locations, THWN/XHHN for wet areas.
3. High voltage wire specifications must be confirmed with the College.
4. All wire terminating in light fixtures shall be of the heat resisting type, approved for the specific application, but not less than 150 degrees C (392 degrees F) insulation and may be type “AF” or “SFF-2”.
5. Use of Aluminum conductors will not be permitted unless reviewed with and approved by the College.
6. Provide solid or stranded conductors for #10 and #12 AWG. Provide stranded conductors for sizes #8 AWG and larger.
7. Voltage Drop should not exceed 3% from the branch panel to the last outlet
8. As a minimum for 120 volts, 20 amp, 1500 watts #12 AWG shall not exceed 75 feet, #10 AWG shall not exceed 120 feet. For 208 volts, 3-phase, 4,320 watts #12 AWG shall not exceed 130 feet, #10 AWG shall not exceed 215 feet.
9. As a minimum for 277 volts, 20 amp, 3325 watts #12 AWG shall not exceed 170 feet, #10 AWG shall not exceed 250 feet, for 480 volts, 3-phase, 10,000 watts #12 AWG shall not exceed 300 feet, #10 AWG shall not exceed 500 feet.
10. All cables shall be plenum rated, unless otherwise noted.

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## 26 05 26 – Grounding and Bonding for Electrical Systems

1. Where available on the premises, the building grounding electrode system shall consist of connections to the main water service piping, building steel, concrete encased electrode, ground ring, and ground rod(s). The grounding conductors used to bond grounding electrodes together shall be identified and sized in accordance with Article 250 of the NEC.
2. The ground rod system shall be comprised of three 10' x 3/4" ground rods spaced in a triangular configuration 10' apart. The rods shall be exothermically welded (cadwelds or equal) together with a grounding electrode conductor sized in accordance current NEC. The bare grounding electrode shall be routed back to the service grounded bus. All cable and rods shall be buried a minimum of 18".
3. The water main shall be grounded with a continuous grounding electrode conductor sized in accordance with current NEC code. The connection must be made no more than five feet from the water main's entrance to the building.
4. Any water meters or pipe unions that might break ground continuity shall require bonding jumpers the size of the grounding electrode conductor.
5. Provide a ground node adjacent to the service switchboard/panelboard tying all grounding electrode conductors to a single location. Install equipment ground conductor from ground node to service switchboard/panelboard.
6. Equipment ground from ER room goes back to grounding node at service switchboard/panelboard.

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# 26 05 33 - Raceway and Boxes for Electrical Systems

## **Raceways:**

1. Exposed conduit shall be run at right angles parallel to the building walls and equipment in a neat and workmanlike manner. All conduits shall be run near the ceiling and at the same height and parallel with the utility piping, where such piping is level. Conduit sleeves, etc., required for the installation of conduit in floors, walls, partitions, etc., shall be set by the electrical contractor, and shall arrange with the general contractor for all slots, openings, etc., which may be required for the conduit installation or for positioning and dimensions of such openings. All conduits shall be concealed unless otherwise noted. Where surface mounted conduit, EMT or GRC, is accessible to students or staff, Contractor must use 1-hole straps for support. Minerallac clamps may be used in all other areas.
2. EMT Conduit shall be used unless otherwise noted in these specifications.  
Minimum trade size of ¾" EMT.
3. Provide (4) ¾" spare EMT conduit for each flush mounted distribution panel board.
4. Provide separate raceways for different voltage systems.
5. All branch circuit conduits (for outlets and switches) shall be run overhead when possible. Feeder conduits (Rigid or PVC) to electrical panelboards must be a minimum of 24" below slab

## **Galvanized Rigid Conduit:**

1. Mechanical room and tunnel conduits shall be galvanized rigid.  
Minimum trade size of ¾" GRC.
2. All exposed conduits outdoors and in damp locations shall be galvanized rigid.

## **PVC Conduit (minimum ¾"):**

1. Schedule 40 PVC conduit shall be used for all underground conduit installations, unless otherwise noted.
2. Schedule EB PVC shall be used when conduits are encased in concrete incoming electrical services.
3. Schedule 80 PVC shall be used when conduits are direct buried under roadways, loading dock areas and sidewalks.
4. To prevent corrosion due to contact with soil and/or concrete and to prevent physical damage, install rigid galvanized steel conduit elbows where transitioning from below grade to above grade installations.

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**Flexible Metal Conduit:**

1. Flexible metal conduit shall be used in 6 foot lengths or less for the wiring of light fixtures, equipment that is subject to vibration, transformers in dry locations and motors in dry locations.
2. An equipment grounding conductor shall be sized per the current National Electrical Code and shall be pulled in all flexible metal conduits.
3. All flexible metal conduits shall originate in a junction box and terminate at the light fixture that it supplies. No fixture to fixture wiring will be permitted.
4. Under no circumstances shall flexible metal conduit be used in lieu of the conduit specified for its particular area unless expressly approved by the College.

**Liquidtight Flexible Metal Conduit:**

1. Liquidtight flexible conduit shall be used for any outdoor installation or any installation that may be subject to damp conditions. It may be used on the same type of equipment listed for flexible metal conduit.
2. Under no circumstances shall liquidtight flexible metal conduit be used in lieu of the conduit specified for a particular area unless expressly approved by the College.

**MC Cable Installation**

1. Support MC cable in accordance with the current NEC such that supports are not more than 6 feet apart.
2. All MC cable work shall be completed in a workmanlike and neat manner/appearance.
3. MC cable may be used for all branch circuits within the building envelope from the last branch circuit panelboard to the last device, except as follows:
  - a. Do not use MC cable when entering or leaving panelboards. Provide a splice box with terminal strips located above panelboards. Feed from panelboard to terminal strips with conduit and wire, feed from terminal strips to last device with MC cable.
  - b. Do not use MC cable in areas where there will be no ceiling. All wiring in these areas shall be installed in conduit.
  - c. Do not install MC cable in concrete or under floor slabs.
  - d. Do not use MC cable when exposed below 8 feet.
  - e. Do not use MC cable for circuits to and from the dimming racks.
  - f. Do not use MC cable for circuits supporting any and all sound equipment indicated on the documents.

**Wiremold:**

4. Use Wiremold 700 series or larger when possible. Provide a wire mold that can accommodate data in classrooms that may be future computer rooms.

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5. Wiremold 700 shall be supported by two whole support straps. Use type V704 only.
6. Use wiremold G-3000 and G-4000 raceways with divider in classroom and computer labs for telecom and power requirements.

**Wireways:**

1. When a grouping of starters, switches, control equipment, etc. are provided, the contractor must furnish and install a complete approved metal raceway or trough for the conveyance and distribution of electric wires and cables, designed for easy accessibility to the wires and cables, and provided with concentric knockouts at intervals for the extension of conduit.
2. Square duct shall be standard 1, 2, 3, 4, 5, and 10 foot lengths, bolted together to form a continuous, unbroken wireway. Small sizes (4 x 4 and smaller) shall be provided with hinged cover and fastening device. Larger sizes (6 x 6 and larger) shall be provided with screw cover and gasket. Provide tees, elbows, pull box hangers, supports, etc., to make same adaptable to building structure. Ducts shall be permanently supported, anchored to wall, ceiling truss, etc. Bond each length together with a #12 AWG (min.) green grounding conductor.

**Electrical Outlet and Junction Boxes:**

1. In addition to the required computer outlets each classroom will have a minimum of two (2) general purpose 20 amp 120 volt circuits dedicated to the receptacles in that room. Provide at least two duplex outlets per wall (if not blocked by heaters, permanent casework, closets, etc).
2. All pull boxes shall be equipped with a proper cover and junction boxes shall be supported either by all-thread rod or securely fastened to the building structure.
3. Size and gauge of boxes shall conform to the current NEC
4. Surface mounted 4" and 4 11/16" junction boxes shall be mounted on concrete walls with a minimum of two plastic anchors with #10 screws. Larger junction boxes shall be mounted on concrete walls with a minimum 1/4" – 20 bolt size Ackerman Johnson lead anchor. When these boxes are mounted to concrete ceilings use steel drop in anchors with a minimum bolt size 1/4" x 20.
5. Wherever standard boxes are of insufficient size, provide and install pull boxes with screw covers as shown or where necessary to facilitate the installation of cables and wires. The pull boxes shall be of type suitable for application and of sufficient size to accommodate all cables within and without crowding.
6. The use of any floor boxes, power poles and horizontal raceways shall be reviewed and discussed with the College.
7. Concealed work outlet boxes shall be code gauge formed steel, galvanized. Use square boxes in wood construction, Use deep boxes throughout. Flush device boxes in masonry or drywall walls shall be 4" square with raised square cut covered masonry boxes designed for installation in masonry or drywall walls. Include all necessary plaster rings. Exposed boxes shall cast type FS or FS with

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- matching cover, threaded hubs, gaskets, and rustproof screws. Seal all unused openings with proper K.O. plugs.
8. Do not provide electrical outlets in restrooms that have a shower or shower wand. Light switches in these restrooms must be waterproof type.
  9. There shall be adequate corridor receptacles for janitorial operations. Coordinate exact locations of pull boxes with other trades.
  10. Switches for 3 way, 4 way, or single pole operation shall be of the highest quality and shall be rated 20 ampere – 120V/277V. Manufacturer shall be “Hubbell” or an approved equal.
  11. Locking key switches for single pole, 3-way, or 4-way operation shall be similar to “Hubbell” 1221L-1223L-1224L.
  12. All switches and receptacles shall be white. Cover plates shall be thermoplastic white. Exceptions: renovations shall match existing device color and cover plate; emergency devices and coverplates shall be red, locations with wood panel/wainscot shall be brown.
  13. Dual Technology occupancy sensors are required for public restrooms and toilet rooms.
  14. GFCI outlets should be situated around the exterior of the building for convenience use. Install each of these circuits on dedicated 20 amp branch circuit to allow the custodian to turn them off when not needed. Install at least two receptacles near the front entry for Holiday lighting and an outlet at least every 100 linear feet along the building perimeter.
    - a. Architect/Engineer should ask the campus what exterior activities are planned for the future activities. Ensure that exterior electrical locations are created for these events to occur
      - 1) Movies, social events, parties, fairs, concerts, etc.
  15. Each exterior outlet shall have an ‘in-use’ (weather proof) cover that is capable of being closed over a plug to maintain a dry outlet.
  16. Review and coordinate with the College, any requirements for exterior hook-up’s required for special exterior events.
  17. Ceiling mount and wall mount displays shall have their outlets on the high wall no lower than 12" from the ceiling. Power cords shall not be plugged in above ceilings.
  18. LCD projectors shall have two (2) 20 amp duplex receptacles mounted in a 2'x2' project mounting pan. Power cords shall not be plugged above ceiling.
  19. Provide a 20 amp GFCI duplex receptacle in every large walk-in plumbing chase.

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**Outlet installation Schedule**

<u>Electrical Outlet and/or Device Type</u>	<u>Mounting Height Above Floor to Center Line of Outlet (Device) Box Note #1</u>
Receptacle outlets, wiremold, microphone outlets (jacks), equipment outlets (jacks), television outlets (jacks), portable telephone outlets, etc.:	
a) General throughout	18"
b) Mechanical Equipment Rooms	18"
c) Above Top of Counter or Backsplash	2" min. to bottom
d) Behind Domestic Refrigerators	46"
e) Behind Domestic Washers & Dryers	46"
f) Serving Domestic Dishwashers	Inside base cabinet
g) Toggle Switches	46"
h) Recessed Motor Controllers	46"
i) Electric Panels, Terminal Cabinets, etc. – to Top of Tub or Box	72"
j) Speakers, Clocks, Horns	Near Ceiling
k) Thermostats	46"
l) Break Glass Stations (fire alarm)	46"
m) Fire Horn/Strobe	80" to bottom
n) Volume Controls, Call-in Switches, Door Bell Buttons	46"

Switches, generally, shall be located on strike sided of door, and 6" to 12" from edge of door, or as directed.

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# 26 05 53 – Identification for Electrical Systems

## Indexing

1. Each distribution panelboard circuit and each branch panelboard circuit shall have a typed directory identifying the area served including spares. Index shall be typewritten upon heavy card stock paper not subject to fading or mildew and shall be covered with a clear plastic window, and held securely in a suitable frame. Type date (month and year) and panel designation on each index.
2. Each index shall be sequenced in accord with actual panel circuiting, i.e.:
3. Left side - top to bottom - 1, 3, 5, 7, etc.  
Right side - top to bottom - 2, 4, 6, 8, etc.  
Standard index cards printed 1, 2, 3, etc., are not acceptable.

## Tagging/Labeling

1. The Contractor shall tag all feeders, sub-feeders, branch circuits, and main cables in all junction boxes, pull boxes, wire gutters, and main switchboard.
2. Provide nameplates on all equipment such as switchgear, switchboards, panelboards, dry-type transformers, motor control centers, motor controllers, VFD's, heavy duty disconnect switches, etc. Nameplate shall include the following:
  - a. Equipment identification name/number.
  - b. Voltage.
  - c. Source fed from.
3. Nameplates shall be laminated phenolic with a black surface and white core for normal power, or red surface and white core for emergency power. Use 1/16" thick material for plates up to 2" x 4". For larger sizes use 1/8" thick material.
4. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4" minimum height letters which occupy four to the inch. Increase letter size to 3/4" on largest plates.
5. Provide arc flash labelling on all equipment such as switchgear, switchboards, panelboards, dry-type transformers, motor control centers, motor controllers, VFD's, heavy duty disconnect switches, etc.
6. Mark circuit designations on all junction boxes and inside outlet cover plates using indelible marker or paint.

## Color coding of conductor insulation

1. The Contractor shall exercise great care in identifying the wires and cables of the electrical conduits.

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2. Feeder and branch circuit wire and cable shall be identified with a visual color code which shall be an integral part of the braid or outer insulation and shall be of the permanent indelible type not affected by moisture, oil, grease and age.
3. Color coding for phase identification shall be as follows:
 

	120/208V	277/480V
Phase "A"	Black	Brown
Phase "B"	Red	Orange
Phase "C"	Blue	Yellow
Neutral "N"	White	Gray
Ground "G"	Green	Green
4. Except when the system is the secondary of a (4) wire delta connected transformer secondary, then the "HI-LEG" phase shall be orange.
5. Generally, conductors of different systems (panelboard, etc.) shall not occupy the same raceway system or enclosures. Where dual occupancy is approved by the Engineer/College, the provisions of the NEC shall be followed.

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# 26 22 00 - Transformers

## Low Voltage General Purpose Transformers

1. Shall comply with NEMA Standard ST 20 "Dry-Type Transformers for General Applications." Transformers shall meet the requirements of Federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment," and shall be no less than the efficiency levels listed in Table 4-2 of NEMA Standard TP-1-2002.

## Transformer Capacity and Voltage

1. Generally, three phase transformers shall have a 480 volt Delta primary and a 208Y/120 volt wye secondary.

## Transformer Design

1. Transformers rated 3 KVA through 25 KVA shall have two (2) 5% F.C.B.N. taps, unless otherwise noted.
2. Transformers larger than 25 KVA shall have two (2) 2 1/2% F.C.A.N. taps and four (4) 2 1/2% F.C.B.N. taps, unless otherwise noted.

## Core, Coil Assemblies, Enclosures and Sound Levels

1. Transformer coils in all cases shall have a final wrap of electrical insulating material to prevent injury to the magnetic wire. Transformers having coils with magnetic wire visible will not be acceptable. The core and coil is to be subjected to a double dip and bake process. The unit is to be pre-baked and receive its first varnish dip while still warm.
2. All windings shall be copper.

## Non-Linear Load Transformers

1. Provide 'K' Rated transformers for all computer related circuits, sized and rated for 200% of the secondary phased current.

## Installation

1. Floor-mounted dry-type transformers shall be provided with a 4" high housekeeping concrete pad by the Electrical Contractor.

## Medium Voltage Pad-Mounted, Liquid-Filled Transformers

1. Shall meet ANSI C57.12.13, IEEE C57.12.00 Pad-mounted, 2 winding transformers. Stainless-steel tank base. Liquid shall have low toxicity and be non-hazardous.

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## 26 24 13 - Switchboards

1. The electrical service shall be coordinated with the local utility company.
2. Main service equipment shall be provided with a 100% rated electronic circuit breaker, with LSIG or LSI where applicable. All feeder/branch circuits in the main service equipment shall be circuit breakers.
3. Provide customer metering at each service entrance switchboard/panelboard.
4. Install surge protection devices within all main service equipment.
5. Where possible, circuit lighting at 277 volts; circuit mechanical equipment at 480 volts, 3 phase; and circuit receptacles and miscellaneous equipment at 208/120Y, 3 phase.
6. Routing of the primary and secondary underground electrical on College property shall be encased with concrete. The concrete shall be a 3000 psi mix with red dye. Exceptions shall be reviewed and approved by the College.
7. All branch circuit and feeder conduits shall be run overhead and not under/or in the slabs where possible.

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## 26 24 16 – Panelboards

1. Panelboards shall be in rooms designated for electrical equipment only. This electrical room can contain both general power panels and computer power panels. Other electrical items such as motor controls, time clocks, relay panels and transient surge suppressors can also be in these rooms. Each electrical room will have a plaque marked ELECTRICAL ROOM and the room number on the plaque. No other systems will be in these rooms except fire and sprinkler piping dedicated to the room. Each electrical room shall have a permanent plaque in the room marked, "ELECTRICAL EQUIPMENT ONLY NO STORAGE". Hallway power panels are not acceptable except as approved by the College.
2. All panelboard bussing shall be copper.
3. Provide ground bar in all panelboards.
4. Provide dedicated panelboards in all ER/TR rooms. Provide integral SPD's in all panelboards.
5. Provide dedicated panelboards in computer classrooms. Provide integral SPD's in all panelboards

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## 26 29 20 – Motors

1. All motors will have an energy efficiency rating that will comply with the local power company guidelines for energy efficient buildings.
2. All motors will have a service factor of at least 1.15.
3. Disconnects shall be sized in accordance with the current National Electrical Code and shall be fused.
4. Where variable frequency drives are not required, all three phase motors two horsepower or larger shall have single-phase protection. The single phase protection shall be a part of the overload block. All overloads shall be the adjustable type.
5. All variable frequency drives for outside motors shall be indoors with their own disconnect. An additional safety disconnect shall be installed outdoors by the motor. Provide auxiliary contacts in all disconnect switches and variable frequency drives for disconnecting control wiring.
6. Motors 1/2 HP and less shall be single-phase and motors larger than 1/2 HP shall be three-phase, except when only single- phase is available
7. Motors and variable frequency drives shall be provided by Division 23. Division 23 will install the motor, division 26 will install the variable frequency drive and install all conduit and power wire. Control wire shall be furnished and installed by temperature control contractor.

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## 26 32 13 - Generators

1. A Natural Gas-Fired standby generator or Diesel standby generator shall be provided.
2. The generator shall serve the following loads, in order of importance:
  - a. Exit and egress lighting
  - b. Fire Alarm System
  - c. Elevators.
  - d. Food Service Freezers and Coolers
  - e. Sewage ejector and/or storm water pumps
  - f. Technology Systems Heating System (critical components, i.e. boiler and pump)
  - g. Emergency phones
  - h. Temperature Controls
  - i. Consider any power needs associated with a shelter (if applicable).
3. The Transfer Switch(s) shall be automatic with built-in bypass for permanent generator or manual double throw type for portable generator, depending on the facility evaluation.
4. Coordinate with the Region any additional generator requirements.

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## 26 41 13 – Lightning Protection System

1. **Lightning Protection Equipment:** All materials shall be copper and bronze and of the size, weight, and construction to suit the application and used in accordance with current LPI, UL, and NFPA code requirements. Class I sized components may be utilized on roof levels 75 feet and below in height. Class II sized components are required for roof levels over 75 feet in height. Bolt type connectors and splicer shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.
2. **Aluminum Components:** Aluminum materials may not be used except on roofs that utilize aluminum roofing components. On aluminum metal roofs or where aluminum parapet caps exist, the entire roof lightning protection equipment shall utilize aluminum components to insure compatibility, however, the down leads and grounding are to utilize copper with the bimetal transition occurring at the through roof assembly with an approved bimetal through roof assembly.
3. **Copper down lead conductors** shall be utilized even when aluminum is required on the roof. Down lead conductors in conduit shall not be brought directly through the roof. Through roof assemblies with solid brass or stainless steel rods shall be utilized for this purpose. Structural steel may be utilized in the installation as outlined by current UL, NFPA, and LPI.
4. **Coordination:** The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. The roofing contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. However, the lightning protection contractor will be required to coordinate locations of through roofs and submit details of through roof penetrations as required. Should the roofing manufacturer require any special walk pads, membrane patches or pavers under the components of the lightning protection system, it shall be the responsibility of the lightning protection installer to install such items with the roofing materials (patches, pads, pavers, adhesive) supplied by the roofing manufacturer at no additional cost to the lightning protection installer. The roofing contractor shall be required to instruct the lightning protection installer of the proper installation procedures of the roof pads, patches and/or pavers if required.
5. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other ground systems.
6. **Completion:** Upon completion of the installation, the lightning protection installer shall secure and deliver to the college the Underwriters Laboratories, Inc. the Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certification certificate.

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## 26 43 13 – Surge Protective Devices

1. SPD to be UL listed and labeled per latest edition of UL Standard 1449, Type 1
1. Integrally mounted.
2. Integral disconnect switch.
3. Indicator light display for protection status.
4. Surge counter.
5. SCCR: 200 kA
6. Inominal Rating: 20kA
7. Locations/Peak Current Surge Rating:
  - a. Main Service Switchboard/Power Distribution Panelboard – 250 kA
  - b. Panelboards serving computer rooms, ER's, TR's – 150 kA

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# 26 51 00 – Interior Lighting

## General

1. Provide lighting per ANSI/ASHRAE/IESNA standard 90.1-2007, best practices, and as required by the application. Information shall be reviewed and approved by the College.
2. All lighting fixture drawings and/or "cuts" for approval shall indicate the manufacturer and catalog number of the ballast being used, if any.

## Lamps, Ballast, Drivers and Accessories

1. Provide not less than 10% spare lamps for fluorescent, incandescent, and exit fixtures. Spare lamps shall be properly packaged and turned over to the College prior to completion of project. Light fixture selections shall minimize lamp types.
2. All new buildings shall use fluorescent lighting with Programmed Rapid Star electronic ballast, less than 10% THD, F32 T-8, 3500K color temperature lamps.
3. Prismatic lenses shall be a minimum of 0.125" thick.
4. Ballasts shall be applied such that ballast sound is inaudible in a room ambient of 30 to 35 decibels.

## Lighting Controls

1. Interior lighting in buildings larger than 5000 square feet shall be controlled with an automatic control device to shut off building lighting in all spaces. Dual technology occupancy sensors that shall turn off within 30 minutes of an occupant leaving a space. Occupancy sensor controls are desired for lighting and energy control in order of priority.
2. Classrooms: Sensor shall be dual technology passive infrared and ultrasonic technology. Provide a manual override (light switch, off only) at the wall near door entry.
3. Offices: Office area occupancy sensors shall be dual technology passive infrared and ultrasonic technology equipped with a manual override switch for 'off' control.
4. Restrooms: provide dual technology passive infrared and ultrasonic technology ceiling sensor.
5. Corridors: provide dual technology passive infrared and ultrasonic technology ceiling sensor.
6. Unoccupied rooms like Storage Rooms, etc. shall have an ultrasonic sensor.
7. Power packs shall be capable for 120 volt and 277 volt and shall have integral HVAC relay with 1 set of normally open and normally closed dry contacts. Provide sensors with correct size and quantity as space permits.

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**Interior Lighting**

1. Interior light fixtures shall be specification grade, painted after fabrication.
2. Interior lighting in classrooms shall be 2' X 4' high performance recessed troffer LED. Utilize dimmable LED fixtures. Where project budget does not allow LED fixtures, provide fluorescent fixtures with T8 lamps. Lamp and ballast shall have direct access from beneath. Provide step switching ballast. Classroom lighting shall operate in two modes, general illumination and A/V mode. Drivers, LED modules, lamps and/or ballasts shall be accessible from below fixture.
3. Office Areas, Conference Rooms, etc. shall be 2' X 4' high performance recessed troffer. Where project budget does not allow LED fixtures, provide fluorescent fixtures with T8 lamps. Drivers, LED modules, lamps and/or ballasts shall be accessible from below fixture.
4. Stairwell lights shall be located where they can be serviced from no more than a six foot ladder.
5. Kitchen Areas: Fluorescent fixtures shall be enclosed on top and equipped with a plastic cover with gasket to seal out dust. Prismatic acrylic lens shall have prisms inverted. Door for prismatic lens shall be gasketed.
6. HID fixtures shall be pulse start metal halide.
7. Areas using HID shall have several quartz restrike fixtures sufficient enough to provide egress in a temporary power fluctuation
8. All fluorescent fixtures throughout the building shall be safety chained (4 corners).
9. HID fixtures shall have a safety chain to the ballast compartment with reflector housing and lens attached to building structural members.
10. Surface mount fixtures shall be chained to the structural members of the building.
11. Provide jelly jar lighting in large walk-in plumbing chases & elevator shaft with switch and timer (for time-out turn off).
12. Systems shall be field tested prior to Building Substantial Completion.

**Auditoriums**

1. Seating: Do not use aisle lights that are built into the chairs. Use strip lighting on each side of the aisle. Stairs shall have strip lighting and not lights built into the concrete stair face.
2. House Lights: All house lights must be serviceable without using scaffolding or pew stepper lifts. This may be accomplished by making all the lights serviceable from the attic above the auditorium. Suitable catwalks may be installed to reach all lights and equipment above the auditoriums.
3. Dimmer Systems: These systems must have their own rooms with air conditioning and filtered air due to the sensitive electronics in these systems. The room shall be insulated to cut down on any equipment noise.

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4. Each dimmer equipment room must have double doors suitable to remove and install dimmer racks when necessary.

### **Exit and Emergency Lighting**

1. Furnish and install exit lights as required by existing codes and regulations. Ceiling light fixtures shall not be located over stairwells or other locations where it will be hazardous or difficult to relamp. Mount fixture on wall a minimum of 8'0" above finished floor or landing to bottom of fixture. All new exit lights shall be L.E.D. type with an integral back-up battery.
2. Integral battery packs only shall be used (if generator is not provided).
3. Provide Red LED lights.
4. Corridors, stairways, auditoriums and other means of egress pathways shall be provided with emergency lighting systems for illumination in event of total power failure. System shall provide emergency lighting for a period of at least 1 1/2 hours (minimum). Emergency lighting in classrooms shall be provided as directed by the College.
5. Emergency light circuits shall be fed ahead of the switch from the same circuit that feeds the lighting in the area.
6. Provide an outdoor LED emergency light over exit areas for means of egress. The remote head shall be weatherproof and mounted to meet building code for illuminating exits.
7. Security lighting: Parking lot lights shall turn on with timers. Building security lights shall turn on with photo cells. Sufficient guards on fixtures for vandalism. New outdoor light poles shall be no taller than 30 feet.
8. Exterior entryway lights should be on exterior lighting control.

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# 26 56 00 – Exterior Lighting

## General

1. Provide lighting per ANSI/ASHRAE/IESNA standard 90.1-2007, best practices, and as required by the application. Information shall be reviewed and approved by the College.
2. All lighting fixture drawings and/or "cuts" for approval shall indicate the manufacturer and catalog number of the ballast being used, if any.

## Exterior Lighting

1. CAMERAS: Adequate lighting will be installed near security camera areas.
2. Building and parking lot lights shall be LED.
3. Parking lot lights should be controlled with a combination of photo cell and timer. College must be able to access and override when required. Show parking lot light locations, lumen levels, and location of the transformer on the site plan.
4. Exterior entryway lights should be on exterior lighting control.
5. Provide LED wall packs on all exterior walls and be part of exterior lighting control.
6. Great care must be taken to not illuminate neighbor's yards with ambient light from College property.
7. Each pole light shall have in-line fusing at its base. The fusing shall be rated at 125% of the total amp draw for that pole. The wiring method for pole lights will be PVC conduit and carry a full size ground based on current NEC. Branch circuits for pole lights shall be sized to prevent a voltage drop of over 3%. The ground conductor shall be increased the same percentage the branch circuit conductors were for voltage drop. Selected pole bases shall have 120 volt, 20 amp, GFCI duplex receptacle with weatherproof cover.
8. Fixtures exposed to weather shall be rustproof, cataloged weatherproof, or weather-resistant and provided with aluminum boxes and trim of stainless steel, cast aluminum, or other nonferrous material.
9. Exterior signage lighting shall be U.L. listed for wet location, HPF ballast, primary fused utilizing high intensity discharge lamps. Fixtures should be controlled with a combination of photocell and timer.
10. Flagpole lighting should be similar to exterior signage lighting except controlled by a photo cell.

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# 27 00 00 – Common Work Results for Telecommunications

## General

1. The following standards are intended to provide design guidelines for new installations. Facility renovations where the existing systems are only being extended or modified based on architectural changes, the general guidance shall be to follow the existing building system criteria to avoid mixing incompatible system components.

## Definitions

1. ER - Equipment Room (Telecommunications)  
An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect.
2. TR - Telecommunications Room  
An enclosed architectural space for housing telecommunications equipment, cable terminations, and cross-connect cabling.
3. TE – Telecommunications Enclosure  
This is specifically where wall-mounted equipment cabinets are provided in computer labs and where dedicated and secured ER/TR cannot be provided.
4. TO - Telecommunications Outlet/Connector  
Per the current standards this is defined as “A connecting device in the work area on which horizontal cable or outlet cable terminates.
5. UTP - Unshielded Twisted Pair
6. MC – Main Cross-connect (This was formally called the MDF – Main Distribution Frame. Although the standards bodies changed this many years ago, some clients still use the older terms.)  
The MC is located in the ER.
7. HC – Horizontal Cross-connect (This was formally called the IDF – Intermediate Distribution Frame. Although the standards bodies changed this many years ago, some clients still use the older terms.). HCs are located in a TR. Exceptions are where Telecommunications Enclosures (TE) are utilized and secured/locked ER/TRs are not provided.

## Compliance with the following is required unless otherwise indicated

1. ANSI/TIA/EIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA/EIA 568-C.1 Commercial Building Telecommunications Standards Part 1: General Requirements

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3. ANSI/TIA/EIA 568-C.2 Balanced Twisted Pair Cabling and Components Standards
4. ANSI/TIA/EIA 568-C.3 Optical Fiber Cabling Systems.
5. ANSI/TIA/EIA 569B Commercial Building Standard for Telecommunications Pathways and Spaces.
6. ANSI/TIA/EIA 606A Administrative Standard for Commercial Telecommunications Infrastructure
7. ANSI-J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
8. TIA-758-a Customer-Owned Outside Plant Telecommunications Infrastructure Standard
9. TIA-526-7 Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant
10. TIA-526-14-B Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant
11. BICSI – Telecommunications Distribution Methods Manual (TDMM)
12. NEC - National Electric Code
13. NFPA - National Fire Protection Association
14. IEEE - Institute of Electrical and Electronics Engineers
15. ISO - International Standards Organization
16. UL - Underwriters Laboratories

### **Cabling Contractor Requirements**

1. The Contractor responsible for this Section shall have a Registered Communications Distribution Designer (RCDD) on staff that will oversee and be responsible for this Project. The Contractor shall have been in business a minimum of five years. The Contractor shall provide a minimum of two references supporting past experience in similar projects.
2. The lead technician(s) on the Project shall carry a current BICSI Technician Certificate or have a minimum of five years related experience in projects of similar scope and shall have a thorough understanding of all referenced standards.

### **Coordination Requirements**

1. Coordinate Electrical requirements for power at outlet locations and Equipment/Telecommunications Rooms (ER/TR) with Electrical Engineer and College.
2. Coordinate Pathway requirements with Electrical Engineer and College.
3. Coordinate HVAC requirements for ER/TRs with Mechanical Engineer and College.

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4. Coordinate Space requirements for outlet locations and ER/TRs with Architect and College.
5. Clearly show locations of the intercom and sound system cabinets in the office, cafeteria, and stage areas. Provide two wireless microphones with each cafeteria systems. Clearly indicate locations of microphone jacks / inputs also.

### **Warranty**

1. The structured cabling system shall include at a minimum a 15-year performance and applications warranty from the manufacturer. The warranty shall warrant that all links have been permanent link tested bi-directionally end-to-end.

### **Extra Materials**

1. Provide one box of each wire color
2. Provide at least 25 extra patch cables to serve work area outlets and 25 to serve patch panels.

### **Cellular System Distributed Antenna System (DAS)**

1. Where indoor cellular telephone reception is unavailable, provisions for a DAS is strongly encouraged. Provide structured cabling to support a DAS. DAS's can cover a wide range of carrier frequencies. Carrier frequencies are a utility similar to power and internet services.
2. Fiber serving distributed antenna systems DAS may have special fiber connectivity requirements. Coordinate fiber connectivity type with specific DAS.

### **Power Conditioning and Backup**

1. For systems which have been deemed critical by the College, Uninterruptible Power Supplies shall be provided in conjunction with a generator. Where a backup generator is provided, these critical systems shall be included on the generator. The UPS shall provide a carry over time of not less than ten minutes where generator support is present. Where a generator is not extant or provided, the UPS battery system shall be sufficient to support the designated telecommunications load for a time limit as directed by the College.
2. Consideration will be given to a centralized UPS system for new facilities.

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## 27 05 28 – Pathways for Communication Systems

1. Primary pathways are those supporting the cabling infrastructure from the Equipment Rooms/Telecommunications Rooms through the corridors and chases to the secondary pathways.
2. Secondary pathways are those supporting the cabling infrastructure from the primary pathway to telecommunications outlets.
  - a. Provide a complete telecommunications cabling support system. The system shall be completely independently supported to the building structure and placed at heights that it is easily accessible from an 8' step ladder (i.e. Do not route cabling through or above structural support beams located at the deck or roof level).
    - 1) Provide cable tray for primary pathways.
    - 2) Provide standards compliant "J-hooks" for secondary pathways.
  - b. All pathway penetrations require EMT conduit sleeves. Provide quantity of sleeves as necessary to accommodate the cabling while maintaining 50% spare space capacity in each sleeve for future cables. All sleeves are to have bushings installed and be firestopped per ANSI/NFPA-70. Primary pathways and ER/TR entrances require four-inch sleeves. Provide ER/TR spaces with a minimum of four 4" sleeved penetrations from the corridor ceiling space for premise cabling. Secondary pathways require a minimum of two-inch sleeves. Larger sleeves should be considered for larger quantity of cables.
  - c. TOs are to be provided with a 2-1/2" deep, double-gang outlet box. Provide each outlet box with (1) 1" conduit has been desired as of late terminated with bushings in the nearest accessible ceiling space.
  - d. Campus backbone UG conduit shall consist of (1) 4" UG conduit with (3) 1-1/4" innerducts. Additional conduits for spare capacity may be specified at the discretion of the College.
  - e. Where new Local Exchange Carrier services are required, provide (3) 4" conduits from the property line into the ER. Coordinate with LEC.

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## 27 11 00 – Communication Equipment Room

1. The ER shall serve as the central telecommunications center for the facility.
2. The ER will include an area to serve as the main connection for cabling and house the electrical equipment for the telephone system, paging interface, file servers, LAN electronics, security system, and WAN electronics.
3. At least one TR per floor should be provided to ease future maintenance and repair as well as reduce the amount of cabling suspended between floors. If a TR per floor cannot be achieved, then at the very least, ER/TRs may serve TOs that are on adjacent floors.
4. ER/TRs shall be located to limit distance to all TOs to a maximum of 90 meters.
5. Provide Panduit for standard cabinets and racks. Specialty cabinets and racks not offered by Panduit must be approved by Ivy Tech

### Equipment Cabinet/Racks

1. Where dedicated and secured telecommunications spaces are provided, all equipment and cable terminations shall be housed in 19-inch equipment cabinets / racks. Cabinets / racks shall be 84-inches in height providing 77-inches of rack mounting space. Provide quantity as required plus future expansion as reviewed with the College. Provide vertical and horizontal wire management as directed by the College.
2. Where dedicated and secured telecommunications spaces cannot be provided, all equipment and cable terminations shall be housed in 19-inch equipment cabinets (TE) with locking doors. Cabinets shall be a minimum of 36" deep. Provide 4" conduits into the top of each cabinet from the nearest accessible ceiling space to house all cabling.
3. Where indicated for instructional spaces provide Hubbell RE4 wall-mount enclosures (or equal) (TE) to house all cable terminations and network electronics when indicated. Include a minimum of one quadruplex receptacle in the top rear of each enclosure. Provide (2) 2" conduits into the top of each enclosure from the nearest accessible ceiling space to house all cabling.
4. Provide covered horizontal wire management in all cabinets and racks.
5. Provide covered vertical wire management in all floor mount cabinets, 2-post open relay racks, and 4-post open relay racks. Vertical wire management not required in wall mount cabinets.
6. Provide each equipment cabinet with a vertical busbar for the purpose of bonding to the TGB/TMGB. Bond each rack independently.
7. Provide ladder around the interior perimeter of each for cable support. Ladder rack shall support cabling from where the cabling enters the room to the top of each equipment cabinet. Ladder shall extend from plywood backboard to top of each equipment cabinet. Provide vertical ladder rack where local exchange carrier (LEC) conduits enter the space.

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8. Provide ER/TR with fully opening, lockable doors which are at least 36-inches wide by 84" tall.
9. ER/TR doors shall open outward for utilization of space.
10. Finished floors should be provided to avoid dust and prevent static electricity.
11. All walls of each ER/TR shall be lined with ¾-inch AC-grade (4 ft.x8 ft. sheets minimum) plywood backboard treated with FF88 fire-resistant paint bright white in color for installation of any miscellaneous wall-mount interfaces. Install bottom of plywood at +1" A.F.F. extend top to +97" A.F.F.
12. To permit maximum flexibility and accessibility of cabling pathways, false ceilings are not permitted in telecommunications rooms. Minimum ceiling height shall be +8'-6" A.F.F..
13. The ER and TRs shall be dedicated to Telecommunications functions and house no other type of equipment or services.
14. ER's should be sized according to equipment to be installed plus future expansion capabilities. Minimum size shall be 15' x 30'. See attached detail for room layout.
15. All TRs shall be a minimum of 9' x 11' inside clear exclusive of any protrusions column wraps etc..
16. Temperature shall be maintained between 64 and 75 degrees F. Evening and off hour setbacks are acceptable to a maximum of 80 degrees for short durations.
17. Humidity range should be 30% to 55% relative humidity.
18. Maintain positive pressure with a minimum of one air change per hour.
19. Continuous (24 hours per day, 365 days per year) and dedicated environmental control.
20. In each ER/TR, consideration should be given to heat dissipation per cabinet/rack in BTU/h.
21. Provide a minimum equivalent of 500 lux (50 Footcandles) measured 3.3 feet above the finished floor.
22. TRs should have a minimum of six dedicated 3-wire 120V AC 20 amp (non switchable) electrical circuits. Place above the ceiling in junction box. Final location of electrical outlets will be determined after placement of telecommunications equipment. Include a minimum of one quadruplex receptacle in the top rear of each cabinet/rack. Quantity of electrical circuits for each ER should be as required for equipment to be installed. Coordinate ER power requirements with College.
23. Supply equipment circuits from backup emergency power source with automatic switch over capability where generator power is provided.
24. Provide separate duplex 120V AC convenience outlets (for tools, test sets, etc.), placed at 6 feet intervals around perimeter walls.

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25. All electrical outlets provided for equipment in the ER/TRs shall have surge protection device installed at panelboard.
26. Provide card access on ER/TRs if applicable.

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27 11 00 – Communication Equipment Room

## 27 13 00 – Communications Backbone Cabling

1. Provide optical fiber backbone cabling from the ER to each TR and TE.
2. Provide Panduit connectivity and Panduit approved fiber.
3. Cable shall be plenum rated 12-strand (minimum) laser optimized 50/125 micron diameter multi-mode fiber cable with dual window of 850/1300 nm and industry standard color-coding. Fiber shall be housed in spirally wrapped aluminum armor with a plenum rated jacket. In addition, cable shall include a minimum of 6-strands of single-mode fiber. Specific fiber strand quantity is determined by the quantity and types of required services. Discuss with Owner.
  - a. Transmission performance for multi-mode fiber shall be as follows:
    - 1) Maximum attenuation – (dB/km) 3.0 @ 850 nm and 1.5 @ 1300 nm
    - 2) Minimum LED bandwidth – (MHz·km) 1500@ 850 nm and 500 @ 1300 nm
    - 3) Minimum Effective Modal bandwidth – (MHz·km) 2000 @850 nm up to 10 Gb/s
    - 4) Serial Ethernet Gigabit Distance – 1000m @850 nm and 600m @ 1300 nm
    - 5) Serial Ethernet 10 Gigabit Distance – 300m @850 nm
  - b. Where cabling is exposed to public view, provide a warning label attached to the fiber sheath at 25-foot intervals identifying the cable as “Optical Fiber”. In addition, provide a label at all fiber breakouts that read, “Do not look into the end of a fiber optic cable or connector may cause permanent eye damage.
  - c. Provide rack-mount optical fiber patch panels for all optical fiber cable terminations. Utilize LC type connectors for all terminations. Include all manufacturer recommended panels, adaptors, coupler plates, wire management, and accessories.
  - d. Provide patch cables necessary to connect fiber system as indicated. All patch cables shall be fully compliant optical fiber cable specifications. Patch cables shall be orange in color and utilize LC –type connectors. Provide patch cables as indicated.
  - e. Fiber serving distributed antenna systems DAS may have special fiber connectivity requirements. Coordinate fiber connectivity type with specific DAS.
  - f. When required for voice services, provide twisted pair copper backbone cable from the ER to each TR. Cable shall be Category 5e compliant and provided under one sheath in increments of 25, 50, and 100-pair. Cabling sheath shall be plenum rated. Size as required for quantity of services.
  - g. Where legacy coaxial cabling infrastructures are still being utilized by the College, provide RG11 coax from the ER to each TR for video services. Provide 1/2 inch hard line coax backbone cable for distances that exceed 500 feet. Varying video applications are typically provided within each premise (i.e. CATV, video surveillance, Internet streaming, VOD, etc.) and each application may allow for different technologies. Discuss each application with the College in detail to determine the best approach.

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## 27 15 00 – Communications Horizontal Cabling

1. All horizontal UTP cabling shall be 4-pair UTP Category 6 compliant at a minimum. Cabling sheath shall be plenum rated.
2. Provide Panduit cabling and connectivity. Panduit certified partners are acceptable for cabling.
3. Utilize T568B pin/pair assignment.
4. Provide quantity of horizontal UTP cabling and terminations as required to support telecommunications services where indicated. Typical telecommunications services can include the following types of devices: Desk-top and Lap-top computers, networked printers/copiers, telephones, network scanners, wireless access points, video surveillance cameras, electronic access control (card access) components, alarm beacons, Displays, AV controllers, video projectors, etc. As technology continues to converge to IP, this list of applications continues to grow. Discuss each application with the College in detail to determine the best approach.
5. In ER/TR, terminate all horizontal UTP cabling on rack-mount 48-port patch panels. Do not install patch panels lower than +24" A.F.F.
6. Provide horizontal wire management above and below each patch panel in the telecommunications rooms.
7. Where legacy coaxial cabling infrastructures are still being utilized by the College, provide RG6 coax from the nearest assigned ER/TR to each TV location for CATV services. Cable sheath shall be plenum rated.
8. Provide patch cables in the ER/TR as necessary to activate services at TOs. All patch cables shall be Category 6 compliant. Provide patch cables in ER/TR/TE and at workstations as indicated.
9. Provide lengths as necessary to properly connect system as specified. Generally, provide 6" lengths in the ER, TRs and TE's. Provide 10' lengths at the workstations.
10. Provide 15% spare patch panel capacity.

### **Telecommunications Outlets (TO) For Structured Cabling Systems**

1. TOs will be located throughout the building for connectivity of LAN, WLAN, AV, Electronic Security, and Telephone System equipment. Coordinate with College to determine quantities and locations needed for desired connectivity.
2. Cabling will terminate on faceplates at the user end. The ER/TR termination will be on Patch Panels.
3. Where TOs are locating in surface raceway, provide mounting plates and all required hardware to accommodate installation of TOs.

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4. Where TOs are locating in industrial or potentially wet areas (i.e Kitchen area, Science Labs, Boiler Rooms, Mechanical/Electrical Rooms, etc.) provide industrial rated hardware to accommodate installation of TOs.
5. Confirm jack color coding, if any, with college.
6. Where all of the ports in a TO faceplate are not populated with jacks, provide blanks to fill unused ports.
7. At all work station outlets provide a minimum of one (1) port for voice services and one (1) port for data services.
8. Confirm faceplate color with College.

### **Cabling Administration**

1. Label all horizontal cabling specifically corresponding to where the cable terminates in the ER/TR. Label both ends of each horizontal cabling as follows:
2. ER/TR Number-Rack Number-Patch Panel Number-Patch Panel Port Number
  - 1) ER is always ER
  - 2) TRs are number 01, 02 ...
  - 3) Racks are number 01, 02 ... Within each ER/TR.
  - 4) Patch panels are numbered A, B ... top-to-bottom.
  - 5) Patch panel ports are numbered with work area space numbers on each patch panel.
3. Label faceplates at the TOs specifically corresponding to the horizontal cable labeling scheme. Provide snap-in colored icons as directed by the Owner.
4. Label backbone cabling identifying origination and destination and cable type/service.
5. Label patch panel port position corresponding to the workstation space identifier.

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## 27 17 00 – Telecommunications Grounding and Bonding

1. Provide each ER with a TMGB (Telecommunications Main Ground Busbar).
2. Provide each TR with a TGB (Telecommunications Grounding Busbar).
3. Bond each TGB to the TMGB with a TBB (Telecommunications Bonding Backbone).
4. Bond all metallic items and equipment within each ER to the TMGB.
5. Bond all metallic items and equipment within each TR to the TGB.
6. Whenever two or more TBBs are used in a multi-story building, bond them together on the top floor and at every third floor, at a minimum, with a GE (Grounding Equalizer).
7. All bonding conductors shall be green insulated copper minimum No. 6 AWG. Provide larger conductors as required by the referenced standards.
8. Bond the TMGB to the ground node , typically located in the main electrical room, using the most direct route possible to minimize conductor length.
9. Label all TGBs and the TMGB with the following:

**WARNING!!!**  
**IF THIS CONNECTOR OR CABLE IS**  
**LOOSE OR MUST BE REMOVED**  
**PLEASE CALL IVY TECH MAINTENANCE**

10. Bond the following to the TMGB and all TGBs:
  - a. Telecommunications panelboard:
  - b. Alternating Current Equipment Ground Bus (ACEG), if equipped, or its enclosure.
  - c. Building structural steel, if exposed. (Steel rebars of reinforced concrete are not required to be bonded.)
  - d. Metallic equipment racks.
  - e. Cable shields.
  - f. All metal raceways and cable trays for telecommunications cabling extending from the same room or space where the TMGB is located.

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## 27 51 23 – Intercommunications System

1. Provide for ceiling-mount audio speakers in all occupied spaces including corridors for emergency notification. Link this system to the fire alarm system, the alert beacon system, and the telephone system.
2. Provide an administrative control console at the security desk and as directed by the College.

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27 51 23 – Intercommunications System •

## 27 52 23 – Telephone System

1. Provide for telephones in occupied administrative and staff spaces (i.e. offices, conference rooms, work rooms, book store, ER/TRs, etc.). Provide in classrooms only upon specific request.
2. System shall include voice mail for all staff and faculty.
3. An integrated IP-based system is strongly encouraged. If non IP-based systems exist, provide hybrid components allowing for a migration path towards an IP-based system.
4. Link this system with the public address system for emergency announcements after hours.
5. Telephony is typically provided by the College.

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## 27 77 10 – Instructional Video System

1. Provide audio/video delivery system with projectors or monitors and controls in all instructional spaces. System should include a computer with network access, DVD, audio enhancement, and lectern (typically part of the furniture package) to house the equipment. All components shall be viewable through the display equipment such as it is.
  - a. Provide the appropriate projector to serve the specific space needs.
  - b. Projector wall-mounting is preferred where possible to keep the ceiling uncluttered and reduce construction coordination issues.
  - c. Projectors will typically project on a wall versus a projection screen unless specifically requested by the College such as in higher end conferencing spaces.
  - d. Small conference rooms will receive monitors versus projectors due to room size as determined by the A/E and the College.
  - e. All AV source switching and scaling will be provided by the instructional video system.
  - f. Provide wall-mount push button controller to serve AV equipment with the following features:
    - 1) AV input source selection
    - 2) Volume control
    - 3) Projector on/off
    - 4) Up / down projection screen control if a projection screen is provided
    - 5) LAN connectivity for desktop computer AV control
  - g. Provide audio / video conferencing as directed by the College
  - h. Provide AV systems to serve special spaces as directed by the College. Items to consider are as follows:
    - 1) Video display method such as projectors or monitors.
    - 2) Projection screens versus wall paint.
    - 3) Sound system.
    - 4) Microphones.
    - 5) Assisted listening.
    - 6) Wireless microphones.
    - 7) AV systems control.
    - 8) AV systems zoning for partitioned spaces.
    - 9) AV systems switching and scaling.
    - 10) Audio video event recording.
    - 11) Public media connections.
    - 12) Lighting control integration.
    - 13) UPS for AV systems.
2. Provide for permanently mounted monitor's in common spaces and as directed by the College.

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## 27 77 40 – Local Area Network/Wide Area Network, and Wireless Local Area Network (LAN/WAN and WLAN)

1. Provide LAN electronics in each ER/TR/TE to accommodate access to system resources. Components should provide for Gigabit Ethernet performance at each workstation and 10 Gigabit through the fiber backbone.
2. Provide for wireless access to network resources through properly placed access points for full premise coverage as directed by the College.
3. Provide surface ceiling-mounted wireless access points.
4. For ease of management and consistency, single manufacturer of system components should be considered to include all LAN, WAN, and WLAN components.
5. LAN, WAN, and WLAN is typically provided by the College.

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27 77 40 – Local Area Network/Wide Area Network, and Wireless Local Area Network (LAN/WAN and WLAN) • 115

## 28 00 00 – Electronic Security Systems

### **Alarm Beacon**

1. Provide data connection
2. Connect to intercom system
3. Typical Locations
  - a. Main corridors
  - b. Public spaces
  - c. Commons
  - d. Study locations
  - e. Vending
  - f. Main Lobby
  - g. Assembly spaces
  - h. Auditoriums
  - i. Other locations as directed by the College.

### **Additional Security**

1. Provide security controls for lockdown procedures. Locate controls as directed by the College.
2. IP access control and IP surveillance systems shall allow for partitioning.
3. Provide panic buttons as directed by the college. Panic buttons can be hard wired or wireless.
  - a. Typical locations:
    - 1) Bursar office
    - 2) Food Service
    - 3) Front Reception at Main Entrance
    - 4) Bookstore
    - 5) All point of sale locations (POS)
    - 6) Locations where money is exchanged.
4. Provide 911 panels. Locate as directed by the College.
5. Provide parking lot emergency telephones. Locate as directed by the College.
6. Provide AED Device with necessary connections. Coordinate location with College.

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## 28 13 00 – Electronic Access Control

1. Provide Electronic Access Control (Card/FOB Access) at key entrances and other high security spaces as directed by the College.
2. Electronic control will be able to be expandable.
3. Provides door position switches on all exterior doors and interior doors with electronic access control.
4. Typical Locations for Electronic Access Control
  - a. All exterior doors
  - b. Technology Rooms (TR)
  - c. Bursar Office
  - d. Human Resources Office
  - e. Computer Labs
5. Additional Locations for Electronic Access Control for Consideration. Provide rough in for future access control in the following locations:
  - a. Industrial Technology / Advanced Manufacturing Labs
  - b. Science Labs
  - c. Culinary Labs
  - d. Nursing/Medical Labs

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## 28 23 00 – Video Surveillance System

1. Provide video surveillance cameras to cover entrances, corridors, parking lots and other high security areas as directed by the College.
2. Provide Raid Level 5 storage for surveillance video data.

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## 28 31 11 – Fire Alarm and Detection System

1. The complete installation is to conform to the applicable sections of NFPA-72 and National Electric Code with particular attention to Article 760.
2. Each and all items of the Fire Alarm System shall be listed under the appropriate category by Underwriter's Laboratories, Inc. (UL) label, and shall bear the "UL" label.
3. The system shall be digital addressable system, and include an automatic voice evacuation sequence for audible alarm notification including the standard tornado warning, intruder notification and all-clear message.
4. The equipment installation and supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type (software driven) of equipment for at least five (5) years, has a fully-equipped service organization within seventy-five (75) miles of the installation, and is certified by NICET Level III installation standards.
5. The system manufacturer shall be responsible for furnishing engineering drawings which indicate the interlocking of all equipment external to the various control panels. These Drawings shall be included in the submittal to the Architect/Engineer for approval.

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## 31 00 00 – Site Construction

### **Building Demolition**

1. Coordination of all utility cut-off or modifications shall be coordinated in design by A/E. These include, but are not limited to gas, electric, water, sanitary and storm sewer, fiber optics, telephone, cable TV, and others as required.

### **Tree Protection and Trimming**

1. Provide a certification that trees and landscape to remain have been protected during the course of construction in accordance with recognized standards of the industry.
  - a. Engage a qualified arborist to perform the work.

### **Shoring, Bracing and Underpinning**

1. Shoring, Bracing, and Underpinning shall be designed and certified by a Professional Engineer.

### **Green Space**

1. Green Space shall be preserved whenever possible.

### **Termite Control**

1. 5-Year Warranty from date of project Substantial Completion.

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## 32 12 00 – Site Paving

1. Reference Space Standards for parking calculation requirements.
2. All drives shall be 24 feet width. Drive should accommodate delivery vehicles, buses, and emergency vehicles where applicable. This includes clear height, width, and turning radii.
3. In areas of expected delivery, bus, and large truck turn around, provide heavy duty asphalt or concrete.
4. A drop-off area should be provided at the main entry to the building. If the campus has a shuttle bus, drop off area should accommodate size of vehicle.
5. Handicap parking spaces should be provided near the main entry in a minimum quantity as required by the Code. Consideration should be given to exceeding the code required number of spaces. Spaces should not be more than 75 feet from the building entrance.
6. Vehicular circulation should loop the entire building where possible for fire and egress access.
7. Code Blue elements should be discussed and determined if they are required.
8. Infrastructure for cameras and call boxes should be incorporated for current or future equipment.
9. Parking lots shall be asphalt. Evaluate the cost benefit of substituting pervious pavement for asphalt to reduce storm water drainage systems.
10. Parking lots shall have curbs but NO concrete bumpers (wheel stops) with consideration for snow removal in regions where applicable.
11. Concrete shall be used at all loading docks and where semi-trucks will approach the buildings.
12. Create a small concrete area for motorcycle parking. Do not use asphalt. The minimum size for each motorcycle stall shall be 4.5' x 12'. Locate near entrance of the building and in a visible location. Provide 5 – 10 motorcycle parking.
13. Sidewalks should be 6 feet wide minimum.

### **Pedestrian Circulation**

1. All parking areas should be connected by walks with crosswalks provided for safe pedestrian travel.
2. At crossing paths provide materials, signage, and markings that indicate a pedestrian Crossing.
3. Walkways shall connect to bus access points on or adjacent to the building site.

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# 32 93 00 – Exterior Improvements

## Site Structures and Enclosures

1. Masonry enclosures to match building materials should be provide around all dumpsters, and ground mounted equipment such as chillers, generators, transformers, meters, or other equipment. The enclosure should provide appropriate clearances for equipment and be tall enough to keep equipment from view. Enclosures should be treated with acoustic absorbing material where appropriate to reduces noise transmission.
2. Smoking Huts are prohibited. An exception to this standard will be made when requested by the Regional Administration and accompanied by a copy of the Region’s smoking policy allowing smoking on campus.
3. Site Signage
  - a. Signage needs will vary greatly from region to region and from campus to campus. Please follow these guidelines for use with all indoor, outdoor, vehicle, and other signage needs:
  - b. Sizes and locations of signs will vary according to local ordinances, and changes to existing signage will need to be evaluated by each campus and changed over time. Those signs that are most visible should be changed first.
  - c. All outdoor signage must use the statewide Ivy Tech Community College logo. If usage is limited to text, the name “Ivy Tech Community College” must be used.
  - d. When color is available, the logo should be reproduced only in the color combinations shown on the approved logos. Colors other than green, gray, black, and white should never be used.
  - e. For signs with a horizontal orientation, use a horizontal version of the logo; for signs with a vertical orientation, use a vertical version.
  - f. All signage must be approved by the Ivy Tech Community College Marketing Department before production.
  - g. Color usage:
    - 1) Green: Pantone 342 C (4 color process – 100C 0M 69Y 43K)
    - 2) Black: Pantone black (4 color process – 0C 0M 0Y 0K)
    - 3) Gray: 50% Pantone black (4 color process – 0C 0M 0Y 50K)
4. Building Entries
  - a. Main entries should have canopy high enough to accommodate a bus drop off. Secondary entrances should have covered areas a minimum of the door depth.
  - b. Avoid straight entry drives that are on direct access with the entrance.
  - c. All entries and exits to the building should connect with accessible walks.
5. City bus access shall be considered in locating the building entry.
6. Include bollards, planters, etc. at the main entries for security.

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### **Chain Link Fencing and Gates**

1. Wire mesh shall be minimum 9 guage and the size shall be 2 inches.
2. Black polymer coating over metallic coating.

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## 32 93 10 - Landscape

1. In-ground sprinkler system is not mandatory. Review with the Region the desire for an in-ground sprinkler system. Recommend native plantings.
2. Landscaping should meet local codes or ordinances.
3. Trees or shrubs that are specified should be considered for the on-site use
  - a. i.e. consider if child care is on site.
4. Do not use fruit trees or trees that have droppings that cause maintenance issues.
5. Do not use trees or shrubs that attract birds.
6. Do use trees that are hardwoods, durable, low maintenance, and will last a long time.
7. Discuss if DNR grants may be utilized and incorporate DNR standards as required per the grant.
8. Prefer grades at 5:1 of less. If grade is 3:1 or steeper, use ground cover in lieu of grass to help with maintenance.

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## 33 00 00 - Utilities

### **Utility Distribution**

1. Architect/Engineer shall coordinate connection of utilities to the building.

### **Site Electrical**

1. Architect/Engineer should ask the campus what exterior activities are planned for the future. Ensure that exterior electrical locations are created for these events to occur
  - a. Movies, social events, parties, fairs, concerts, etc.

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## 33 46 00 – Site Drainage

### Site Drainage

1. Meet all water quality requirements local, state and federal and when determining the best option for site drainage, provide a solution that allows for the most natural look. Owner preference in order:
  - a. Swale
  - b. Rain Garden
  - c. Dry Basin
  - d. Dry Well
  - e. Underground structure per municipal guidelines.
  - f. Wet Pond
2. If a wet pond is used, consider including a fitness track or nature trail. Lighting and security will need to be considered.
3. Evaluate the cost benefit of substituting previous pavement.

This document provides initial criteria for the design of all facilities in the college. All information must be reviewed, confirmed, and modified appropriately to meet site-specific conditions and budget parameters. The proper balance between specialization and flexibility must be provided to accommodate future changes.

# EXHIBITS

Exhibit A: Mechanical systems comparison

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