VANDERBILT UNIVERSITY

2025

ARCHITECTURAL & ENGINEERING GUIDELINES

PLANNING, DESIGN, AND CONSTRUCTION

Contents

Advice to Architects and Engineers

Your team has been chosen as the Architectural/Engineering team most qualified to design the project, based on your ability to effectively communicate and demonstrate to the selection committee your team's design expertise, your understanding of the project, and your commitment to service. For your team to successfully exercise the highest degree of design potential afforded by the project, we offer you a few words of advice for the attainment of that goal.

1. Ask questions

a. Although your team was chosen as the best suited to the project, this may be the first project of this particular building type you have undertaken at Vanderbilt. Vanderbilt's design philosophy does not allow for a "cookie cutter" approach to design; hence, there will be many unknowns to your team in working with Vanderbilt. Prior to the beginning of Architectural programming, it will be valuable to:
b. Spend time researching the project goals Vanderbilt had in mind when preparing the RFQ/RFP.
c. Become familiar with the campus infrastructure and overall vision as set forth in the 2017 FutureVU Masterplan. *Note that the University will be updating the Campus Masterplan in 2026. Be on the lookout for these updates as they become available.*

The office of Planning, Design & Construction are assigned the responsibility of leading the project on behalf of the University and are your single best resource for the project. All questions and communications regarding the project, the users or the University must be routed through this office. This is the established project protocol and will be further detailed to you by members of that team. Is it their responsibility to answer in a timely and professional manner or direct you to those who can answer specific questions regarding any topic connected with the project.

2. Time is Money

A common comment we hear from design professionals is that the project budgets, schedules and professional fee structure precludes firms from devoting the proper amount of time toward design excellence. Vanderbilt realizes that design is a time-driven undertaking, and we believe this comment can be directly attributed to poor project communications which is a waste of time, money and opportunity. The project budget, schedule, and your compensation will allow for both a successful design and a successful business partnership, providing the following items are observed:

a. Strictly follow procedures for approvals. Under no circumstances should verbal approval be accepted or given. Any inquiry or direction that potentially affects project scope, budget, schedule or your compensation should be made in writing and responded to in kind.
b. Assume nothing. Assumptions made by your team without written clarification in the form of letters, meeting minutes, sketches, or written telephone/video conferencing will promote misdirection, miscommunications, design errors and subsequently, lost time. It is your responsibility to ask for and receive clarification. The worst possible assumption your team can make is that a User will instantly and instinctively understand graphic or technical aspects of design without a thorough and concise explanation. Photographs and three-dimensional realistic renderings are invaluable tools to achieve this understanding.
c. Direction, approvals, clarification, etc. must go through the Office of Planning, Design & Construction. Those that do not originate or go through this office, no matter the level or subject, are not acceptable and are non-binding.

3. Contingencies

Many architects are under the impression that project contingencies (for design, construction and inflation) are for the use of design "extras". This is incorrect. Vanderbilt shall carry contingencies based on the level of function and construction difficulty and total project duration. Contingencies

shall only be utilized to attain the critical project function and quality parameters, or “base” scope, as defined by the architectural program and schematic design.

4. **Expectations**

The Design Team is required to be within the design phase budget. If the project estimate at the completion of a particular phase indicates the design is over budget, the team will not receive the necessary approval to proceed to the next phase. The Design Team will then be required to expend the necessary time and effort to bring the design within the budget, at the Design Team’s expense.

It is easy to recognize that the further over budget the design is, the more time and effort will be required to bring the project within the budget. This is time that will not be compensated. It is therefore in the best interest of the Design Team to obtain the highest degree of detail appropriate at all phases of the design process, to account for cost ramifications of the design intent, and avoid promotion and pursuit of design elements that can neither be justified by the program nor are affordable within the project budget.

It Is the university’s expectation that by following the guidelines, procedures, and advice as presented in this document, the Design Team will produce a facility that not only meets program, budget, and schedule but also achieves a quality of design excellence that produces a high performing and easily maintained facility.

Project Guidelines Overview

1. **Purpose of the Project Guidelines**

The Vanderbilt Office of Planning, Design & Construction (PDC) Architectural and Engineering Guidelines for Construction apply to all Vanderbilt construction projects. All parties are advised to refer the sections of the Guidelines that relate to their project and adhere to its Guidelines.

2. **Project Guidelines Overview**

The 2025 Architectural and Engineering Guidelines for Construction are an update to the April 2023 A/E Guidelines. The 2025 Guidelines are intended to serve as a tool to assist in the planning, design and construction of Vanderbilt projects. The Project Guidelines consist of three interrelated sections:

a. **Section 1: Process Guidelines**
   The Process Guidelines identify roles and responsibilities of project team members, governing entities and Stakeholders. The Process Guidelines identify processes and procedures at Vanderbilt and provide a guide to common campus resources.
b. **Section 2: Design Guidelines**
   The Design Guidelines assist the project team by setting expectations for design considerations. These Guidelines define Vanderbilt’s requirements related to functionality, aesthetics, safety, performance, sustainability, resiliency and energy optimization.
c. **Section 3: Technical Guidelines**

The Technical Guidelines assist the project team by providing information on how Vanderbilt constructs, operates and maintains building and their systems. It defines performance criteria for products, materials and equipment selections as well as considerations for installation, fabrication and construction.

All questions and communications regarding the Project Guidelines shall be directed to the Office of Planning, Design and Construction.

3. Variances to the Guidelines

These Guidelines are the minimum requirements for design and construction at Vanderbilt. Contractors and Consultants must adhere to the Project Guidelines in all cases unless a written variance is obtained by Vanderbilt. Instances where **"or Approved Equal"** are used, should be seen as a **Variance Request** and proposed manufacturer should be submitted for review and evaluation.

Every Design Professional MUST initiate a **Design Variance Process** for any item that deviates from the below guidelines. Failure to submit a variance request assumes that the Design Professional(s) have adhered to these Guidelines.

The **Design Variance** is a process in eBuilder. Please contact your PDC team member should you have any questions regarding this process.

4. Updates

These Guidelines will be updated as requirements and procedures based on university changes.

SECTION 1 – PROCESS GUIDELINES:

1. Planning, Design and Construction Group

Vanderbilt's Office of Planning, Design and Construction (PDC) works with Vanderbilt Administration and associated user groups to manage all construction related projects from project initiation and programming through project closeout. References in this document to PDC refers to the team as a whole. The responsibilities of this team include the following:

a. **Planning**
   i. The team includes planners, program managers and assistant program managers.
   ii. Responsible for the development, implementation and oversight of the comprehensive masterplan of Vanderbilt's campus
   iii. Evaluate and perform planning options for space and site use for specified purposes
   iv. Ensure project coordination across planning scales
   v. Collaborate with campus partners to understand future requirements and space needs to anticipate solutions and guide planning efforts
   vi. Work with stakeholders to gather requirements and establish scope of projects
   vii. Establish and maintain project budgets inclusive of all project costs
   viii. Develop project milestones and schedules to establish project timelines
   ix. Conduct feasibility studies and evaluate planning options for space use
   x. Develop concept design options to assist customers in determining programs

xi. Coordinate program changes or design modifications and communicate changes to program, budget, or schedule with stakeholders and VU leadership
xii. Maintain project governance through Steering or Executive meetings and upward communication to leadership
xiii. Provide clarification of university project expectations during pricing phase and contractor award
xiv. Ensure schedule and budget compliance through project completion

b. Design

i. This team includes design managers, University Landscape Architect and University Interior Designer.
ii. Participates in the programming and feasibility phases to ensure overall design intent meets Vanderbilt Guidelines.
iii. Co-Manages the selection process for Design Professional and Construction Manager with the Planning team and Procurement.
iv. Co-Manages the finalization of contracts for services.
v. Manages the design process from Schematic Design through Construction Documents, ensuring compliance with the program budget and schedule.
vi. Manages the design to ensure compliance with Vanderbilt Guidelines.
vii. Manages all meetings between Vanderbilt User Groups and the design team.
viii. Reviews and approves all payments for services throughout the design process.
ix. Manages coordination with other support services, including but not limited to VUIT, Card Services, VU Public Safety (VUPS), Maintenance & Operations, Grounds, Housekeeping, Security, etc.
x. Maintainability and major system access safety must be considered in the design phase

c. Construction

i. This team includes construction managers, construction inspectors and construction coordinators.
ii. Participates in the design process to ensure constructability
iii. Responsible for total contract administration from award through completion ensuring safe and timely construction, within the available budget, and an acceptable level of quality
iv. Conducts Pre-construction meetings to coordinate the initial on-site activities with the client, contractor, and Vanderbilt representatives
v. Processes contractor-generated Requests for Information (RFIs) and submittals after review by appropriate personnel
vi. Coordinates road/parking lot closures and utility outages with affected partners
vii. Validates invoices for payment
viii. Reviews change order proposals for price reasonableness
ix. Proactively ensures that Contractor's are working safely and following their safety plan
x. investigates field discrepancies in order to provide timely technical and economical solutions
xi. Conducts pre-final and final inspections to accept work on behalf of Vanderbilt

d. Maintenance and Operations

Vanderbilt University Maintenance and Operations (VUMO) is responsible for all physical facility maintenance and operational activity and therefore has a vested interest in the maintainability and long-term operational cost of the University's built environment. A VUMO

representative(s) shall be invited to attend scheduled project meetings in both the design and construction phases and may elect to include other VUMO personnel based on their experience and technical expertise to act as project reviewers.

The responsibilities of the VUMO representatives include, but is not limited to the following:

i. Offer guidance and information related to Vanderbilt infrastructure, maintenance and operations.
ii. Advise on serviceability, maintenance, safety and quality aspects of all project components and systems.
iii. Review documentation for compliance with Vanderbilt Guidelines.
iv. Review shop drawings and product submittals to ensure compliance with Vanderbilt Guidelines.
v. Attend all regularly scheduled project design and construction team meetings.

SECTION 2- DESIGN STANDARDS

1. Architectural Design Standards *(Appendix A - These are being developed in conjunction with the 2026 Campus Masterplan)*
2. *Campus Landscape Design Standards – Refer to Appendix B.*
3. *Signage and Wayfinding Design Standards – Refer to Appendix F.*

SECTION 3 – TECHNICAL GUIDELINES

These Guidelines are meant to augment, not supersede, the applicable codes. Except as otherwise noted herein, these Guidelines are not specifications and shall not be used as the Project Specifications. The design professional is expected to generate individual project specifications per these Guidelines.

These Guidelines may require modification to meet the needs of a specific project. It is up to the design professionals and their consultants to inform the Office of Planning, Design and Construction of important deviations and obtain a variance approval to document said deviation and to obtain the necessary approvals to move forward. Nothing in these Guidelines should remove the ultimate professional responsibility of the design professional.

1. Overall Instructions to Designers

a. Communications, Trademarks and Logo's

Communication policies with designers, construction managers, partners, vendors, etc.:

i. Vanderbilt partners are free to do their own communications for their audiences, but if Vanderbilt is named, a request must be submitted through the office of PDC to communications for approval.
ii. Vanderbilt is a non-for-profit organization; therefore, we cannot endorse a for-profit company and must remain neutral and impartial.
iii. Any documents or materials using Vanderbilt branding, logos, etc. must be submitted for approval. The use of any Vanderbilt logo or Vanderbilt University mark on a project as signage or decoration must be approved. The Star "V" is restricted to Athletics Facilities ONLY.

iv. Additional information on Vanderbilt's policies: - https://www.vanderbilt.edu/communications/trademark-licensing/External-Use-of-Name-and-Insignia-FAQ.php
v. The turnaround time for approvals is 10 business days. Approval can be expediated for urgent circumstances.

b. Value of Historic Places

Vanderbilt is home to several historic buildings which are listed as part of the National Register of Historic Places. As such, designs should maintain the architectural significance of these buildings. Wherever possible, design solutions should use on-grade entrances or low slope ramps integrated into the site to avoid the requirement for railings at abrupt level changes. As an alternative, consider on-grade entrances or down-grade sloping ramps that connect to interior elevators. This may require locating an accessible ramp elsewhere.

c. FM Global

FM and Vanderbilt University partner to identify and mitigate property risk across VU's campus. FM should be involved with changes as early as possible. Bringing in FM even at the conceptual planning stages can pay dividends in the long run. Identifying loss prevention concerns at the early stages of a project enables you to incorporate them in your design and to budget them in your cost estimates. Alternative methods of protection are much easier to explore in the conceptual stage than during construction and will help ensure you maintain the highest level of protection that is the most economical.

Contacts:

FM Plan Review Office: ENGAtlantaPlanReview@FMGlobal.com

Process:

1. Review FM Data Sheets for initial loss prevention guidance or reach out to the FM Field Engineer or Account Engineer.
2. Ensure the use of FM Approved products. A list of approved products is available at approvalguide.com.
3. Use FM Plan Review Guidelines to determine specific items that should be submitted as part of the review package.
4. Be sure to include a brief project scope, site address, index number, and contact name for the project.
5. An FM engineer will review the submitted documents and provide a letter detailing the scope of the submittal, and whether it is in accordance with FM's best guidance. If not in accordance, recommendations will provide suggested changes. A resubmittal should be provided addressing all recommendations should the initial submittal not be deemed acceptable.

When to Submit Plans:

Submit via email for Quick Review:

1. Relocations of Sprinkler Heads
2. Send Cut Sheets of Sprinkler Heads/ and Piping
3. If using flex head supply hydraulic calcs.
4. Minor Roof Repairs – Larger than 500 sq. ft.

5. Fire Alarm Installations

Submit for Full Review

1. New Build
2. Extensive Renovations
3. Changes in Occupancy
4. Roof Replacement or New Roof Installation
5. New Sprinkler System Installation or Major Modification of Existing Sprinkler (Requiring new Hydraulic Calculations)
6. Changes/Additions to Fuel Fired Equipment (Boilers)
7. Diesel Fuel tanks & piping systems
8. Any projects completing a Recommendation on the FM Risk Report
9. Any Power Generation changes
10. Fire Pump installation/Changes
11. Installation of Solar Panels

No submittal needed for the following:

A. Cosmetic Changes
B. Relocation of Walls
C. Changes to Lighting
D. Changes to Landscaping
E. Changes to Life Safety Equipment like (fire extinguishers, eye wash stations, etc.)

Considerations Prior to Construction:

1. Storm water should be evaluated in the design phase as it is a known exposure across campus. If possible, the building should be constructed to avoid any below ground occupied spaces. If this is unavoidable, care should be taken so critical electrical rooms, utility rooms, storage or equipment will not be below ground. Roofs or awnings should be constructed over any subgrade outdoor entry ways, as well as exterior stiles before the steps.
2. Insulated metal panels are a fire hazard and should be avoided. If panels are going to be used, the composition of the panel's insulation should be discussed with FM prior to the purchasing of materials to determine the significance of the exposure being introduced. Unless the insulation can be validated at least 70% inert by chemical compound ratio, panels are known to cause vertical fire spread.
3. Exterior Insulation and Finishing System (EIFS) should be avoided due to weakness against impact damage and fire spread characteristics.
4. Avoid the use of spray foam insulation unless it is FM Approved.

Domestic Water Leak Prevention:

The most frequent cause of loss for universities is domestic water leak. The following items should be incorporated to ensure that losses are minimized in both frequency and severity:

1. FM Approved leak detection and flow meters should be installed in the multistory buildings throughout the campus. The detection and flow meters should be tied into a constantly attended location, building management system or a monitored mobile device. Arrange leak detection devices near potential water leakage sources to promptly notify site personnel of an emergency condition. Typical leakage points include near equipment,

tanks, pipe fittings, valves, joints and couplings. Additionally, water tends to travel from the leak source to the lowest elevation within a room; therefore, placement of leak detection devices at low points is needed. Domestic water pipes should not be routed over areas that will contain high value.

2. At a minimum, the following areas should be protected using a flow meter:
    a. Incoming domestic and make-up lines on closed loop systems including chilled water, hot water (hydronics), ground source heat pump loops systems to the building, on supply line of each floor, provide flow detection for offices.
3. Leak Detection installation guidelines:
    a. High value equipment areas: Leak detection should be provided directly under or adjacent to water leakage sources. For ceiling level piping, sensing cable should be attached to the underside of the piping above high valued equipment.
        i. Telephone and data transmission rooms
        ii. Critical electrical and alarm system rooms
        iii. Areas containing high-value items such as research freezers or antique storage
        iv. Critical rooms having equipment and/or materials required for business continuity
        v. Rooms immediately adjacent to or above high-valued equipment areas
    b. Mechanical rooms
        i. Areas of likely water accumulation, including building basements, elevator pits or drainage pits
        ii. Rooms/areas containing water-handling equipment such as domestic water pumping and distribution headers, HVAC equipment, automatic sprinkler system riser rooms, entry locations of domestic water and fire protection services, etc.
        iii. Locations where the pressure or temperature of liquids changes (e.g., boilers, hot water heaters, chiller plants, etc.)
        iv. Rooms containing electrical distribution equipment including transformers, electrical switchgear, UPS systems, etc.
        v. Around or under the fire protection water storage tanks (typical within multi-zoned, high-rise fire protection systems)

Submittal Checklists:

AUTOMATIC SPRINKLERS:
Provide:

1. Prints of the proposed automatic sprinkler system
2. Hydraulic Calculations
3. Product Specifications (sprinkler heads/piping/valves/peripheral equipment)
4. Water supply test data within 1 year
5. Occupancy Details – In order to review submitted plans to ensure adequate protection, accurate occupancy details must be provided. These include but are not limited to materials being stored and storage height. This is also critical for occupancy changes such as converting offices to lab space.
6. The Contractor's Materials and Test Certificate Form No. 85 should be completed by the installing contractor for all installations and submitted to FM.

ROOFING:
Provide:

1. **Structural Prints**
   These should include information such as drawings of the roof installation, flashing installation, and roof design load (both live and dead load).
2. **Roof Drainage System**
   Drawings should show drain sizes, locations with respect to building columns, and the number of drains to be installed. Roof drainage calculations should be submitted proving that the design drainage is adequate for the anticipated rainfall intensity. (reference FM Global Data Sheet 1-54)
3. **Snow Loading Calculations**
   Snow loading potentials may exist. When applicable, these should be submitted to ensure that the average snow load due to an unbalanced snow load does not exceed the design live load of the roof. (reference FM Global Data Sheet 1-54)
4. **Roof Specifications and Roof Nav Assembly Number**
   FM Global Form 2688 "*Application for Acceptance of Roofing Systems*" should be completed for each type of roof covering system for each building. RoofNav is recommended for the selection of FM Approved roof assemblies. Contractors can find out more information at www.roofnav.com. Criterion for roof Securement can be found in FM Global Property Loss Prevention Data Sheet 1-29 *Roof Deck Securement and Above Deck Roof Components*.
5. **Wind Uplift Rating**
   The uplift rating of the roofing system should be specified to ensure that it is properly designed to withstand the anticipated uplift pressures.
6. **Specific Flashing Details**
   Roof edge flashing should be an FM Approved flashing assembly with the proper minimum wind rating. Design and install in accordance with FM Global Property Loss Prevention Data Sheet 1-49.

CONSTRUCTION:
Provide:

1. **Construction Drawings – Full Set**
   Include a full set of construction plans (Architectural, structural, mechanical, electrical, plumbing, etc.) These should include finished roof elevations of both new and any adjacent, existing buildings, as well as finished grading elevations, and details on additions and modifications to the yard mains, control valves and fire hydrants.
2. **Specific Exposures**
   For areas requiring specialized construction, technically complete drawings and calculations should be submitted.
3. **Materials Used**
   Use noncombustible materials (FM Approved or listed by UL or other recognized testing laboratory) for all suspended ceilings, supports and pipe and duct insulation (including adhesives). All filters should be UL Class 1, or equivalent. Keep all concealed spaces free of combustibles. Any new ceiling tiles, sound attenuation blankets, HVAC duct insulation or building insulation should be made of FM Approved Materials, or noncombustible materials. It is also acceptable to use non-plastic materials which have been tested to ASTM E-84 and have shown a flame spread rating of 25 or less.

4. Insulated metal panel walls should be FM Approved and installed in accordance with FM Global Property Loss Prevention Data Sheet 1-57, Plastics in Construction.
5. Composite panels should not be used in new construction as there are no FM Approved composite panels. If their usage is unavoidable, utilize metal composite panels (MCM & ACM, aluminum composite panels) that have passed a large-scale fire test such as FM 4880 or NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components. Install panels provided with a fiber or similar non-combustible core material. Plastic core materials such as polyethylene or polystyrene should not be considered due to the high combustibility of the material.
6. Exterior insulation and finish systems (EIFS) are no longer FM Approved and are not recommended for new construction. EIFS may be subject to moisture penetration and mechanical impact damage and typically contain combustible components.

FIRE PUMP:
Provide:

1. Prints of the fire pump/booster pump installation.
2. Manufacturer's Specifications & Cut Sheets for the fire pump, driver, controller, etc.
3. Pump Curve: Manufacturer's Certified Bench Curve for the pump.
4. Pump House Design & Layout information
5. One-Line Electrical Diagram showing the electric feed arrangement to the pump.
6. Installation of the fire pump/booster pump should be in accordance with FM Global Property Loss Prevention Data Sheet 3-7 *Fire Protection Pumps*.
7. Confirmation that emergency power is being supplied to jockey/booster pumps

SPECIAL PROTECTION SYSTEMS:
Provide:

1. System diagram
2. Calculations: The contractor's or installer's calculations are needed to show that the required concentrations or densities, and durations are available from the special protection system.
3. Manufacturer's Equipment Specifications
4. Occupancy Details
5. Satisfactory completion and submittal of the Contractor's Application for Acceptance for the specific special protection system.
6. The Special Protection system should be in accordance with FM Global Data Sheet 4-0, *Special Protection Systems.*

FIRE-FUELED EQUIPMENT:
Provide:

1. Fuel Train Piping Diagram
2. Electrical Ladder Diagram or Controller Program Logic
3. Equipment and Materials List – The manufacturers name and model number should be included for all equipment
4. Safety Ventilation Calculations for ovens a. Direct fired ovens

5. Oven processing materials containing flammable solvents

DIESEL FUEL EMERGENCY GENERATOR:
Provide:

1. Specifications for the main storage tank
2. Fuel oil riser diagram
3. Identification of interlocks planned between leak detectors and the fuel oil pumps
4. Emergency generator installation
5. If the main tank and generator will not be located outside the building, the specific construction assemblies planned for the tank room and the emergency generator room

d. Design Considerations for Central Utilities

1. Steam system operating pressure is 125 psig. It is superheated to 415 degrees F.
   i. Underground steam systems shall be Class A, drainable dryable, testable systems equal to Thermacor Duo-Therm 505.
   ii. Underground condensate piping shall be Thermacor Ferro-Therm or approved equal.
2. Heating hot water design pressure is 150 psig. Size pipes for 20-degree F temperature change.
   i. Underground hot water piping shall be Thermacor Ferro-Therm or approved equal.
3. Chilled water design pressure is 150 psig. Size pipes for 10-degree F temperature change.
   i. Underground chilled water piping can be Thermacor Ferro-Therm or high density polyurethane (HDPE).

e. Design Considerations for Housing Projects

1. No paper towel dispensers, only electric dryers.
2. Access for terminal boxes from the corridor is preferred.
3. Accessible lint traps to be installed with any laundry room for proper maintenance.
4. No operable windows.
5. No wall coverings.
6. Access to mechanical and electrical spaces should not be through student-occupied floors.
7. Redundant domestic hot water system is required.
8. For faculty apartments, the following is required:
   i. Install a domestic water heater in the domestic hot water line, set to activate if the building hot water system needs an outage.
   ii. Specify blower coil air handling units for the faculty apartments and install small circulating pumps in the heating hot water and chilled water piping serving the apartment air handling units. Activate the blower coil pumps if the building pumps are deactivated.
   iii. Locate MEP equipment for the apartment in an equipment room accessible from the corridor.
   iv. Provide user controllable thermostats in the apartments. Blower coil units will use controllers that are connected to the building automation system but will operate regardless of the BAS condition.

v. Over communicate with the occupants to provide mutual understanding of issues, requirements and desires.
vi. The AE team shall provide detail drawings of the apartment MEP systems with resiliency measures annotated and fully described.

9. Bathrooms and showers should be provided with continuous exhaust.
10. The AE team shall specify a control system graphics page that shows all backup systems that operate in utility outages.

f. Design Considerations for Dining Projects

1. Capacity and Flow: design to handle peak student traffic; provide efficient circulation;
2. Future Adaptability: Consider providing infrastructure for changing foodservice models and technology.
3. Comfort: Provide adequate ventilation and HVAC supply; Provide acoustic treatment to minimize echo and create zones for quiet dining; encourage both social gathering and intimate dining
4. Technology: Consider mobile app integration, kiosks, as well as security and access control.
5. Back of House: Provide staff support spaces such as locker and break rooms, administrative offices; Provide efficient delivery, storage, and preparation areas.
6. Flooring materials must be designed for commercial kitchen use and provide slip resistance even in the presence of water, oils, or food debris.
7. If an elevator is used for transporting food and materials, it shall be dedicated for this use. The elevator must be a robust, heavy-duty Class C3 freight elevator. There should be a stairwell adjacent to the elevator as well.
8. Back up domestic water feeds for all refrigeration equipment is required.
9. All refrigeration equipment should be water cooled.
10. Kitchen grease duct must be accessible for cleaning and maintenance.
11. The location of the compactor should have a nearby hose spigot with hot and cold water and drain.
12. Design the loading dock and trash area such that the area may be easily cleanable and maintainable.
13. No outside air intakes within 50 feet of trash areas or loading docks.
14. Minimize above ceiling equipment in the food prep area. If needed, equipment must be accessible.

g. Design Considerations for Lab Projects

1. Refer to Appendix C for Laboratory Safety Design Guidelines.
2. Decouple lab equipment cooling loop with a heat exchanger from the building chilled water. The equipment cooling loop should only feed one floor.
3. Critical laboratories shall have redundant HVAC systems.
4. All equipment must be placed in an accessible area in an open walkway area (no above lab equipment).
5. The cabinet area under lab sinks should belong to VUMO. (No dangerous chemicals storage underneath)
6. Acid neutralization should be accomplished by a centralized passive system limestone chip tank, providing at minimum effluent pH monitoring tied to the building automation system, with alarm points set to metro's required effluent range.

7. Lab systems should be centralized (RO/DI, vacuum, etc.).
8. Acceptable manufacturers for high performance air valves include Antec and AccuValve.

h. Design Considerations for Athletic Facilities

1. Humidification is not needed.
2. Redundant domestic hot water system is required.
3. Locker rooms must be 100% exhaust.
4. Seasonal facilities should be designed to be capable of winterization.

i. Design Considerations for Every Project

1. Accessibility

Vanderbilt requires compliance with the Accessibility sections of the Building Code, American National Standards Institute ANSI A117.1, and Americans with Disabilities Act to be a minimum level of design required for accessibility. Every practical effort shall be made by the design team to improve on this minimum level of accessibility to facilitate barrier-free environments.

Additional Guidelines for Vanderbilt University:

i. Accessible Route
   1. The minimum width for interior shall be increased to 45 to 60 inches.

ii. Doors
   1. All doors to public spaces should be 36 inches wide and shall provide a minimum 32 inches clear opening with the door open to 90 degrees.
   2. The force to open all doors (exterior and interior) is not to exceed 5 lbs and a timing for closure shall be 5-7 seconds from a 90-degree open to latching.
   3. It is recommended that all exterior doors and those doors subdividing major building corridors have 7-1/2 inch minimum kick plate at the bottom of the door.
   4. It is highly preferred that at least one accessible entrance is equipped with an automatic opener per university standards.

2. Building Certifications

i. The Vanderbilt Built Environment Capital Project Design standard is the set of design decisions and features with the goal of providing the lowest Total Ownership Cost as the basis of design, with all other standards being considered and priced as alternates for budget and leadership consideration. As standard practice, the University follows many of the design guidelines suggested by USGBC including waste recycling, VOC limitations, water efficiency practices, reduced heat island efforts, optimizing energy performance, HVAC commissioning, air quality monitoring, etc.

ii. Formal certifications are not to be pursued, however all new construction and major additions/renovations projects should be designed to meet a minimum of LEED **Silver** based on certification standards set forth by the USGBC, as baseline guidance for benchmarking purposes. The University's goal is first and foremost to improve building performance and efficiency.

iii. Other certification standard criteria may be explored and priced as alternates for evaluation. This includes design criteria associated with LEED Gold/Platinum, Living Building Petal, Net Zero, WELL, Fitwel, Zero Waste certification standards and/or other resilient and high-performing building standards.

iv. In addition to meeting such baseline criteria, design teams shall use energy modeling to determine energy savings to meet an initial goal of at least 50% below ASHRAE 90.1-2016 or at least 20% below ASHRAE 100-2024, as appropriate for the project, or latest applicable standard, and to meet EUI targets of at least 50% below ASHRAE 90.1-2016 or at least 20% below ASHRAE 100-2024, as appropriate for the project, or latest applicable standard as outlined in Vanderbilt's High-Performance and Resilient Infrastructure Design Guidelines. Refer to Appendix G.

2. **High-Performance and Resilient Infrastructure Design Guidelines (HPRIDG)** – Refer to Appendix G.
   i. The HPRIDG seeks to integrate efficiency and resiliency concepts into the workflow of individual infrastructure projects to support overall university energy efficiency, energy independence, and resiliency goals. Design professionals and contractors should review these guidelines but understand that the overall direction from PDC is that any initiative must consider the total project ownership and will be evaluated as such for review and approval, as noted in Item 2 above.

3. **Lactation/Wellness Rooms**
   i. Vanderbilt University will provide support for breastfeeding mothers as part of a campus wide initiative to offer safe and welcoming spaces to feed or pump.
   ii. Design of new construction lactation rooms shall follow guidelines as set forth by the American Institute of Architects, Lactation Room Design Best Practices (Recommendations for designing lactation/wellness rooms). These guidelines shall be followed in renovated spaces whenever reasonably possible.

4. **Gender Inclusive Restrooms**
   i. Access to accessible and gender inclusive restrooms are a standard part of new construction projects on campus. The office of PDC strives to place at least one gender inclusive restroom in each new building or major renovation project. Each restroom shall be accessible and shall contain a lavatory and toilet. Where appropriate a shower may be provided to encourage healthy lifestyles.
   ii. Gender inclusive restrooms shall be convenient and easily located or grouped with similar spaces.
   iii. The signage for gender inclusive restrooms (as with all rooms on campus) shall be with raised letters on a contracting background placard mounted adjacent to the door.

5. **Shower Design**
   i. Provide pliable sheet-applied waterproofing and vapor-retarder such as Schluter-Kerdi under floor tile, wall tile, and shower surrounds

6. **Fall Prevention Systems**
   i. Roof leading edges should be protected whenever feasible with railings or parapet walls constituting a physical barrier. When not feasible due to slope or other existing architectural features, hooks, rings, or a man line installation system shall be integrated into the design.
   ii. Designs should consider the safety of maintenance personnel when maintaining the building and work to minimize obstructions and hazards.

7. **Roof Access**
   i. Roof access should be constrained to an area of the building not typically accessible to students such as a mechanical room, basement, or locked closet.
   ii. Roof access should not be in a stairwell.
   iii. When using a hatch for access, a hatch lock is required (when not located inside an access controlled space). The lock shall be located at the bottom of the ladder to allow those who need access to unlock the hatch while standing on the ground level.
   iv. Stairs and doors for access are preferred over ladders and hatches.
   v. Roof hatches or doors shall not be located within 3-feet of the edge of the roof.

8. **Elevators**
   i. Within new construction, a minimum of 2 elevators shall be provided.

9. **Plumbing Design**
   i. Duplex backflow preventors are required.
   ii. Wall mounted flush valve toilets are preferred, but single restrooms can use floor mounted flush valve toilets. If tank type will be used, initiate a Design Variance process.
   iii. Provide shut off valves for plumbing at each floor and each restroom.

10. **Mechanical Design**
   i. Mechanical equipment (fans, VAV boxes, etc.) must be fully accessible and not located above gypsum board ceilings.
   ii. Consideration should be given for access to mechanical equipment and adequate working clearances as well as removal of equipment at a future date.
   iii. If installing cold rooms or rooms with mechanical components, these components shall be located in a mechanical room, preferably on the same floor as the equipment.
   iv. No equipment in stairwell ceilings.
   v. Any equipment located higher than can be accessed via a 10-foot ladder needs a lift provided by the project.
   vi. Serviceable equipment located above a tall ceiling or specialty ceiling should be labeled on the ceiling grid using a reflective sticker.
   vii. All individual offices, dorm rooms, etc should be individually controlled (no zone control).
   viii. Interior air conditions must be capable of achieving 68˚F in cooling and 74˚F in heating.
   ix. Absolute humidity must be maintained below 53˚F dewpoint. Control air handling unit discharge humidity to 52˚F dewpoint maximum.
   x. For design purposes, assume the steam conditions entering a facility are 125 PSIG and 415˚F.
   xi. Use 45˚F chilled water temperature for design purposes. Size coils for 16˚F temperature rise.
   xii. Use design hot water supply temperature of 140˚F. Size coils for minimum 30˚F temperature drop.
   xiii. All new HVAC systems should be equipped with fault detection.

xiv. If a building requires humidification, it should be provided by central plant steam. Clean steam generators are not required for humidification.
xv. Rooftops must be clear. Equipment must be in penthouses. If a Project Variance form is approved for mechanical equipment on the roof, roof curbs shall totally enclose all piping and conduit to the unit. To minimize sound transmission from this equipment to the building, install rail isolators and maintain the roof deck continuity underneath the unit with holes for only the duct, piping, and conduit. Do not place HVAC systems directly on the edge of a building. Locate the HVAC man access door on the side not facing the leading edge of the roof. A stair and/or elevator for access to roof should also be provided (see roof access in “roofing” section).
xvi. Supply-air ductwork mounted on or above roofing is not allowed. Exhaust-air ductwork on or above roofing is acceptable only where other means of exhaust are impractical and a Design Variance is approved.
xvii. Filters should be of a standard size (24x24” or 24x12”) and easily accessible for replacement. Pleat filters should be MERV8 and equivalent to Camfil 30/30/ Pocket filters should be MERV11, have a minimum depth of 12” and a maximum depth of 36”, and be equivalent to Campfil HiFlo ES.
xviii. No pre-filters are needed.
xix. Air intakes shall be minimum 10 feet above grade.
xx. The conditioned building envelope shall be everything located within the building skin. Ventilated, unconditioned spaces are not permitted.
xxi. All occupied spaces shall be designed for noise level NC 30 or below. Equipment rooms shall be 55 dBa maximum. Outside noise levels shall be 55 dBa maximum at any occupiable outdoor space.
xxii. The contractor shall generate composite plans that coordinate all equipment and building structure. Coordination drawings shall show mechanical items to proper graphic scale. BIM models must be reviewed with PDC and VUMO 10 days prior to construction.
xxiii. All obstructions within equipment rooms, penthouses and attic spaces containing serviceable equipment must maintain a clearance of 7’ 6” above finished floor. Minimum 3’ wide walk path and access to equipment is required.
xxiv. Housekeeping pads in mechanical and electrical rooms should be painted safety yellow.
xxv. Placement of air handling units shall require adequate space for normal fan and filter maintenance, SMACNA-approved duct connection arrangements, and coil removal space. Minimum spacing at access door on each side of the coil for cleaning and control access.
xxvi. In new buildings, future air handling unit replacement can be accomplished with unit assembled in place. Openings larger than 6’ x 6’ are not required unless the largest AHU component requires a larger opening.
xxvii. Provide an appropriate floor drain near-by for condensate drainage; "thru-wall to grade" condensate drains are not permitted.
xxviii. A start up meeting is required with PDC and VUMO prior to activating any building conditioning system. Operation of the HVAC system during drywall, casework, trim, painting, or other airborne contaminate production process is strictly forbidden.

xxix. Design all systems so that they are protected from freezing without requiring heat trace.

11. Electrical Design

i. All generators and transformers must be located inside the building.
ii. Vanderbilt, in an ongoing effort to reduce energy consumption, requires projects to develop a lighting plan that is energy efficient and makes maximum use of daylighting and other strategies to lower building lighting energy requirements.
iii. Where appropriate the use of ceiling mounted occupancy sensors in ACT applications and wall mounted in drywall ceiling applications is recommended.
iv. The different types of lamps selected should be kept to a minimum and reviewed with PDC and VUMO.
v. Do not specify incandescent or fluorescent lighting.
vi. Lighting provided should meet IES (Illuminating Engineering Society) standards for illumination requirements for both interior and exterior areas.

12. Green Roofs –

i. Green roofs are not allowed.

13. VUIT Network Infrastructure Standards – Refer to Appendix D.

14. VUIT A/V Design – *(Appendix F - These are being developed as in conjunction with the 2026 Campus Masterplan)*

15. Laboratory Safety Design Guidelines - Refer to Appendix D.

16. Room Numbering

i. Facilities Information Services is responsible for room numbering all projects, regardless of the size and scope of the project. It is necessary to coordinate this activity with each and every time you need room numbers.
ii. Room numbering should try to be established at the end of Schematic Design or the beginning of Design Development, when the floor plan is set. At this stage, the proposed floor plan should be submitted to Facilities Information Services for room numbering. A process in eBuilder can be used for submission and tracking of approval. Contact PDC to assist in this process. Any changes to the floor plans should be reviewed with Facilities Information Services and numbers adjusted accordingly. Changing of room numbers without review is to be avoided.

17. Tree Replacement

i. Projects are to make every reasonable effort to avoid negatively impacting or removing trees. Any tree removed, to the maximum extent practical, should be replaced at the following rates, depending on DBH. If removed tree is:
   a. <6” DBH, replace at 1:1
   b. >6” DBH, replace at 2:1
ii. Replacement trees must be a minimum of 3” DBH

DIVISION 0 – PROJECT FORMS, GENERAL CONDITIONS COSTS, TAX SAVINGS PROCEDURES/OWNER PURCHASE ORDERS

Pay Applications

Refer to the Planning, Design and Construction website, under Resources for standard pay application forms. It is recommended that the Contractor schedule a meeting with PDC to review pay application format prior to submission of first application.

Owner Purchase Orders/Tax Saving Procedures

The purpose of this procedure is to establish guidelines associated with the pursuit of Owner Purchases within construction projects to save 7% in state sales tax. Note that the 2.75% city tax is still required to be paid. Note there may be situations that we must deviate from these guidelines based on the nuances of a specific project as outlined below.

Owner Purchases Orders (OPOs) are Purchase Orders (POs) with the sole intent of direct purchasing materials on behalf of the contractor direct to suppliers to realize savings associated with state sales tax based on Vanderbilt's sales tax exemption status.

1. **Projects Over $5M in Construction <u>must</u>** pursue Owner Purchase Orders. Typically, a project can expend up to 20% of the total construction cost in OPOs which, based on a construction cost of $5M, results in an approximate savings in the amount of ($5M * 20%) * 7% = $70,000. These projects would require contracts modified to indicate the amount of anticipated owner purchases so that this value can be deducted from the Contractor's PO and established as a separate line item in eBuilder. Per Vanderbilt construction agreements, contractors are assigned responsibility for the coordination of delivery and installation of all products purchased by OPO's. Invoice approval is also coordinated by the contractor. There are some instances, even with projects over $5M, where we may decide to not pursue certain OPOs. An example would be an OPO with a total value between $25K and $99K that anticipates having multiple invoices (i.e. invoice count greater than 15-20, as an example). The Construction Manager must work with PDC at the outset of a project to determine which OPOs should be considered.
2. **Projects Under $5M in Construction <u>may</u>** pursue Owner Purchase Orders based on the following criteria:
   a. An OPO with a total value of $100,000 or more ***should be*** pursued. This decision is to be evaluated prior to executing the contract with the Contractor.
   b. An OPO with a total value of $100,000 or less should **<u>not</u>** be pursued ***unless*** the order will involve ***ONLY*** one (1) invoice. This decision is to be evaluated prior to executing the contract with the Contractor.
3. **Renovation and Renewal Projects**, Owner Purchases are typically identified during bidding. Typically, there is not an AIA Contract associated with these projects and are of size that contractors will not have projects engineers or office support to process detailed paperwork. As such contractors do not review OPOs in "eBuilder" (Vanderbilt's Construction Project Management System). These OPO's are established as regular purchase orders and handled as part of the construction line item. The Contractor or Construction Manager (CM) is responsible for coordinating delivery and installation of products purchased by OPO's. Invoice approval is handled by the PM.

Contractor's Self-Performed Work

1. The Contractor may perform trade work with the Contractor's own forces or through a Related Party only if specifically approved in writing by the Owner after receipt of full written disclosure of the parties' relationship, the circumstances warranting the self-performance, a full breakdown of the proposed pricing and the results of competitive bidding.
2. The competitive bidding shall include written bid proposals from at least two (2) potential subcontractors preapproved by Owner, the Owner shall receive and open the proposals and the Contractor shall submit its written bid proposal at least twenty-four (24) hours before the bid deadline. Any agreement between the Contractor and a Related Party must be in writing and in accordance with the same terms and conditions as any other Subcontractor, Sub-subcontractor or Supplier. With respect to trade work performed by the Contractor's own forces, the details of such arrangement must be specified in the Agreement or incorporated into the Contract by Modification, and if performed on the basis of cost plus a fee, the cost of such work shall be subject to the "Cost of the Work" restrictions set forth in Article 16, specified labor and labor burden rates, and a guaranteed maximum cost.
3. The Contractor's self-performed work shall be paid on a direct material and personnel cost basis, plus labor burden, fee and overhead percentage. The Contractor's fee percentage and overhead percentage for self-performed work shall be the same as for the Cost of the Work.

Contractor's General Conditions Costs

Refer to the Planning, Design and Construction website, under Resources

DIVISION 1 – GENERAL REQUIREMENTS

The following shall be incorporated as part of the specifications, denoting requirements to contractors working on campus:

Work Restrictions/Use of the Premises

1. Many projects at Vanderbilt have restrictions that will affect construction operations. These include limited physical access to the project site; partial occupancy of buildings under construction; surrounding buildings that are in use; pedestrian and vehicle traffic near the project site; and other restrictions due to the nature of construction on a university campus.
2. Project specific instructions to the Contractor should be documented regarding restrictions of construction hours, noise restrictions, restrictions due to partial occupancy of a building or other restrictions, if any.
3. In general, normal construction hours can be observed on many projects however noisy construction work (including blasting, hydro-excavation, hydraulic demolition hammers, trucks with backup alarms, jackhammers, backhoes, line-drilling, etc.) near occupied residence halls cannot start before 9:00 AM. Normal construction activity may begin no earlier than 7:00AM.
4. Efforts must be explored to minimize all construction related noise, particularly when near residence halls and classrooms. Pure tone or "tonal" backup alarms shall not be used during the school year. Contractors shall use OSHA compliant backup alarms (most commonly called broadband or white noise backup alarms). It is also requested that Contractors create site logistics that minimize the need for mobile equipment to reverse, for example placing concrete wash-out pans in a location that allows trucks to drive up to and past them without going in reverse.

5. Contractors shall assume a minimum of 4 days per year when there shall be no construction activity. These dates involve Commencement, in mid-May, and Move-In in mid-August. Additional dates such as for Board of Trust meetings may be requested as non-work days if said construction is near the location where meetings or special events are being held.
6. Contractors shall also assume in construction areas near occupied residence halls a minimum of 20 days per year where additional restrictions would apply specifically during finals week and reading days. During these days it should be assumed that “noisy” construction work (including blasting, hydro-excavation, hydraulic demolition hammers, trucks with backup alarms, jackhammers, backhoes, line-drilling, etc.) shall take place.

Employee Conduct

Construction personnel are to adhere to the following:

1. Vanderbilt University is a smoke-free campus. Smoking is strictly prohibited.
2. At any time during construction of a project on Vanderbilt University property, if the conduct of any worker is judged by the Owner, Contractor, Architect or Engineer to be of nuisance to the Owner, or a worker be considered incompetent or detrimental to the work, the Contractor shall order such parties removed immediately from the grounds; whistling at and directing attention or related noises towards any campus occupant are grounds for such removal.
3. No dialogue is to occur between workers and campus occupants. Use of campus facilities (toilets, interior premises, etc) or grounds elements (benches, dumpsters, containers, etc) by construction related workers is prohibited unless terms are otherwise agreed upon.
4. All contractors shall have visible identification, including company clothing with logo.

Site Use Map

The Construction Manager shall provide a Site Use Map with area layout along with all necessary diagrams to delimit and locate staging for construction material storage, trailers, on-site contractor(s) parking with access and non-access routes noted, do-not-disturb areas, priority vegetation, topsoil storage, and any other site considerations. Project limits must be clearly designated on site plans. Plans are to be reviewed by PDC and other members of the Vanderbilt community including Traffic & Parking, Public Safety, VUMO, etc and then taken to the Facilities Review Committee for final approval. The Designer will review all items jointly with PDC and the Construction Manager. The finalized plan should be included in the Bid Documents for reference.

Protection to Streets, Walks, Lawns, Vegetation, Irrigation Systems, Etc.

Contract Documents must include Specifications that will ensure that access routes to and from the project, and the project premises are protected from mud, sand, stone, litter, and debris of any form, and that this protection be made the responsibility of the Contractor(s). All damage and temporary soiling of an area or misuse of property within, or exterior to, a construction site in variance with agreed upon terms shall be corrected time wise and to approximate the original condition to the satisfaction of Vanderbilt. Corrective measures that must be taken by outside parties at Vanderbilt's direction upon failure of Contractor(s) to make the mutually agreed upon corrections will be the financial responsibility of the Contractor(s).

Key/Card Access to Facilities

Building security is a high priority for Vanderbilt. Access to all buildings and grounds is to be coordinated in advance with PDC. Contact PDC to arrange for card reader or key access one week prior to requiring access.

Access to Buildings Housing Faculty/Students

1. Access into occupied faculty apartments or student rooms is strictly prohibited unless prior approval has been granted by PDC and Housing. This includes patios and balconies.
2. When access is authorized, all contractors shall exercise the highest level of professionalism and courtesy while on the premises.
3. Please ensure that your staff and subcontractors:
   a. Do not enter any unit without a valid purpose, and only after receiving permission from both PDC and Housing.
   b. When entry is approved: knock, announce yourself clearly, respect the resident's space, and complete your work with minimal disruption.
4. Failure to follow these guidelines may result in immediate removal from campus. We take faculty/student privacy and safety very seriously, and we expect all vendors to do the same.

Waste Disposal & Recycling

For all projects, contractors are responsible for handling all waste materials according to Vanderbilt's High-Performance and Resilient Infrastructure Design Guidelines. Refer to Appendix G.

Maintaining Daily Campus Activities

1. Care must be taken to maintain or to designate rerouting of primary pedestrian circulation pathways around the construction site.
2. Signage may be required to be added for directing pedestrians, vehicles and other personnel in and around the construction site. Contractor shall coordinate with PDC any signage required.
3. Anticipated impacts to the flow of pedestrians and vehicular activities should be brought forward to PDC a minimum of three weeks prior to impact so that notifications can be sent to the Vanderbilt community in advance and address any areas of concern.

Site Utility Protocol

Vanderbilt University strives to keep a 99% uptime of all utilities on campus. Unplanned construction outages are unacceptable. This protocol is intended to prevent unplanned outages for steam, chilled water, hot water, electrical, and IT systems on campus.

1. **Pre-Task Planning**
   a. The Contractor shall generate a plan that details the methods for excavation and construction that includes safety requirements for finding these utilities and exposing them. Additionally, the plan should include work scope, existing site conditions, site logistics, site safety, project plans and specifications, and quality controls.
   b. This plan must be submitted to PDC and VUMO one week before the pre-construction meeting. The Contractor shall perform a pre-construction meeting (preparatory meeting) on site with subcontractors and VUMO prior to the start of work, no less than 10 business days before the start of work.

2. **Utilities Notification**
   a. Contractors must notify Tennessee One Call before performing any earth moving operations including digging, trenching, boring, site demolition, excavation, backfilling, or grading in all public ways and private property.
   b. This notification must be made at least 72-hours (excluding weekends and holidays) prior to the work described above, but not more than 10 calendar days before commencement of the contemplated work and should be renewed every 10 calendar days while the work is ongoing. The toll-free number is 811 or 1-800-351-1111.

3. **Tracking Existing Utilities**
   a. Contractors are required to review changes in conditions on a daily basis and report new information, identify hazards, and communicate current planned activities. Any unforeseen conditions shall be reported immediately to PDC.
   b. During Weekly Progress Meetings, the Contractor shall provide updates on existing conditions, progress of planned work, and communicate and/or identify utilities that have been modified and/or abandoned.
   c. Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground, any wall surface requiring demolition or coring, any concrete slab on grade or paved surface where existing underground or hidden utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground or encased obstruction not indicated, or specified to be removed, that is indicated or discovered by TNOCS or during scanning using hydro-excavation methods before any other method of mechanical excavation is employed to avoid unplanned utility outages.

4. **Protecting Existing Utilities**
   a. Contractor shall perform work in such a manner, and with reasonable precautions taken to avoid damage to utilities under the surface in said areas of work. Immediately notify any known or suspected damage to underground utilities to the owner of such utilities.
   b. Prior to the start of excavation and/or trenching work the Contractor shall coordinate a pre-construction meeting with the subcontractor performing the work and PDC to review planned excavations and VU requirements for tree protection.
   c. Excavation adjacent to existing utilities must be performed with caution. Existing utilities shall be protected as required and hand excavation or hydro excavation must be utilized when new excavations or trenching encroach upon existing utilities that have been marked by underground locators.
   d. Existing utilities required to be relocated for the installation of new work shall be coordinated with the Contractor prior to installation of additional work.

5. **Document Control and Communication**
   a. When undocumented or unforeseen conditions arise the contractor shall notify the owner of the utility, the designer of record, and Vanderbilt PDC.
   b. The Contractor shall document the "issue" providing corresponding photos, drawing references, and documentation as required to request additional information from the designer of record. The report will be attached to a formal Request for Information (RFI) for review and response by the owner, designer, and construction team.

6. **Utility Relocation, Abandoned Utilities, and As-Built Conditions**
   a. Contractor will keep a working copy of construction as-built drawings. Subcontractors shall provide updated information on a weekly basis for new utility locations, changes in existing conditions, and identify utilities that have been modified and/or abandoned. The Contractor shall also make field observations and report as-built records or modify existing construction plans to reflect existing conditions.
   b. The Contractor will document changes in the underground utilities plans as work progresses and provide VU PDC and VUMO regular updates to coordinate with timely revisions to the VU GIS mapping drawings.
   c. 3D as-built drawings or models are required, tied to state plane coordinates, for all new and uncovered existing underground utilities.

Utility Outage Requests

1. Utility outages require a minimum of 10 business day notice and shall be entered through eBuilder by the Contractor requesting the outage, utilizing the Utility Outage Process. Contact PDC for assistance with this eBuilder process.

Hot Work Permit

1. A hot work permit for cutting and welding with portable gas on ARC equipment shall be filled out and submitted a minimum of two days before starting work.
2. At the time of any cutting and welding within existing buildings, the Contractor shall coordinate protection of shutdown of existing smoke detectors. An Outage Request will be required should the existing system be interrupted.
3. The Field Superintendent shall maintain these permits on file at the jobsite, confirm that the required procedures are followed and complete the checklist and final checkup, as outlined on the form.
4. Jobsites are subject to unannounced inspections by VU Safety representatives. Upon discovery of violations, they are empowered to temporarily close the jobsite until corrective measures are taken.
5. The form can be found on the Planning, Design and Construction website, under Resources or at FM Global Website at https://fmglobalpublic.hartehanks.com/AssetDisplay?acc=11FM&itemCode=F2630

Confined Space Access

1. Confined spaces are managed by the zone managers and the powerhouse manager. Access to many of them is by permit only.
2. Coordination for access to any confined space must be conducted 48-hours in advance. Several confined spaces require advanced rescue training and equipment. Access will not be granted without a completed permit which must include a communication and rescue plan. Some spaces are not accessible after storms or rain due to poor drainage, this should be factored into your access plan.
3. Contact VUMO and PDC for the confined space assessment and permit process.

Temporary Utilities

1. Most areas of the campus are served by Vanderbilt Utilities. However, in some areas, electrical power is only available from NES. When available at the project site, the Owner shall provide to the Contractor electrical power, telephone, steam, and chilled water at no cost to the Contractor. If not available from the Owner, the Contractor shall be responsible for obtaining these utilities from local providers. Costs for the temporary utilities necessary for the completion of the Work shall be a part of the Cost of Work to the extent that these charges are not provided for or directly billed to the Owner.
2. During frame construction and closing-in the building, the Contractor should include in construction cost; utilities for temporary electricity, heat, and water. It is the Contractor's responsibility to obtain the metered services from the appropriate utility company and pay all costs associated with these temporary services.
3. After the building is closed-in, it is generally in the best interest of the University to provide steam and electricity from the Central Plant and/or University substation if these are the permanent sources. Permanent metering acceptable to VUMO needs to be provided by the Contractor before connecting to the University's steam or electric system. Charges will be made for actual usage at current rates. VUMO staff will be responsible for reading the steam and/or electric meter. Payments will be coordinated through PDC.
4. Where a new project has a direct Nashville Electric Service (NES) permanent electrical service or a stand-alone heating system, the Contractor is responsible for all utility expenses until the Project is accepted for occupancy by Vanderbilt.

Smoking

1. Vanderbilt University is a smoke-free campus. Smoking is prohibited in all buildings on campus, including University residence halls and Greek chapter houses, and on the grounds of the campus with the exception of designated outdoor smoking areas.

Fencing, Barricades, and Pedestrian Safety

1. Any excavation, trenching deeper than 2 inches, open utility, etc., regardless of duration or depth that cannot reasonably be fenced must be posted at all times with blinking light barricades at all approaches.
2. Project fencing should consist of six (6) foot high chain link fences on driven metal posts. Care should be taken when driving metal posts as to not hit irrigation or other buried conduit. Underground utility locating company are required to define all underground utility locations.
3. Black Windscreens should be securely attached and maintained to prevent them from detaching or blowing into walkways.
4. Contractor shall apply, if requested, Vanderbilt provided banners on top of the Contractor provided black windscreens.
5. Perimeter fencing must be maintained and kept in good condition, and projections into the pedestrian path shall be avoided.
6. Fencing must not obstruct adjacent pedestrian walkways, including ensuring that fence bases or supports do not protrude into walking paths or create tripping hazards. When feasible, fencing should be anchored by driving poles into the ground rather than using weighted bases that extend into pedestrian areas.

7. A minimum clear width of 5 feet must be maintained for pedestrian walkways to ensure accessibility and accommodate two-way foot traffic. Where feasible, 6 feet is preferred in high-traffic areas. (note: this will likely be a challenge, so we might discuss this further)
8. Windscreens must be securely attached and maintained to prevent them from detaching or blowing into walkways.
9. Fence lines must be able to withstand a minimum of 200 lbs of lateral force.
10. Fencing and barriers must be inspected and secured in preparation for high-wind events.
11. Perimeter fencing near roadways must be reinforced with barriers to prevent vehicle collisions.
12. Water-filled barricades must be kept full, properly sealed, and in good condition.
13. Convex mirrors must be installed at blind corners or obstructed views to enhance safety for both pedestrians and vehicular traffic.
14. Any material used to protect walkways, must be properly installed and maintained to avoid creating slip, trip, or fall hazards. Material placed on the ground to protect pavers or roads must be slip resistant. Wood, if used to protect pavers, shall not be installed on a long term basis and should be pulled up at the end of the delivery period.
15. Where pedestrian routes are impacted, clear and visible detour signage must be installed to direct foot traffic safely around the construction area.
16. All temporary modifications to egress paths or accessibility features must be approved in advance by Built Environment Review Committee then forwarded for inclusion in GIS and website communications.
17. Projects within existing building that may affect egress shall ensure that proper signage and communication to building occupants is relayed with possible in person training. Routing plans shall be reviewed with VUPS, PDC and the AHJ. Whenever possible, means of egress should not be blocked.

Gates and Access Control

1. All gates must be locked at the end of each workday to prevent unauthorized access.
2. Gates must be monitored, when open at all times, or secured when attendants are not present.
3. Post visible signage at gate entrances with key emergency contact numbers.
4. A designated spotter is required whenever heavy machinery is operated near or across campus pathways to ensure safe maneuvering and pedestrian awareness. When necessary, Vanderbilt may require trucks traveling through pedestrian corridors be accompanied by the Contractor to ensure pedestrian safety.
5. Any fire safety system inside the site or obstructed by the site needs to have a sign marking the location (ex: FDC)
6. It is recommended that one site fence be secured with a lock with key/code access and one secured with a Knox padlock to allow access to the site for daily operations and emergencies.

Temporary Construction Fence Lighting

1. When fencing is installed adjacent to pedestrian paths, adequate temporary lighting—such as construction-grade caged string lights—must be provided to ensure safe passage during low-light conditions.
2. Maintain a minimum illumination level of 0.2 foot candles along the entire perimeter fencing to ensure visibility and security
3. The contractor shall also provide temporary power to lighting outside the project perimeter that is cut off due to construction.

4. Where street lighting is adequate, this requirement may be waived. Contractor shall walk the project perimeter with PDC to verify light levels and requirements.
5. If a fence hinders or otherwise obscures an emergency call box from access or view, consultation with OEM is required.

Emergency Response and Contact Information

1. Emergency signage must be posted inside the construction site and at all gate entrances. This must include:
   a. How to report emergencies (e.g., “For emergencies, call 911. For non-emergency situations, call (615) 322-2745.”
   b. Instructions for reporting utility strikes (e.g., “If a utility line is struck, contact BSC at 615-322-2621.”)
   c. Emergency contacts for the construction contractor (available 24/7).
2. Provide general contractors with information on AlertVU and VandySafe.
3. Promote calling 911 or VUPD Dispatch for emergency assistance
4. Contact information for large projects should be shared with Public Safety or stored in a place that VUPS can access.

Knox Boxes

1. Any existing knox box, located on a building to be demolished, shall be removed and turned over to Vanderbilt personnel.
2. For new buildings or buildings without a knox box, general contractors need to coordinate with VUPS and PDC to order a new knox box.
3. PDC will work with VUPS for key placement.

Dust Control

1. Dust control measures must be implemented to reduce airborne particles, especially near pedestrian paths, building air intakes, and occupied areas.
2. Methods may include water spraying, covering stockpiles, or using dust suppressants as appropriate.

Asbestos Abatement

1. Vanderbilt will handle the testing and abatement of existing asbestos from facilities as required to complete the proposed construction activity, unless otherwise agreed upon with the Contractor.

Submittal Review

1. At a minimum, VU must review and approve the following submittals:
   a. All fire protection system submittals
   b. All fire alarm system submittals
   c. All elevator submittals
   d. Commissioning Plan, Certificate of Readiness, and Commissioning Report submittals
   e. All mechanical system test reports, including TABS and controls or any industrial ventilation systems
   f. All major mechanical equipment
   g. All major electrical equipment including transformers, overhead transmission and distribution, and substations

h. All color selections
i. Any extensions of design, critical materials, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by VU

2. A full listing of submittals should be submitted to PDC to verify and confirm review requirements. In addition, the requirements for FM Global review should be followed as noted above.

Project Closeout

Successful Closeout of a major project requires close cooperation of the Designer, Contractor, and Vanderbilt University. It is the responsibility of the Designer to take a leading role in the process to ensure that appropriate requirements are included in the Contract Documents; that submittals and record documents are transmitted and organized.

1. The Designer and Contractor shall share responsibility for production of the following record documents:
   a. **As Built Drawings** – The Contractor shall be required to provide a set of “As Built” Contract Documents, in undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. The mark-up’s need to indicate new information which is recognized to be of importance to Vanderbilt University. Give particular attention to concealed work which would be difficult to measure and record at a later date. Note related change order numbers where applicable.
   b. **Record Drawings** – Record Set Deliverables shall be as indicated on the “Record Set Deliverable Requirements” document, dated April 2025. This document can be found on the Planning, Design and Construction website, under Resources.
   c. **Product Data Submittals** – Provide one pdf copy of each Shop Drawing and product data submittal and mark-up significant variations in actual work in comparison with submitted information. Shop drawings are to be organized and collated using standard CSI format.
   d. **Operating & Maintenance Manuals** - Provide organized and comprehensive digital Operating-and-Maintenance Manuals. Include emergency instructions, spare parts listing, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data and similar applicable information.
   e. **Training Sessions** - Training sessions shall be arranged with Vanderbilt personnel for each major system or piece of equipment in order to ensure operational efficiency and commitments to ongoing maintenance. Video recording of these training sessions shall be provided and stored within eBuilder.
   f. **Contact List** – Contractor shall provide a list of all subcontractors and associated contact information associated with any warranty related items.
   g. The manual shall include all warranties, bonds, final certificates, and other similar documents. Furnish an index which outlines all work covered by specific warranties identifying the item, the length of the warranty, and the contractor responsible for the warranty.
   h. For new buildings and major renovations, the Designer shall provide a Finishes Manual which outlines the brand name, manufacturer's number, color, and finishes for the building, such as carpeting, paint, wall finishes, ceilings, casework, light fixtures, hardware, etc. Sufficient information should be provided to serve as a reference source to order similar products for future renovations or replacements. This information will be stored within eBuilder.
   i. Facility Turnover Planning Meetings
   Meet with Vanderbilt stakeholders to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-

Construction Conference meeting with a discussion of the Facility Turnover process and convene at regularly scheduled turnover meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

i. Facility Turnover Checklist
   1. The Vanderbilt Construction Manager will provide the Contractor a copy of the Facility Turnover Checklist template.
   2. Prior to 75 percent completion, modify the Facility Turnover Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Facility Turnover Checklist to the Vanderbilt Construction Manager. Vanderbilt University may request additional activities be added to the Facility Turnover Checklist at any time, as necessary.

ii. Meetings
   1. Chair and lead regular Facility Turnover Meetings beginning at approximately 75 percent project completion, or three to six months prior to your Beneficial Occupancy Date (BOD), whichever comes first.
   2. The Vanderbilt Construction Manager will establish the frequency of the meetings, which is expected to increase as the project completion draws nearer.
   3. At the beginning, Facility Turnover Meetings may be every two weeks then increase to weekly towards the final month of the project.
   4. Using the Facility Turnover Checklist as a Plan of Action and Milestones and basis for discussion, review upcoming critical activities on your closeout schedule and identify strategies to ensure work is completed on time.
   5. Provide registers of all contract deliverables as defined in your contract specifications to include warranties beyond the standard 1 year warranty, spare parts, O&M's, and training, and ensure that these deliverables are submitted per the contract and discussed during the Facilities Turnover Meetings.
   6. During the Facility Turnover meetings discuss with the Vanderbilt Construction Manager any upcoming activities that require Vanderbilt University involvement.
   7. Maintain the Facility Turnover Checklist by documenting the actual completion dates as work is completed and update the Facility Turnover Checklist with revised planned completion dates as necessary to match progress.
   8. Distribute copies of the current Facility Turnover Checklist to attendees at each Facility Turnover Meeting, and distribute minutes following each meeting.The full requirements of the Record Set Deliverables can be found on the Planning, Design and Construction Resources, under Resources. This document lays out naming conventions and files types needed for document management by the Facilities Information Services department.

j. Final Cleanup

i. The Contractor shall, at the end of each contract and prior to final inspection, thoroughly clean the project, leaving interior spaces broom clean and exterior areas fine graded, clean and free of all debris, papers, discarded or broken glass, materials, tools and equipment. The Owner shall then coordinate with VUMO to conduct a final clean prior to occupancy.

Commissioning Agent (CxA)

1. Commissioning is a systematic process that helps ensure that all the Owner's needs are incorporated into a project's design and function.

2. The commissioning agent (CxA) is contracted directly by Vanderbilt to administer and oversee the commissioning process.
3. The commissioning process does not reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning facility.
4. The CxA firm must be independent from the project's design and construction team.
5. The intent of the CxA is to proactively support design and construction to provide Owner's requirements for the project without increasing construction schedule or costs.
6. The CxA should use the software CxAlloy or equivalent for all commissioning communication. Coordinate with VUMO's asset management team for requirement equipment identification and information.
7. The CxA should include building envelope commissioning unless otherwise approved by PDC and VUMO.
8. The CxA should start work no later than schematic design and provide enhanced commissioning throughout the project, including opposed season verification.
9. Other than enhanced commissioning, specific required items for Vanderbilt University include:
10. Facilitating the Owners Project Requirement (OPR) charettes with stakeholders and then preparing the OPR document
11. Facilitating in-depth controls review meeting during design and controls summit meeting during construction
12. Leading weekly commissioning readiness project meetings after 75% construction completion
13. Leading a post-project lessons learned meeting with stakeholders.
14. All commissioning procedures and functional tests should be complete before occupancy, with the exception of opposed season verification.
15. For projects involving laboratories, project shall comply with the commissioning requirements in Appendix C - Laboratory Safety Design Guidelines.

DIVISION 2 – EXISTING CONDITIONS

1. **Selective Site Demolition**
   a. Erect barriers, fences guard rails, enclosures, chutes, and shoring as required to protect structures and utilities remaining intact.
   b. Protect designated trees and plants from damage.
   c. Ensure minimum interference with roads, street, driveways, sidewalks and adjacent facilities. Any impacts or closures shall be coordinated with PDC 15 business days in advance and shall include presenting impacts to the Facility Review Committee. As part of closure, a plan should be provided indicating alternative routes around closure.
   d. Any debris shall be promptly removed.
   e. Do not store or burn materials on site.
   f. When blasting is required, the Contractor shall submit a blasting plan for full review and coordination with PDC a minimum 20 days in advance and shall not be done during specified quiet periods, as noted above.

DIVISION 3 – CONCRETE

1. **Concrete**
   a. All concrete slabs with floor drains shall have position slope to drain.
   b. See notes under division 32 for concrete walks and paving for information on exposed aggregate or sandblasted finish concrete walks and paving.

c. See notes under division 9 for finishes for information on mechanical room floor finishes.

DIVISION 4 – MASONRY

1. Masonry

a. Vanderbilt will participate in the selection and approval of all exterior masonry finishes.
   i. Mock-Up Panels
      1. Mock-up panels of all masonry used on the exterior of a project shall be specified. Exact requirements are a function of the project size and shall be reviewed with PDC. Mock-up panels should include all elements of the wall including flashing, mortar net, caulking, weeps, thermal insulation, damp-proofing or weather barrier. Mock-up panels should be built in the same location as the project, so site conditions are mimicked.

b. Unit Masonry
   1. PDC shall review and approve the color of all caulking used on horizontal and vertical joints in the masonry. Generally vertical joints should match the masonry, and horizontal joints should match the mortar.
   2. Dry cutting of masonry units is prohibited. A wet saw is to be used in designated areas only. Confirm location with PDC before any and all cutting.

c. Mortar
   1. While a buff-colored mortar is generally used, the exact color depends on the brick or stone used. The designer shall review and receive approval or proposed brick/stone color AND mortar color through PDC.

DIVISION 5 – METALS

1. Metals

a. All exposed exterior masonry lintels must be galvanized. Except at exterior exposed lintels in masonry partitions the use of galvanized metal that must be painted on the exterior of the building is not recommended. If galvanized metal is used it must be properly prepared to receive paint.

b. Exterior steel handrails, guardrails, ladders and stanchion posts must be primed with two coats of a rust inhibiting primer before receiving the first color coat. The primer should be specified to be one that is recommended by the manufacturer of the finish coat. Specify that the entire length of the stanchion post, including that part to be anchored in substrate, must be primed and painted with two color finish coats prior to installation.

c. All rails at sidewalks and at stairs shall be steel and painted black, unless otherwise approved by PDC.

d. Exterior steel stanchion posts that support handrails and guardrails must be anchored so that they do not crack or split the material into which they are set. When steel stanchion posts are grouted into concrete, stone or masonry, there shall be a minimum of ½” of exterior expansion joint sealant covering the grouted anchor attachment. Sealant shall be installed to completely cover the grout and provide positive drainage away from the stanchion post stems. Standing water adjacent to stanchion posts is not acceptable.

e. Tie-offs for maintenance and window washing shall be provided as needed, based on design.

DIVISION 6 – WOOD AND PLASTIC

1. Finish Carpentry

a. All materials in this section shall be “Premium Grade” unless otherwise instructed by PDC.
b. The use of redwood should be avoided.
c. The use of particle board shelving should be avoided.
d. Only “Heavy Duty” brackets and supports should be specified for wood shelving. Shelving shall be ¾ inch minimum thick with support spacing a minimum of 2’-0” on center.
e. Base cabinets below sinks in labs, kitchens, bathrooms, laundries, etc. shall be constructed of marine grade plywood. Adjacent cabinets may be constructed of exterior grade plywood, but particle board and MDF are not acceptable in base cabinets in any “wet” room location.
f. Wood or metal blocking is required to be installed between studs for shelving, upper cabinets, etc. where loading of the shelf or cabinet is a concern.

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

1. Roofing

a. Membrane roofing shall be a fully adhered/fleece back system with a minimum system thickness of 300mils.
b. Loose laid membrane roofing and ballasted roofing are not allowed.
c. Metal roofing shall be standing seam, copper, stainless steel or aluminum.
d. A 30-year warranty is required for all new roofs.
e. An inspection of the roof by the roof manufacturer is required for all roofing installations.
c. Refer to FM Global requirements for all roofing materials and installations.
d. Walk pads are required on flat roofs and should extend from the point of roof access to and around any and all mechanical equipment that needs to be serviced.
e. Projects with steeply sloped roofs or low roof areas containing service equipment, will need to provide a permanent means for maintenance personnel to tie off to safely maintain the building.
f. Provide consideration of permanent fall protection through the use of parapets, guardrail systems, or other fall protection anchor points to facilitate roof access and maintenance.

2. Flashing and Sheet Metal

a. Stainless steel is the preferred flashing material. Other flashing materials such as copper, copper fabric and self-adhered bitumen may also be utilized.
b. Ice and water shield should be used in strategic areas as an underlayment.
c. Provide end dams at all window openings. All joints in metal shall have either mitered joints or shall be properly lapped and sealed or soldered at inside and outside corners.

DIVISION 8 – OPENINGS

1. Doors and Door Hardware

a. Door Standards
   i. In general, all interior doors shall be solid core wood, faced in wood veneer to match any adjacent existing doors to remain.
   ii. No plastic faced doors shall be used without review and approval by PDC.
   iii. Aluminum or aluminum and glass doors are preferred for exterior building entries, unless otherwise discussed as part of the design review with PDC.
   iv. Wood doors for exterior building entries should be mahogany, or white oak. The designer should specify two coats of alkyd-based primer prior to two finish coats on all exterior wood doors.

v. Painted hollow metal doors are preferred for minor building entrances and service entrances.

b. Hardware Standards:
   i. Mortise locksets to be Yale (Accentra) 8800 Series or Best Manufacturing 45 Series
   ii. Cylindrical locksets to be Sargent 10 Line Series or Best Manufacturing 9K Series
   iii. Door Closers to be LCN 4040XP Series. Any floor mounted closers or operators are not recommended.
   iv. Exit Devices to be Von Duprin 99 Series for HM or wood doors, or 33 Series for Aluminum Storefront
   v. On doors below 8' in height, 4 HW ball bearing hinges are to be used. On doors 8' and higher, 5 HW ball bearing hinges (or more) are to be used.
   vi. Where automatic door operators are used, install a doorstop to keep stress off of the operator when someone is leaning on it. Additionally, locate door stop in such a manner that it is not a tripping hazard and does not interfere with the normal cycling of the door operator.
   vii. Finish should be 26D unless otherwise approved by PDC.
   viii. Thresholds shall not protrude in such a way that a tripping hazard is present.

c. Keys and Keying
   1. Provide keyed brass construction cores and keys during the construction period at all exterior and interior doors.
   2. Construction control and operating keys and cores shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying section. Permanent cores and keys (prepared in accordance with the Owner Provided Keying Schedule) will be provided to the VUMO Key Shop for final installation.
   3. Prior to finalization of the hardware submittal, a meeting should be arranged with the Architect, Owner (including PDC, VU Card Services, VUMO Key Shop) and Hardware Supplier to ensure locksets and locking hardware are functionally correct and keying and programming complies with these guidelines.
   4. Key Schedule: For both renovation and new construction, the VUMO Key Shop shall work with PDC and the user to establish the Keying Schedule and shall be responsible for how a building is keyed and maintained.
   5. The initial installation of temporary cores in new construction and major renovations will be managed by the Contractor.

2. Access Control Hardware

a. Electromechanical locks and latch retraction exit devices are preferred over electrified solenoid trim, electric strike, or mag lock.

b. Electrified Hardware Coordination Conference:
   i. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware, including card readers, and associated wiring with Vanderbilt Key Shop, Card Office, PDC, VUPS, electrical subcontractor, doors and frames subcontractor, and other related suppliers.
   ii. Confirm all required wire sizes for electrical components.
   iii. Wire size for electric latch retraction panic devices (QEL) to be minimum 18 AWG stranded copper wire.
   iv. Other wire sizes as required by voltage, load and wire run distance.

c. Cable and Connectors:
   i. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
   ii. Provide minimum 18 AWG wire for latch retraction exit devices, from device to power supply.
   iii. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
   iv. Provide through-door wire harness for each electric power transfer for connection to power supplies.
   v. Specify only electric power transfer devices equal to Von Duprin EPT. Do not specify electric thru-wire hinges.
d. Electric Power Transfer
   i. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
   ii. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.
   iii. Thru-wire type hinges are prohibited for transfer of wire from door to frame.
   iv. Provide quick connect option with wire harnesses for all wiring between device and power supply.
   v. Provide door and frame preps for electrified hardware components that includes space to accommodate extra harness length for component servicing purposes.
e. Vanderbilt has invested in the CBORD access solutions across campus and utilizes HID card readers. Verify with PDC that the card readers and power supply will be Owner Furnished and Contractor installed devices.

DIVISION 9 – FINISHES

1. Drywall

a. In all residence halls, use National Gypsum Abuse Resistant Board or approved equal in all demising walls between student rooms and corridor walls with sound insulation in the cavity.
b. Sound Attenuation: In walls between residential rooms, use sound-attenuating insulation with staggered stud construction and/or resilient channel with Type X gypsum board achieving a minimum STC 40.
c. Moisture-Resistant Board: Use moisture-resistant gypsum board (e.g., green board or mold-resistant purple board) in restrooms, janitor closets, and other areas with high humidity.
d. Impact-Resistant Backing: In high-traffic corridors, especially in student-accessible areas, consider a layer of plywood behind the gypsum board for added impact resistance.
e. Fire Rating: Clearly indicate required fire-rated assemblies and ensure Type X or equivalent gypsum board is used as needed per code requirements.

2. Flooring

a. When carpet is specified, carpet tiles are preferred over broadloom.
b. Durability & Maintenance - Specify commercial-grade flooring suitable for high traffic use in hallways, lounges, and common areas.
c. Use moisture-barrier underlayment where flooring is installed over concrete slabs-on-grade

d. Slip Resistance: Flooring in entry vestibules and near building exits should be a minimum COF of 0.6 wet
e. Transition Strips: Use ADA-compliant transition strips between flooring types and ensure transitions are flush wherever possible.
f. Within housing restrooms utilize a Resinous Systems similar to Sherwin-Williams HPF, Resuflor Deco Quartz DB23 or equal.

3. Mechanical Room Floors

a. All Mechanical Room floors shall be Dexotex, epoxy or approved equal to achieve a waterproof seal and extend sealant up curb face.
b. Slope to Drain: Floors in mechanical rooms must be sloped to floor drains to prevent pooling.

4. Ceilings

a. If Acoustic Ceiling Tile (ACT) is used, 2' x 2' is preferred. Use 15/16" grid, 9/16" grid is not acceptable.
b. Designer shall coordinate the location of above-ceiling equipment. Above ceiling equipment shall be located above lay-in ceiling wherever possible. Any equipment located above gypsum board ceilings must be reviewed and approved by PDC and be provided with access panels.
c. Designer shall pay close attention to serviceable equipment located above acoustical ceilings and shall limit the use of "specialty ceilings" in these locations due to continued maintenance. Ceilings requiring special clips or other hardware for access to above ceilings are not allowed where serviceable equipment is located.
d. Access Panels: Label all access panels on reflected ceiling plans (RCPs) and ensure they are flush-mounted and lockable where needed.
e. Noise Control: Consider using acoustical ceiling panels with a Noise Reduction Coefficient (NRC) ≥ 0.70 in learning environments or lounges.

5. Painting

a. Finish Selection:
    i. Use eggshell or semi-gloss finishes in high-touch areas like corridors, stairwells, and lounges for cleanability.
    ii. Wall Preparation: Ensure all surfaces are properly primed and sanded. Provide Level 5 finish for gypsum board walls in critical lighting conditions, high-visibility areas, or areas to received wallcovering or graphics.
        1. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work, where exposed in equipment rooms:
            a. Equipment, including panelboards
            b. Uninsulated metal piping
            c. Uninsulated plastic piping
            d. Pipe hangers and supports
            e. Metal conduit
            f. Plastic conduit
            g. Tanks that do not have factory-applied final finishes
            h. Duct, equipment, and pipe insulation have a cotton or canvas insulation covering or other paintable jacket material
        2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards
b. Uninsulated metal piping
c. Uninsulated plastic piping
d. Pipe hangers and supports
e. Metal conduit
f. Plastic conduit
g. Tanks that do not have factory-applied final finishes
h. Duct, equipment, and pipe insulation have a cotton or canvas insulation covering or other paintable jacket material

3. Paint portions (up to 12") of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces flat black.

DIVISION 10 – Specialties

1. Marker Boards

a. All marker boards shall be either porcelain steel with aluminum trim or glass.
b. Approved Manufacturers
   i. Ghent
   ii. Claridge
   iii. Clarus
   iv. Or approved equal

2. Projection Screens

a. In the case of Front Projection arrangements, glass bead viewing surface should not be specified; fiberglass matt white is preferred.
b. Acceptable brands are Da-Lite, Draper, or an approved equal.
c. Automatic projection screens are preferred. Only use manually operated screens with specific authorization of PDC.
d. Consider tensioned projection screens in classrooms that seat more than 35 students.

3. Toilet Partitions

a. Toilet partitions should be solid phenolic, powder coated steel of HDPE (High Density Polyethylene)
b. Partitions shall be floor mounted with wall bracing.
c. All accessories shall be stainless steel.
d. A minimum of three (3) wall mount brackets, fastened to wall blocking, per panel, should be specified.
e. Features shall include scratch and graffiti resistance, and adjustable legs for uneven floors.

4. Accessories

a. Vanderbilt provides toilet paper, paper towel and soap dispenses. Cutsheets of selected products will be provided to the design team for coordination purposes. Below are the current selections.

Product Type	Dispenser Type	Finish			GOJO Model #
Hand Soap	Electronic - Wall Mount	Graphite			ES8 - SOAP
Hand Sanitizer	Electronic - Stand Mount/Wall Mount	Graphite			ES8 - SANITIZER
Shower Soap	Manual - Wall Mount	Faux Stainless			FMX-20

Product Type	Dispenser Type	Finish		Scott Pro Model #	Req'd Dispenser Module	Optional AC Adapter (1 per Dispenser)	Optional 24V Transformer
Tissue	2-Roll, SRB, Manual	Stainless Steel		09606	NA	NA	NA
Tissue	2-Roll, SRB, Manual	Black		09604	NA	NA	NA
Tissue	4-Roll, SRB, Manual	Black		44518	NA	NA	NA
Tissue	1-Roll + Stub, Jr. Jumbo, Manual	Stainless Steel		09601	NA	NA	NA
Tissue	1-Roll + Stub, Jr. Jumbo, Manual	Black		09602	NA	NA	NA
Towel	Roll Towel,Surface-mount, Electronic	Black		34348	NA	51224	53736
Towel	Roll Towel, Recessed, Electronic	Stainless Steel		31501	34359	51224	53736
Towel	Roll Towel, Recessed w/ trim, Electronic	Stainless Steel		43823	34359	51224	53736
Towel	Roll Towel,Surface-mount, Electronic	Black Mosaic		58720	NA	NA	NA
Tissue	2-Roll, SRB, Manual	Black Mosaic		58722	NA	NA	NA
Tissue	2-Roll, SRB, Manual	Black Mosaic		58721	NA	NA	NA
Tissue	4-Roll, SRB, Manual	Black Mosaic		58723	NA	NA	NA

b. Vanderbilt provides trash cans and recycling containers. Cutsheets of selected products will be provided to the design team for coordination purposes in built in cabinetry, under counters, etc.
c. Mirrors (min 24" x 36") shall be provided with shatterproof safety glass. Mounting shall include secure, tamper proof hardware.
d. In wall trash receptacles should be avoided.
e. Coat Hooks should be specified and installed at each toilet stall and at each single use restroom.

f. For Housekeeping Closets, a floor mounted sink with check valves on hot and cold water shall be provided with FRP board mounted on all sides to a height of 5'-0" a.f.f. Heavy duty shelving (minimum 2 – 18" deep) and brackets capable of holding paper and chemicals should also be provided in addition to mop rack with hooks mounted above floor sink. Closets should be a minimum of 4'x6' with outswinging door.
g. Space for a cleaning cart shall be provided in each housekeeping closet.

DIVISION 11 – EQUIPMENT

1. **Vehicle and Pedestrian Equipment**
   a. Refer to Appendix B – Campus Landscape Design Standards for bollard selection
   b. Technology Integration
   c. In coordination with Vanderbilt's IT and Card Access teams, ensure equipment such as parking gates has been provided the appropriate power/data

2. **Food Service Equipment**
   a. In coordination with VUIT, ensure food service equipment requiring data connection (e.g., interactive menus, mobile order enabled coffee makers) has been provided the appropriate data wiring
   b. Ensure food service equipment has the appropriate power, domestic water, and drain connections.

3. **Laboratory Equipment**
   a. Refer to Exhibit C - Vanderbilt Laboratory Safety Design Guidelines

4. **Athletic and Recreational Equipment**
   a. In coordination with VUIT and VUMO, ensure athletic equipment requiring data connection has been provided the appropriate power/data wiring.

5. **Equipment Finish Coordination**
   a. Equipment finishes must be coordinated with architectural finishes (e.g., wall coverings, exterior façade) for cohesion and durability.

6. **Equipment Procurement**
   a. Before preparation of Contract Documents, the Designer shall verify with PDC which equipment VU wishes to purchase directly and which equipment shall be provided by the Contractor. All equipment provided by the Contractor shall be incorporated in the Designer's Contract Documents. Unless specifically directed by PDC, the Designer shall incorporate the following equipment in the Contract Documents, to be provided by the contractor:
      i. Equipment that requires MEP Coordination
      ii. Built-in appliances (e.g., microwaves, refrigerators in breakrooms if fixed or integrated)Commercial kitchen equipment (if part of a full build-out, especially in hospitality or healthcare)
      iii. Lab or medical gas systems (fixed lab or healthcare equipment)
      iv. Built-in AV infrastructure (racks, wall speakers, projector mounts—though equipment itself may be Owner-furnished)

v. AED's, fire extinguishers, and sharps disposal container locations and mapping shall be coordinated with VUPS and PDC.

b. All equipment needed for the project shall be designed by the Architect and services as noted provided for proper operation.
c. A responsibility matrix for equipment denoting which items are Contractor or Owner provided should be developed and noted whether the item is Contractor or Owner installed. This matrix should be reviewed during design to confirm responsibilities.

DIVISION 12 – FURNISHINGS

1. Furnishings

a. Interior Designers should review the entire section.
b. For Early Coordination & Project Timeline Integration
   i. Designer shall develop a furniture procurement and installation schedule coordinated with the project's critical path timeline.
   ii. Lead times for furniture procurement, especially for custom or imported items, must be clearly identified and communicated to the VU Interior Designer.
c. ADA and Accessibility Compliance
   i. All furniture layouts and specifications must comply with ADA and other applicable accessibility codes. Designer must confirm clearances and reach ranges in furniture layout plans.
d. Technology Integration
   i. In coordination with Vanderbilt's IT and AV teams, furniture layouts must support integration of power/data needs in conference rooms, workstations, and study areas.
   ii. Include furniture specifications that accommodate technology infrastructure (e.g., grommets, cable management, monitor arms).
e. Coordination with Building Systems
   i. Ensure coordination of furniture placement with HVAC, lighting, sprinkler systems, and fire alarm devices.
f. Finish Coordination
   i. Furniture finishes must be coordinated with architectural interior finishes (e.g., flooring, wall coverings) for design cohesion and durability.
g. Contract Documents - FF&E
   i. Before preparation of Contract Documents, the Designer shall verify with the VU Interior Designer which furnishings Vanderbilt wishes to purchase directly and which furnishings shall be provided by the Contractor. All furnishings provided by the Contractor shall be incorporated in the Designer's Contract Documents. Unless specifically directed otherwise by the VU Interior Designer, the Designer shall incorporate the following furnishings in the Contract Documents, to be provided by Contractor:
   ii. Fixed Furnishings and Fixtures
      1. Millwork (custom casework, built-in cabinetry, reception desks)
      2. Laboratory casework and countertops
      3. Fixed seating (e.g., auditorium or lecture hall seating, jury box seating)
      4. Window treatments (manual or motorized blinds/shades)
      5. Built-in benches or banquettes
      6. Wall-mounted furniture (e.g., fold-down tables, shelving attached to walls)
      7. Toilet partitions and accessories (though often considered Division 10, they can overlap with FF&E)

8. Lockers and cubbies
9. Chalkboards, whiteboards, tackboards (if fixed/mounted)

iii. Specialty Items Installed During Construction
1. Operable partitions
2. Demountable wall systems (sometimes)
3. Interior signage and wayfinding systems
4. Display cases and exhibit panels

h. Selection
i. Before preparing proprietary specifications, the Designer will consult with the VU Interior Designer to determine whether Vanderbilt wishes to bid furniture among manufacturers, local suppliers or work with a selected vendor.
ii. During preparation of Drawings and Specifications, Designer will consult with the VU Interior Designer to determine which proprietary furnishings are preferable in terms of:
1. Quality
2. Price
3. Sustainability metrics
4. Service
5. Lead Time
6. Durability and Warranty
a. Specify products with a minimum of a 10-year commercial-use warranty where feasible.
b. Emphasize durability, especially in high-use or public areas, including resistance to impact, stains, and moisture.
7. Standardization and Modularity
a. Where appropriate, recommend furniture systems that allow for modularity and reconfiguration to support long-term flexibility.

iii. If requested by PDC, the Designer will provide manufacturers' literature to be reviewed by Vanderbilt. Vanderbilt will be given an opportunity to review Designer's drawings and specifications before such documents are finalized by the Designer. Designer should carefully consider probable necessary lead time to allow ample time for review and revision.
iv. Custom-made furnishing shall be detailed and specified by the Designer in such a way that it can be competitively bid.
v. Where floor rises stepwise, i.e., when specifying auditorium, fixed classroom or stadium seating, the Designer shall specify riser mounted seating.

i. Procurement & Request for Proposal (RFP) Process
i. Designers who are contracted by Vanderbilt to provide interior design services should expect that Vanderbilt will purchase fixed and moveable furniture directly. The Designer will prepare a layout plan with tagged furniture that corresponds with schedule of furniture specified. The Designer will prepare complete specifications for all furnishings noting preferred model numbers and selected finishes. Vanderbilt will utilize the Designer’s drawings and specifications, along with an Owner-issued Request for Proposal (RFP), to solicit bids from furniture manufacturers or vendors. The RFP, issued by the Purchasing Department, will contain instructions to bidders, liquidated damages clause (if applicable), and general conditions. The Designer will participate in the review of bids. The Designer will be expected to advise PDC and VU Interior Designer regarding negotiations with the successful bidder(s). The Designer will not negotiate directly with bidders.

j. Installation
   i. The Designer will undertake all submittal and shop drawing review of custom-made furnishings and any other furnishings provided by the Contractor.
   ii. When fixed furnishings are specified, the Designer will inspect rough-in requirements and installation of fixed furnishings.
   iii. The Designer will inspect moveable furnishings upon delivery.
   iv. The Designer will provide Vanderbilt with written verification of field inspection of furnishings and compliance of furnishings with Drawings and Specifications. If defects or non-compliance are discovered, Designer will notify the VU Interior Designer in writing of such defects or non-compliance. Written verification of inspection must be provided prior to completion of final punch list.
   v. Delivery Coordination - Designer must coordinate with the VU Interior Designer to ensure furniture deliveries align with building access logistics and do not interfere with construction activities.

k. Punch List and Deficiency Resolution
   i. Walk the space immediately after furniture installation.
   ii. Verify that all specified items have been delivered and placed correctly according to the furniture plan.
   iii. Examine each item for visible damage (scratches, dents, tears, broken parts).
   iv. Verify finishes and fabrics match the approved submittals.
   v. Ensure all furniture has been properly assembled and moving parts are operable.
   vi. Confirm alignment and spacing of modular systems, seating rows, or groupings.
   vii. Prepare a written punch list of missing, damaged, or incorrectly installed items.
   viii. Include photographs where applicable and reference tag numbers or item codes.
   ix. Submit the punch list to the PDC, VU Interior Designer, and vendor promptly.
   x. Verify that all punch list items are resolved in accordance with specifications and provide Vanderbilt with written confirmation that all furnishings are compliant with the approved

l. All upholstered seating furniture must comply with:
   i. CAL TB 117-2013: All fabric coverings, fillings, and barrier materials must pass the smolder resistance test specified in California Technical Bulletin 117-2013.
   ii. Each item must bear a manufacturer's tag or permanent label showing the compliance standard.
   iii. Furniture shall not incorporate untreated polyurethane foam or other high-flammability materials unless fully encapsulated in compliant barrier or upholstery fabrics.
   iv. Outdoor furniture used indoors must comply with indoor fire safety standards.
   v. All custom, reupholstered, or donated furniture must meet the same fire safety testing criteria
   vi. The University's Built Environment, Environmental Health & Safety, or Public Safety teams reserve the right to inspect and remove non-compliant furnishing drawings and specifications.

2. Window Treatments

a. The A/E will review all window treatments (shades or blinds) selections with PDC.
b. Window blinds should be 1" aluminum Bali, Levelor, Hunter-Douglas or approved equal. The standard color used for buildings on campus is Levelor "Alabaster" #112. Additional colors include bronze and white. Designers wishing to use another color will secure authorization to do so from PDC.

c. Motorized and non-motorized window shades should be Mecho, Draper and Lutron or approved equal.

DIVISION 14 – CONVEYING EQUIPMENT

1. Elevators

a. To keep University elevator equipment in a peak operating environment, all new and renovated elevators shall have air conditioning and humidity controls in the control cabinets or equipment rooms. Shaft ways exposed to exterior environment (i.e. parking garages) shall be provided with humidity control to prevent water condensation on rails and operating mechanisms. The spaces shall maintain a temperature range between 68 to 84 degrees Fahrenheit year-round.

b. Double jack elevators are not allowed.

c. HVAC systems for elevator equipment shall be connected to the existing building utilities where available. HVAC equipment shall be integrated into the building automation system (BAS) for monitoring.

d. In order to properly maintain elevators on campus, it is preferred that 3rd Party Non-OEM manufacturers and components be specified as follows:

i. Hydraulic Controllers:
   1. Motion Control Engineering (MCE)
   2. Elevator Controls – Pixel
   3. GAL – GALaxy
   4. Smartrise Engineering
   5. Or approved equal

ii. Traction Controllers:
   1. Motion Control Engineering (MCE)
   2. Elevator Controls – Pixel
   3. GAL – GALaxy
   4. Or approved equal

iii. Traction Machine:
   1. Hollister-Whitney
   2. Imperial
   3. Torin Drive
   4. Or approved equal

iv. Passenger Elevator Door Equipment:
   1. GAL – MOVFR or MOVFE
   2. Or approved equal

v. Signal Fixtures:
   1. Innovation Industries
   2. Or approved equal

vi. Cab Interiors:
   1. Elevations South
   2. SnapCab
   3. Eklund's
   4. Gunderlin, Ltd.
   5. Globe Architectural and Metal

vii. Entrances:

1. Columbia
2. Hauenstein & Burmeister

DIVISION 21 – FIRE SUPPRESSION

1. Fire Suppression

a. Designer shall follow all requirements set within the Code and to meet FM Global.
b. All piping shall be Schedule 40.

DIVISION 22 – PLUMBING

1. Drains, Backflows and Shut Off Valves

a. All mechanical rooms shall have a floor drain with floor sloped to drain. All equipment requiring drains shall be conveniently located drawings.
b. All mechanical rooms shall have a hose bib installed and accessible within the room.
c. All floor drains installed below the invert of site gravity drain piping shall have backwater valves.
d. A floor drain shall be installed for each water heater. Water heaters installed outside dedicated mechanical spaces shall be set in a 4” deep drain pan with piped drain. Locate floor drains close to equipment so that horizontal drainpipes to the floor drain are limited to maintain serviceability.
e. Sump pumps and lift stations shall be avoided if possible. When they are absolutely required, duplex systems should be installed with alarms reporting to the building automation system.
f. Duplex backflow preventers shall be installed inside all buildings on domestic water. Acceptable backflow preventer manufacturers are Wilkins (preferred) and Watts. Always install pressure reducing valves upstream of the reduced pressure backflow preventers.
g. Each project must provide a valve tag list/chart that shows number, location, service and normal position. Coordinate with VUMO for tag requirements.
h. All building shut off valves shall have a 4”x6” red valve tag stating building shut off.
i. All water hammer arrestors must be reasonably accessible.
j. Domestic water systems shall have Cold Water, Hot Water, and Hot Water Return shutoff at each floor. Review location with PDC and VUMO. Typically, these shut offs are located near the restroom or closet served. These valves need to be fully accessible and should not be located in a janitor closet.
k. All piping shall be identified by type and flow pattern.
l. Domestic water systems shall have a shutoff valve serving all external hose bibs and external fixtures.

2. Domestic Water Piping

a. Water supply piping must be copper or stainless. Waste piping stacks must be cast iron. Solid core PVC piping is allowed when approved through the Design Variance Process. Double wye type fittings are preferred in back to back bathrooms. If double cross or figure 5 fittings are used, provide a vent cleanout that goes through the finish surface.
b. For cross-linked polyethylene to be considered as an alternate, the number of fittings must be minimized. Also, fittings must have the same inside diameter opening as pipe. PDC and VUMO need to approve the alternate.
c. Any fixtures served by horizontal piping arms must connect to the vertical main with combination fittings.

d. For 2” and smaller, use bronze ball valve rated for bubble tight shutoff at 600 psid, with chrome plated ball and Teflon seats.
e. For 2” and smaller, sweated connections are acceptable. For anything larger than 2” threaded connected as required.
f. Install all valves so the valve handle points in the direction of flow when open and in horizontal runs the valve handle shall point straight down when closed.
g. Locate valves in accessible locations, and in corridors, if possible.
h. Polyethylene tubing with push-to-connect and/or compression fittings is not allowed for connecting coffee makers, ice makers, drinking fountains and other small appliances. Copper tubing shall be used.

3. Plumbing Insulation

a. At pipe hangers, use insulation that will not deform under the hanger load.
b. Insulate all domestic water piping and equipment.

4. Plumbing Equipment

a. Any building served by central heating hot water or steam requiring more than 5,000 watts of domestic hot water capacity should use heat exchangers to produce domestic hot water. Redundant heat exchangers should be installed.
b. Steam-fired water heaters should be semi-instantaneous type with electronic controls; connected to the Building Management System and be rated for 125 psig steam.

5. Plumbing Fixtures

a. Plumbing fixtures should be low flow.
b. Acceptable plumbing manufacturers for toilet, lavatory, and urinal china are Kohler and American Standard.
c. Acceptable plumbing manufacturers for automatic, touchless, hand wash lavatory faucets are Technical Concepts, Zurn, and Toto.
d. Acceptable plumbing manufacturers for breakroom sinks are Delta (preferred) or Zurn.
e. Acceptable plumbing manufacturers for kitchen sinks are T&S Brass (preferred) or Chicago.
f. Acceptable plumbing manufacturers for mop sinks are T&S Brass (preferred) or Chicago.
g. Acceptable plumbing manufacturers for laboratory sinks are T&S Brass (preferred) or Chicago.
h. Acceptable plumbing manufacturers for flush valves are Sloan and Zurn.
i. Acceptable plumbing manufacturers for shower valves are Symmons (preferred), Delta, and T&S Brass.
j. Toilets shall be wall mounted with elongated bowl and battery operated flush valves. Only toilets within single use restrooms may utilize a floor mounted toilet. Flush volume should be 1.28 GPF (gallons per flush). Features should include anti-overflow design, vandal resistant flush valve cover and tamper resistant mounting hardware. Tank type toilets are only permittable with an approved Design Variance.
k. Urinals shall be wall-hung with floor mounted carriers for support. Flush volume should be less than or equal to .5 GPF (gallons per flush). Features should include integral splash guard, integral trap seal to reduce odors, vandal-resistant drain covers and vandal proof mounting.
l. Sinks/Basins shall be wall mounted or drop in and are to have automatic faucets (battery operated) and strainer drain fittings. Material may be vitreous china with anti-microbial glaze,

porcelain enamel, stainless steel or solid surface composite. Basin shall be deep bowl with anti-splash edge.

m. Battery-powered automatic flush valves and faucets are preferred.
n. Faucets shall have a flow rate less than or equal to .5 GPM (areated) with integrated thermostatic mixing valve (TMV).
o. Washout-type water closets and urinals are preferred; the blow-out types are never to be used in back to back gang arrangements. Public water closet seats shall have open fronts, no top and check-stop hinges.
p. Shower fittings must be institutional quality with single-lever temperature regulated faucets and fixed adjustable spray nozzles.
q. Floor drains shall be constructed of cast-iron. Strainer tops in finished pedestrian traffic areas shall be bronze or nickel; those exposed to vehicular traffic or in mechanical rooms shall be cast-iron. Drains which receive piped effluent from mechanical spaces shall have 8" square, recessed tops.
r. Shower drains must be minimum 2". Shower drain covers must have grid/grate; hidden shower drains are not allowed.
s. Drinking fountain selection shall include a water bottle filler option with filter for new fountains or conversion kit for existing fountains similar to Elkay EZ H2 Bottle Filling Station. All bottle fillers must go to drain.
t. Plumbing fixtures which are wall hung shall be installed with the manufactured wall carriers. All wall carriers must be accessible.
u. Where floor or roof drains are installed, the floor or deck is to be sloped towards the drain.
v. The locations of shower nozzle discharge shall always be at right angles to the shower entrance unless the shower stall is unusually large.

DIVISION 23 – HVAC

1. General Provisions

a. All mechanical room floors should be finished with an epoxy coating similar to Dex-O Tex epoxy waterproof flooring. This includes floor areas under mechanical equipment. The floor under mechanical equipment shall be coated prior to equipment placement. Any duct or piping penetration above occupied spaces must have epoxy coated housekeeping pads around the penetration to minimize accidental water flow through the penetration.
b. All abandoned equipment, wiring, piping, utilities must be demolished and removed from the building. All remaining floor and wall penetrations must be sealed.

2. Utility Layout and Distribution

a. The Designer shall receive approval from PDC and VUMO early in the design process as to the routing of all utilities. All efforts should be made to avoid routing any utility in such a way as to require trenching or any disturbance of the root zone of campus trees. Consolidate and restrict utilities to every extent possible to those ground areas having already received utility runs.
b. All buildings must be connected to the central heating, cooling, and electrical systems.

3. Chemical Treatment

a. The Contractor is to generate and submit flushing and cleaning plans with VUMO and Vanderbilt's preferred vendor, Nashville Chemical. Any flushing, cleaning, and chemical treatment plan must be approved at least 10 days before work begins.

4. **Steam Condensate System**
   a. Cleaning of steam condensate piping requires flushing without circulation. Cleaning and degreasing agents are not required. Prior to returning condensate to the Power Plant, all condensate waste to drain for a period of time determined by the Power Plant Supervisor. The time period is predicated on the quality of condensate as determined by chemical analysis. That analysis will be provided by the Power Plant Supervisor.
   b. After the Power Plant Supervisor approves of the steam condensate cleanliness at each building, the condensate may be discharged to the building condensate return units and returned to the condensate return unit at the Power House.
   c. Once placed in service, the Contractor will re-torque all flange bolts to the required specifications.

5. **Variable Frequency Drives**
   a. Acceptable drive manufacturers include ABB, Square D, and Yaskawa.
   b. Each drive is required to provide a Bacnet MS/TP connection to the building automation system. Bacnet BAS network visible points from each drive must include:
      i. % speed (rpm)
      ii. Power (kW) – Instantaneous power – enabled for 5 minute interval trending
      iii. Frequency (hz)
      iv. Command Speed

6. **Controls**
   a. Controls demolition shall include:
      i. Preparation and submission of a demolition plan to remove abandoned building automation system (BAS) field devices and control panels. Where sensors or controllers are removed from ductwork, abandoned penetrations are to be sealed.
      ii. Remove pneumatic tubing back to the distribution header; cut and cap the tubing at the nearest main; remove all poly tubing back to the copper head.
   b. All controls wiring must be in conduit.
   c. All BAS shall be of the direct digital control (DDC) type. Field devices and controllers shall use Bacnet/IP.
   d. Each BAS shall report to Vanderbilt's Building System Control (BSC) department located in the Power House.
   e. The BAS shall interface with the lighting control system for all new projects and renovations.
   f. Approved Manufacturers for centrally monitored BAS Systems:
      i. Johnson Controls Metasys
      ii. Automated Logic
   g. Graphics
      i. Color graphics are required for all projects, detailing each floorplan, system and component. Submit custom graphic layout sketches to VUMO for review.
      ii. Graphics and acronyms for variables shall be in accordance with Vanderbilt's current BAS. Set alarms as directed by VUMO.
   h. Control Valves
      i. All water control valves shall be pressure-independent control valves with threaded or flanged ends. Electronic pressure independent control valves are not acceptable.

ii. Control valves shall fail 'closed' or 'last position'. Pre-heat steam or hot water control valves shall fail open.
iii. Medium and high-pressure steam control valves shall have stainless trim and must have minimum ANSI Class VI shut off rating.

i. Third Party Controllers and Devices
   i. Each Third Party Control Panel or device shall have backlit display interfaces that shows all pertinent parameters necessary to monitor and troubleshoot unit operation.
   ii. The BAS must monitor all steam, chilled water, domestic water, and electricity utility meters when installed.
   iii. All network engine locations, AHU system duct static pressure sensors, water DP sensors, and flow meters shall be noted in the BAS system and drawings.
   iv. Primary outside air temperature and humidity and global economizer for control sequencing must come from VU's global weather station.
   v. All system enables and alarm resets shall be at the top of the page on system info. All multi-story buildings shall have static pressure sensors on top and bottom floors, and locations shall be noted in the BAS system and drawings.
   vi. The following point data must be accumulated for trending analysis.
      1. All setpoints and binary points: At Change of Value (COV).
      2. All other points: 5 minutes or 300 seconds @ buffer size with the repository enable alarms.
   vii. Alarms
      1. Any alarm generated must have the location of the device or equipment in alarm.
      2. No alarm "pop-ups" when the associated system is disabled (Example: No high chilled temperature alarm when chillers are not commanded to be on.)

7. Meters and Gauges

a. Specify the range for all hydronic, vapor and electrical meters.
b. Temperature & pressure test plugs shall be installed on each side of water side equipment that produce temperature or pressure change but are not to supersede the placement of gauges.
c. In hydronic systems, piping from pressure tap to gauge shall be ¼" sch 80 brass.
d. PT test plugs shall be installed at the following location:
   i. Suction and discharge of pumps.
   ii. Inlet and outlet of coils in air handling units.
   iii. Entering and leaving of chillers on chilled water and condenser water.
   iv. Inlet and outlet of converters.
   v. Building entrance and exit of chilled water from the central plant.
e. Flow Meters:
   i. Fan wall airflow must be measured with a piezo ring Paragon FAATS-1000 fan array totalizing system, reporting to the building control system via BACnet protocol.
   ii. Steam Meters shall be a Veris Accellabar with integrated temperature and pressure sensors for compensated flow measurement.
      1. Steam metering associated with the Powerhouse requires transmitters by Foxboro, ABB or Rosemount with HART compatible 4-20ma signal output.
   iii. Chilled Water, Hot Water & Steam Condensate Meters shall be Flexim or Vortec Ultrasonic with maximum +/- 1% inaccuracy and must be configured for Bacnet MS/TP communication and 4-20ma output.

1. Flexim or Vortex Ultrasonic may be selected in single or dual channel configuration as appropriate for the project application.

iv. Natural Gas Meters shall be vortex-type, multi-variable flow meter configured for Bacnet/MSTP communication and 4-20ma output.
   1. Acceptable Manufacturer: Vortek Pro-V

v. Domestic, Makeup and Blowdown Water Meters – for use measuring building domestic water, plant make-up water, blow-down or sewer deduct water.
   1. Acceptable Manufacturers include Metro Water Sensus SRII and Omni C2. Remote 510M MXU Single Port wired transceiver required and must inspected and registered with Metro Water for all Makeup Water and Blowdown Meters.

vi. Chilled Water, Hot Water and Condensate Flow Meters are to be provided with local displays and connected to the building automation system via Bacnet MS/TP. When multiple flows are required, dual channel processors are acceptable.

f. Building Level Utility Metering and Data Collection
   i. Dedicated metering and meter data collection is required for each utility input to the building, including: Electricity, Steam, Steam Condensate, Chilled Water, Hot Water, Natural Gas and Domestic Water.
      1. Installed metering must be Bacnet Network visible via the installed BAS or network IP connection (except electric or steam meters). Data accumulation/trending must be enabled in the BAS if connected to the BAS.

g. Metering Units and Trend Intervals by Utility
   i. Electric meters – kWh and kW, 5 minute interval data, IP network trends, represented in the “Meter Data Warehouse” (BDX)
   ii. Chilled Water, Hot Water – gallons per minute, 5 minute trend interval
   iii. Steam – lbs/hr, 5 minute interval trends should be established along with an additional hourly totalization trend
   iv. Steam Condensate – pumped condensate is measured in lbs/hr, condensate flow trends will be hourly totalization trends.
   v. Natural Gas – gas flow measured in cubic feet, 5 minute interval trends should be established along with an additional hourly totalization trend.
   vi. Domestic, Makeup and Blowdown Meters – water measured in cubic feet with hourly and monthly totalization trend.

h. BTU Calculation and Energy Trends by Utility
   i. Electric Meters – all electric meters will be made Modbus network visible via dedicated IP connection. The meter Modbus points will be identified and integrated into the “Meter Data Warehouse” (BDX).
   ii. Chilled Water – chilled water BTU will be calculated using measured flow data and the associated supply and return water temperatures. Calculated BTU values will be captured in 5 minute intervals along with hourly, daily, and monthly totalization trends.
   iii. Steam – steam BTU trends will be calculated using the BTU content of the steam at the pressure and temperature associated with the distribution point. Calculated BTU values will be captured in 5 minutes intervals along with hourly, daily, and monthly totalization trends.
   iv. Steam Condensate – steam BTU will be derived from the hourly totalization of pumped condensate in gallons. Calculated BTU values will be captured in hourly, daily and monthly totalization trends.

v. Natural Gas – natural gas BTU will be calculated using the site average heat content. Calculated BTU values will be captured in hourly, daily and monthly totalization trends.

8. General Duty Valves

a. All pipe valves and fittings should be soldered, brazed or welded as appropriate.
b. Chilled water and heating hot water values with stems higher than 7' above the normal accessible working floor in mechanical rooms shall have chain operators, sprocket guide and chain hook. The chain shall have a valve tag at the bottom of the chain and the valve shall have a position indicator visible from the ground.
c. Gate valves 4" and larger for team service shall have a 3-valve bypass and drain. The bypass valve shall be a globe valve. It shall be 1/3 the size of the main valve.
d. Valves shall be of the extended-neck design to allow for the installation of full-thickness insulation over flanges.
e. Valves (buildings outside central plant):
    i. For steam and condensate over 15 psig – 2" and smaller: Class 800 forged steel, socket weld ends. For steam and condensate over 15 psig, 2 ½" and larger: Class 300 cast steel flanged, OS&Y.
    ii. For steam and condensate 15 psig and less – 2" and smaller: Class 800 forged steel, socket weld ends. For steam and condensate 15 psig and less, 2 ½" and larger: Class 125 cast steel flanged, OS&Y.
    iii. For circulating water systems 2" and smaller: 600 psid bronze ball valve, chrome-plated ball with screwed or solder ends. Valves on insulated piping shall have an insulated stem extension similar to Nibco's "Nib-Seal" to allow the handle to clear the insulation.
    iv. For circulating water systems 2 ½" and larger: Class 125 cast iron flanged gate valves for shut-off or class 125 flanged cast iron ball valves equal to American Valve series 4000.
    v. Butterfly valves should not be used. The one exception is that butterfly valves may be used in the common bridge on chilled water.
    vi. Solder-less crimped ('pro press') valves and pipe fittings such as those manufactured by Viego and 'Nibco' are not allowed. All pipes should be soldered, brazed or welded as appropriate.
    vii. Provide valves to isolate risers and/or major branches from mains, each piece of equipment and/or fixture.
        1. Combination automatic flow balancing and shut off valves with integral unions may be used on terminal boxes and fan-coil units provided sufficient installation and maintenance clearance is available.
        2. Valves installed overhead shall be installed with the valve handle in the horizontal position. Valves shall be installed so the valve handle points in the direction of flow when open. In horizontal runs, the valve handle shall point straight down when closed.

9. Piping Identification

a. All insulated piping shall be stenciled to indicate size, contents and direction of flow. Steam and condensate shall also be stenciled to indicate pressure. All equipment shall be identified in a visible location on the equipment.
b. Generate a valve list with valve position, location and purpose to be included in the O&M manual and post a laminated list in all mechanical rooms.

c. Where previous naming conventions are already present, the engineer shall continue with existing on construction drawings subject to PDC/VUMO discretion.

10. HVAC Insulation

a. All ductwork requiring insulation shall have external insulation. Internal duct lining is not allowed.
b. Pipe that is insulated outdoors, inside tunnels, 7' or below in mechanical rooms, or subject to abuse shall have smooth-aluminum jacketing, .016" thick minimum.
c. Use rigid insulation for ductwork and equipment in mechanical rooms or other areas unless concealed.
d. Where service access is required for valves or other equipment underneath insulation, provide a means for temporary removal of the insulation without its destruction. Use prefabricated removable jacket for valve insulation on steam isolation, by-pass and pressure reducing valves and condensate valves larger than 2 ½".
e. Do not insulate hydronic expansion tanks.
f. Extend piping insulation without interruption through all walls and floors. Install protective sheet metal insulation shields at hanger locations for all piping.
g. Insulate all piping, ductwork, and equipment subject to producing condensation and as required to maintain thermal properties.
h. Vapor barriers may be of aluminum foil or mastic.
i. Pipe fittings should be insulated with preformed insulation.
j. On piping insulated with insulation that could crush, a rigid insulation saddle, equal in thickness to the insulation, must be installed.
k. Duct insulation must be inside trapeze hangers and must not crush under the weight of the duct. Use rigid insulating supports to avoid crushing.

11. Sequence of Operation

a. The contract drawings for each project shall have a sequence of operation written in layman's terms which describes the prescribed operation, interlock, and interface requirements with the university-wide building automation system (BAS) for all mechanical systems such as air handling units, pumps, exhaust fans, terminal units, unit heaters, convectors, etc. The development of the sequence of operations shall be consistent with current VUMO control strategies. A draft of this sequence shall be reviewed with the engineer and VUMO prior to drawing issuance for construction. During construction, the contractor shall coordinate a controls summit meeting with PDC, VUMO and the designer to review the scope and programming at the submittal review stage.
b. Naming of various mechanical equipment and control elements shall agree with the nomenclature of the contract documents.
c. Install control sequences and diagrams on prominent walls in mechanical rooms containing control panels. These documents shall be laminated in clear plastic and attached to the wall with hooks for removal, use and replaced on the wall.
d. All setpoints and time durations shall be user adjustable.

12. Supply Air Temperature Control

a. Economizer should be controlled by the campus wide global weather station signal. If network communications are lost, unit shall go into economizer mode when either of the following conditions is true for 10 minutes:

i. T-oa is less than 60 degrees F with less than 52 degree dewpoint and
ii. OA dewpoint is less than 52 degrees and t-oa is less than t-ra.

13. Supply Air Temperature Reset Control

a. BAS shall reset the t-sa setpoint linearly according to the schedule below.
b. If h-ra exceeds 55 degrees F dewpoint, reset shall be disabled. When h-ra falls below 53 degrees F dewpoint, reset shall be enabled.

Oat t-sa

70 degrees F – setpoint

40 degrees F – setpoint +5

14. Supply Fan and Return Fan Speed Control

a. For VAV units with return fans, OA flow should be set using a supply and return airflow offset. Supply fan VFD speed shall modulate to maintain duct static pressure setpoint.
b. Return fan VFD shall modulate speed to maintain a set of differential between supply and return air airflow (differential is equal to minimum outside air flow listed in AHU schedule sheets).

15. Supply Fan Status Pressure Reset

a. Utilize fan static pressure when applicable. Boxes that stay 100% for greater than 24 hours (adj.) or don't meet airflow setpoint greater than 24 hours should alarm. Remove these boxes from the static reset calculation.

16. HVAC Piping and Pumps

a. Circulating water piping shall be type "L" copper with sweat connections for nominal pipe sizes 2" or less. Larger piping shall be steel, standard wall, with butt weld fittings.
b. All condensate piping through 10" size shall be schedule 80 and all steam piping shall be seamless schedule 40. Fittings for all steam and condensate 2 ½" and larger shall be butt weld, wall thickness to match pipe. Fittings for 2" and smaller for high pressure steam piping and condensate piping 30-lb and above, shall be class 3000# forged steel socket weld. Fittings for low-pressure steam and condensate shall be socket weld or 300# screwed malleable iron. 2" and smaller connections to welded steam and condensate lines shall be welded construction through the first shut off valve.
c. "Weld-O-Lets" may be used for branch connections if the branch pipe is at least one size smaller than the main. Saddle connections may be utilized on condenser water systems. Dielectric assembly with bronze ball valve, red brass nipple and copper male adapter shall be used at junctures between steel and copper pipe.
d. In hydronic systems, do not use Bullhead Tees.
e. On all domestic water lines located under slabs use Type "K" seamless copper tubing.
f. Underground steam systems shall be Class A, drainable dryable, testable systems equal to Thermacor Duo-Therm 505. Underground condensate, hot water, and chilled water piping shall be Thermacor Ferro-Therm or approved equal.
g. Provide cleanable strainers "Y" type on all pump suctions and upstream of control valves. Water strainers shall have fine mesh startup strainers; once cleaned, install monel 20 mesh screens. All strainers shall be provided with blow-down piping to nearest floor drain.

h. End suction pumps shall not be used if the inlet size is greater than 3". Horizontal split-case pumps shall be used above 3" suction size. Pump casings are not to be insulated with removable Armaflex. All pumps shall have a minimum ¾" deep drain pan and piping to capture all pump components and connection flange condensation. Insulation must be applied to pump flanges or other components that overhang a drain pan.
i. Each drip pan shall have an appropriate connection for drainage piped to the nearest floor drain. The drain piping shall be routed to avoid a tripping hazard.
j. Rooftop air handling unit condensate drains shall be copper, minimum type "M".
k. Chilled water and heating hot water piping systems in a building shall be equipped with an air/dirt separator, including systems fed from Vanderbilt's district utilities. The air/dirt separator shall be Spiro Therm; Spiro Vent Dirt or approved equal.
l. Provide low-point drains as required to properly drain the piping system. Drains shall have means of connecting a ¾" garden hose.
m. Provide high-point vents as required to properly vent the piping system. Vents shall have means of connecting either a ¾" garden hose or a ¼" refrigerant hose.
n. All underground steam and condensate welding shall be 100% non-destructive examined (NDE) and all defective welds corrected and NDE again.
o. All welding shall be done by certified welders according to ASME Power Piping Code. Welds shall be appropriately stamped by the welder who performed the work. Welding procedure specifications, welding procedure qualification records and welder operator qualifications shall be submitted before any welding is performed.

17. Steam Specialties

a. For condensate, steam traps are required of the float and thermostatic or bucket type sized for two times the capacity of the served equipment.
b. Steam transmission line end-of-main traps shall have Spirax Sarco PC-3000 weld in pipeline connector or approved equal with UFT32 ball float steam traps or approved equal.
c. At each control valve and steam trap, T-Type Strainers are required with removable brass strainer baskets and blow down valve.
d. The contract drawings shall indicate the capacity, in LBS/HR, of all steam traps.
e. The discharge of strainer blow down shall be directed to a floor drain.
f. Steam to water heat exchangers shall have flanged connections on the water side.
g. All traps downstream of a control valve shall be a minimum of 18" below heat transfer equipment being serviced.

18. Steam Condensate Pumps

a. Condensate pumping equipment must have duplex pumps with autoflow regulators on pump discharge.
b. Pumping equipment shall be installed with pump failure status alarm or contacts for connection to Vanderbilt's university wide building control system (BSC) where applicable.
c. Pumping installations shall have discharge check valves for each pump within an associated discharge isolation valve. Check valves on steam condensate shall be DFT SCV threaded in-line check valves or approved equal.

19. Refrigeration Piping

a. Refrigeration piping shall be type "ACR" copper with brazed joints.

20. Ductwork and Air Distribution Systems

a. All air distribution inlets and outlets shall be constructed of aluminum with the exception of wall registers within five feet of finished floors. In which case, industrial type steel registers shall be used.
b. All air distribution systems shall have ducted air return.
c. All fans shall have direct drive.
d. For ceiling applications, louver-faced diffusers are preferred. When installed in modular ceilings, louver-faced diffusers should have extended panels if the selected diffuser dimensions are smaller than the grid.
e. The use of lined ductwork is prohibited.
f. Maximum pressure for installed fire dampers: 0.1 inch w.c. at 1500 FPM.

21. Terminal Reheat Boxes

a. Terminal units shall be installed so as to be easily serviceable. A minimum of 24” clear shall be maintained on the control side of the box. Access panels must be installed upstream of each hot water reheat coil for future cleaning without removal of the terminal box.
b. Terminal box casings shall be constructed of panels with insulation sandwiched between galvanized steel. Where hydronic reheat coils are applied, the terminal box casing must have a removable, gasketed access panel upstream of the reheat coil for cleaning purposes.
c. All terminal boxes shall have discharge air temperature sensors.
d. The use of electric re-heat coils is forbidden. Hot water reheat coils are preferred.
e. Terminal box re-heat coils must be selected for an entering water temperature of 140 Deg-F.

22. Chillers

a. All buildings should be connected to a central chilled water loop.
b. Unitary chillers by Trane Daikin, or York will be given equal consideration based upon IPLV performance and cost.
    i. All chillers are required to have owner-witnessed ARI-550/590 factory performance tests.
    ii. Refrigerant should have zero global warming potential.
    iii. Hermetic oil-less compressors are preferred for electrical centrifugals; where external motors are used, room air-conditioning must be installed to off-set the motor heat rejected to the room. The engineering cost studies must include the penalty for cooling the room for open-drives.
    iv. Electrical centrifugal chillers shall have variable-speed drives. Inverter cabinet cooling for variable speed drives should not be directly cooled with condenser water.
    v. Integral water-cooled heat exchangers for these drives must have cleanable strainers sufficiently sized to limit blow-down to once a week.

23. Cooling Towers

a. Select cooling tower fans to limit generated noise levels at full speed to a maximum of 65 db at 25’ from the intakes and discharge. In addition, noise levels must meet campus outdoor noise standards listed in this guideline.
b. Cooling towers shall be screened from view.
c. Provide FM Approved or noncombustible cooling towers. Where combustible cooling tower components are present, provide automatic sprinkler protection.
d. Cooling towers should be packaged or field-erected based on the return on investment as determined through a study with PDC and VUMO.

e. Acceptable manufacturers for packaged units include Marley, Baltimore Air Coil, and Evapco.
f. Acceptable manufacturers for field-erected units include EvapTech and CCS.
g. Provide distribution basin covers for all cooling towers and stainless steel hot water and cold water basins.
h. Hot water basin heaters are preferred.
i. All cooling towers shall have variable speed drives with 'hard-wired contactor' bypass in addition to the standard electronic bypass.
j. Install a 1-1/2 inch hydrant within 25' of all cooling tower basins.
k. There should be a maximum seven-degree approach.

24. Central Station Air Handling Units

a. Air handling unit shall be designed for a 40-year useful life.
b. Air handling unit should use hot and chilled water for heating and cooling.
c. Acceptable manufacturers include Huntair, Ingenia, ClimateCraft, Governair, Temtrol, Energy Labs, Trane Custom, York Custom.
d. Casings shall be constructed of 3" thick top and side composite panels made with minimum R20 foam insulation injected between hot dipped galvanized steel sheets.
e. Appropriate doors for service and access to internal components shall be similarly constructed and flush-mounted with heavy duty door hinges, gaskets, and heavy duty latches.
f. Doors for sections under negative pressure will swing outward; for positive pressures, door swing will be inward.
g. Each section containing access doors shall have LED light fixtures that don't create an access hazard for maintenance personnel with switches externally mounted to the casing.
h. A combination of base rail height and housekeeping concrete pad height are necessary to provide the correct condensate and steam trap heights. Actual dimensions must be shown for all traps.
i. Provide a Magnehelic differential pressure gauge to indicate filter DP.
j. Chilled water coils must have stainless steel supports.
k. Coil Tube Thickness:
   >6,000 CFM - .035" minimum
   <6,000 CFM - .020" minimum
l. All coils shall have ½" drain and vent with ball valve and ¾" hose connection.
m. Where humidifiers are required, they should be installed upstream of the cooling coil.
n. Fan-walls shall be equipped with one variable frequency drive per fan. The fan airflow shall be metered piezo ring or port measurements.
o. Units shall incorporate UV lights with minimum URV 10 rating and controlled to operate any time the unit is dehumidifying. Operation time should be accumulated in the BAS.
p. UV lamps should be non-proprietary.
q. Where outdoor air preheat coils are not installed, air blenders should be used.

25. Ductless Split Systems (VRF)

a. Variable refrigerant flow (VRF) systems are not allowed.

26. Chilled Beam Systems

a. Active chilled beam systems are preferred by VUMO, but a full evaluation during design shall be made to confirm appropriateness of the proposed system for the project/building usage. For renovations, the existing building system type may be changed (versus replaced in

kind) when the proposed change results in a reduced (lifecycle) cost of ownership. For new construction, the selected system should provide the lowest (lifecycle) cost of ownership. Cost of ownership is defined as the total costs of operation across a 20-year period, with costs verified by the Designer of Record or 3rd Party estimator. These costs will be comprehensive of all capital and operating costs (energy and maintenance) and shall consider both VU cost avoidance and/or cost savings and shall be documented as an official project exhibit for review and approval.

b. Acceptable chilled beam manufacturers include Price Industries, TROX, Titus, SEMCO, and Dadanco or approved equal.
c. Active chilled beams are preferred.
d. Constant volume primary airflow chilled beams are preferred.
e. Single coil beams are preferred with six-way or equal control valves for heating and cooling.
f. Airflow through induction coils must be eliminated during building start up and clean out.
g. Exhaust fans are preferred over return fans.
h. Prefer that primary air is generated and supplied by a dedicated outside air unit with heat recovery.
i. Heat exchangers are not required for secondary chilled water loops, blending loops are acceptable.
j. Building services, access panels, return grilles can be integrated into chilled beams.
k. Hoses are not allowed for chilled beam connections.

27. Fan Coil Units

a. Fan coil units should not be used. If a Design Variance is approved, the following verbiage applies.
b. Acceptable manufacturers include Johnson Controls, International Environmental Corporation, Price, and ENVIRO-TEC.
c. General requirements for all fan coil units on campus include:
    i. Gravity condensate drains are required, no pumps are allowed.
    ii. Auxiliary drain pans with either an obvious ¾” drain with hose connection or a water sensor tied into the building automation system.
    iii. Valve packages with pressure independent control valves and appropriate unions.
    iv. Adequate access for maintenance, including the removal of the fan coil unit for replacement.
        1. 2’ minimum to control valves and panels
        2. 2’ maximum above ceiling
    v. All fan coil units must have EC motors that can modulate to 30% of design airflow.
    vi. All fan coil units must have discharge air temperature sensor.
    vii. Fan must be removable without completely disassembling the unit or cutting wires.
d. Three main types of fan coil units used on campus and their requirements include:
    a. Housed horizontal fan coil units typical to residence halls
        1. Housing width and depth sized to accommodate piping packages, including control valves and unit controller, with an adjustable sleeve to match ceiling height.
        2. Fan coil unit must be removable from below the housing.
        3. Hinged, finished bottom cover that includes a filter grille and robust, tamper-resistant latches.
        4. Auxiliary stainless drain pan under chilled water control valve.

5. Unions and electrical connections that allow removal of the fan coil unit from the housing.

b. Unhoused horizontal fan coil units above lay-in ceilings typical to classroom or office buildings
   1. Auxiliary drain pan must protect from coil and control valve leaks or sweating.
   2. Controller must be in an adjacent or attached electrical housing suitable for controls.

c. Cabinet style vertical fan coil units
   1. Cabinet width and depth sized to accommodate piping packages, including control valves and unit controller.
   2. Discharge grille must be a substantial bar grille, not punched louvers.

27. Coils

a. Provide freeze protection pumps for pre-heat coils.
b. Coils shall not have ferrous and non-ferrous metals in contact with one another. Coils with copper tubes and cast-iron headers or copper tubes with copper headers and a steel service connection are not acceptable.
c. Air-handling units with multiple coil sections shall be constructed to allow removal of one coil with the remainder staying in place.
d. All cooling coils, except those installed in room terminal units, shall have drain pans constructed of stainless steel.
e. Piping connections to coils shall be hard pipe connections only. No rubber flexible connectors shall be allowed on terminal devices in hydronic systems. Connectors shall be stainless bellow-type with braided stainless steel outer covering.
f. Fin spacing should be no less than 10 fins per inch.

28. Humidification

a. Humidifiers that are designed to evaporate condensate are preferred. With this type of humidifier, condensate drains are unnecessary.
b. Interlock steam control valves with air flow to prevent steaming with loss of air movement.
c. Control humidifiers to a discharge air dew point temperature.

DIVISION 26 – ELECTRICAL

1. Basic Materials and Methods

a. Aerial utilities and utility poles are not acceptable. Special circumstances must be approved in writing by PDC and VUMO through the Design Variance process.
b. Fiber-Optic underground communication lines shall be installed with a metallic wire detectable by underground location equipment.
c. Utilize dry type transformers or an FM Approved transformer with FM Approved less flammable fluid.
d. Emergency generators and their associated fuel supplies should be located outside of important buildings where practical, and they should be installed and protected in accordance with FM Global Loss Prevention Data Sheet 5-23 Emergency and Standby Power Systems.

2. General Provisions for Electrical Systems

a. Complete Short Circuit, Protective Device Coordination, and Arc Flash Study to meet requirements of NFPA 70. ARC Flash Study to include new panels and existing equipment being modified. Study should be completed through design engineer.

b. Arc Flash Sign Installation: Implement the Arc Flash sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E.
c. Arc Flash Study: Perform Arc Flash Analysis to include the following at each distribution bus:
    i. Bolted fault current
    ii. Arc fault current
    iii. Protective device characteristic and arc fault duration
    iv. System voltages and equipment class
    v. Working distances
    vi. Calculated incident energy
    vii. Calculated arc flash protective boundary
d. On completion of work, installation shall be tested to be entirely free from grounds, short circuits, and open circuits. Balance all circuits so that feeders to panels be not more than 10% out of balance between phases with all available load energized and operating.
e. Furnish Vanderbilt, as a part of closing file, a copy of such tests including identification of each circuit and readings recorded. Test information to be furnished includes ampere readings of all panels and major circuit breakers, insulation resistance reading of motors and transformers.
f. Prior to final observation and acceptance, test, leave in satisfactory operating condition all electrical systems and equipment including but not limited to the following:
    i. Electrical distribution system
    ii. Ground fault protection system
    iii. Emergency power generation system
    iv. Transformers
    v. Fire alarm and smoke detection system
    vi. Electric motors for all equipment
    vii. Master clock system
    viii. Electric safety devices
    ix. Any alarm system, including narcotics, generator, door security, etc
    x. Isolation panel ground monitor
    xi. CCTV system
g. Properly identify all starters, contactors, relays, safety switches and panels with permanently attached black (normal power) or red (emergency systems) phenolic plates with 1/4" white engraved lettering on the face of each attached mechanically. Starters and relays connected by the electrical tradesman to be identified by him whether furnished by him or others.

3. Medium Voltage Cables

a. The contractor doing the work must have the appropriate qualifications and certifications to do medium voltage connections.
b. The installation shall be capable of operating continuously in both wet and dry locations at a conductor temperature of 90 deg C for normal operation.
c. Splices: Shall be 3M or Raychem Cold Shrink Splice Kit, 5700 Series, for copper shielded cable 15kv 133%. Splices shall have a clear protective coating after completion and conforming to Federal Specification TT-L-50F. Power cable circuits may be spliced only at locations where specified. Splices shall not be made to utilize short lengths of cable, nor shall they be made to provide correct lengths on cable initially cut too short for a circuit.
d. Conductors to be annealed, Class B compact stranded copper.
e. Shield to be bare 5-mil minimum thick copper tape helically applied over the extruded insulation with 25% nominal overlap.

f. Jacket to be covered with CLX metal clad armor or approved equal when installed in Vanderbilt's bored tunnels.
g. Manholes, and Cable Trays - Cable will have 3M Fire and Arc Proofing Tape installed, two (2) layers 1/2 wrap. All cables shall be grouped together and in the groups shall be of ABC phase.
h. After all cable, splices, and terminations are installed they shall be tested according to NETA Specifications by an independent testing company or Vanderbilt University. All information will be given to Vanderbilt University in writing.
i. Parallel circuits must be identical in length and grouped together in ABC phase groups.
j. Label all circuits with imprinted labels. Stick-on labels are not allowed. Labels shall be installed at all manholes and termination cabinets.
k. Cable shall be carefully checked and tested to verify the electrical condition, size, and length before being pulled into raceways. Cable pulled into the incorrect raceway or cut too short to rack, train, or splice as specified herein shall be removed and replaced by and at the expense of the Contractor.
l. Cable in Manholes: Cable shall be always supported during handling. Cable ends shall be sealed to prevent the entry of moisture or dirt. Cable racks or trays shall be provided for permanent support. Temporary support required during placement shall be with rope slings, timbers, or alternate method acceptable to Vanderbilt.
m. Cable supports and securing devices shall have bearing surfaces oriented parallel to the surfaces of the cable sheath and shall be installed to provide adequate support without deformation of the cable jackets or insulation. Adequate cable end lengths shall be provided and properly placed in electrical equipment or manholes to avoid longitudinal strains and distorting pressures on the cable at termination points and duct end bells. Final inspection shall be made after all the cables are in place. Where supports, bushings, and end bells deform the cable jacket, additional supports shall be provided as directed by Vanderbilt.
n. Cable racks shall be furnished and installed as required to provide the proper cable support. Cable racks shall be installed and spaced 36 inches apart and bolted to permanent wall surfaces with anchors or continuous slot concrete inserts. Ground metal arms on cable racks if used.
o. Cable ends shall be kept sealed except when termination and splicing work is being performed. Seal with heat-shrinkable caps with the sizes recommended by the cap manufacturer for the cable outside diameter and insulation. Caps shall contain sufficient adhesive that shrinkage of the cap during application results in formation of a positive, watertight seal. Heat-shrinkable caps shall be "Thermofit" as manufactured by Raychem Corporation or equal.
p. Before and after pulling, the leading end seal of each length of cable shall be examined and replaced if necessary. All cut cable ends shall be promptly sealed after cutting except those to be spliced or terminated immediately.
q. Live front stress cones shall be 3M-7600 Series termination (cold shrink type) with grounding kits. Rated 15 KV as required. Raychem Heat Shrink type of equal rating is also acceptable.
r. Acceptable manufacturers include Raychem, 3M, and Cooper.
s. Modular insulated connectors shall be suitable for use under the following service conditions:
    i. In air, including exposure to direct sunlight.
    ii. Intermittently or continuously submerged in water.
    iii. Environmental temperature between -20 degrees C to 65 degrees C.
t. Ratings:
    i. Phase to phase voltage = 14.4 KV.

ii. Phase to Ground = 8.3 KV. 3. BIL = 95 KV.
iii. Current = 200 Amp or 600 Amp as required.

u. Manufacturers:
i. 200 Amp LB Elbow Connector, 15 KV - 36 KV: Cooper LE series, with capacitive test port, or equal.
ii. 200 Amp and 400 Amp DB Elbow Connector, 15 KV - 36 KV: Cooper DE series, with capacitive test port, or equal.
iii. 630 Amp DB Bolted Tee Connector, 24 KV - 36 KV: Cooper DT series, with capacitive test port, or equal.

4. Low Voltage Electrical Power Conductors and Cables

a. Provide wire and connections to electrical devices and systems via a conduit raceway system. Cables can be routed in cable tray.
b. Conductors for branch circuits and feeders shall be 600 volt, UL approved, copper.
c. For fire alarms and control systems, use stranded wire minimum #18 gauge conductors labeled "THHN" or "THWN."
d. Use stranded copper, type "THHN" or “THWN” for conductors #8 and larger, except when required by code.
e. MC cable shall not be used in new construction other than lighting whips.
f. No conductor for branch circuit wiring shall be smaller than 12 gauge.
g. Complete conduit system and install bushings before pulling any wire or cable. Conductors shall be continuous from outlet to outlet or to branch circuit over current devices.
h. Make splices only in junction boxes. Splices shall not be made in panelboards. Splices in pull boxes where conductors are not being tapped and other unnecessary splices will not be permit- ted.
i. Provide a separate insulated ground wire for all power branch circuit wiring. Ground conductors to be installed in conduit.
j. Conductors shall be color coded to differentiate between systems of different voltage and to differentiate between phases of each system. Color coding shall be consistent throughout so that across phases and voltages the given phase of a given system shall always be the same color. Colors for 120/208 volt systems shall be Black, Red, and Blue. Colors for 480 volt shall be Brown, Orange and Yellow.
k. All 120 volt branch circuit, including light circuits, shall have their own neutral (no shared neutral).
l. Elbows and connectors should be as follows:
i. Twist-on connectors - for connecting No. 8 AWG and smaller shall be rated 600 volts consisting of metal spring, steel shell and color coded long skirted PVC insulator. The connector shall be a UL listed connector.
ii. Bolted-pressure connectors - for conductors No. 6 AWG and larger are to be of a cast non-ferrous material.
iii. Compression-type connectors - for conductors No. 6 AWG and larger are to be a pressed non-ferrous material.

5. Raceways and Boxes for Electrical Systems

a. Rigid conduit, intermediate metallic conduit, & electrical metallic tubing to be hot dipped, galvanized, or electro-galvanized steel that is NEC approved by Triangle, Allied, or Raco.

b. For interior EMT conduit connectors from 1/2” to 2” trade sizes shall use set screw type. For interior EMT conduit connectors from 2-1/2” to 4” trade sizes shall use two set screw type.
c. For exterior EMT conduit connectors from 1/2” to 4” trade sizes shall use compression type.
d. Minimum size of conduits shall be 3/4 inch (1/2 inch permissible for switch legs).
e. Use electrical metallic tubing where drawings call for conduit to be concealed in walls, run exposed (except in powerhouse applications), and installed above suspended ceilings.
f. Use only rigid galvanized steel, or intermediate galvanized steel conduit when installed exposed in powerhouse applications, and for feeders.
g. All conductors shall be installed in conduit.
h. Run exposed conduit at right angles to, or parallel to walls.
i. Conduit shall be supported directly from the building structure. Use caddy clips, beam clamps, conduit straps, or other steel supports designed for the purpose. Electrical tape, plastic ties, plumbing strap, and tie wire will not be permitted.
j. Use short pieces, approximately two feet in length, of flexible conduit to connect motors and other devices subject to motion and vibration. Connectors for flexible conduit shall be steel.
k. Use expansion fittings properly bonded to assure ground continuity across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel enclosures.
l. All empty conduits shall have a galvanized steel pull wire or a nylon pull string.
m. Conduit shall not be permitted to pass through elevator shafts or elevator equipment rooms.
n. Flexible conduit shall not exceed 6’ in length above ceiling and may not be used inside walls.

6. Underground Electrical Service

a. Duct lines to be rigid PVC Schedule 40.
b. Concrete: 3000 psi type dyed red with maximum aggregate of 3/4 inch.
c. Manholes shall be sized as shown on detailed drawings with pulling eyes in walls and lifting irons in the floor. All manholes to be externally waterproofed and provided with watertight manhole covers. Provide drain for all manholes and sump pumps where possible. If manhole is hinged, the manhole shall lay flat on the ground and not present a crush hazard while in the open position.
d. Install at least 2 spare conduits, equal in size to the largest conduit in the duct bank, in duct-banks.
e. All abandoned conductors shall be removed.

7. Networked Lighting Controls and Light Management Software

a. The lighting control system shall be an IP based addressable system using a Windows based control software. The base LCS must be capable of managing time schedules, scene control, task tuning, load shedding, daylight harvesting and management reporting. The LCS must be capable of managing these functions at both the individual fixture and branch circuit levels. The LCS must utilize a central network-based server which will integrate simple I/O devices and nonproprietary ballast, lamps, fixtures or sensors for daylight harvesting and occupancy detection.
b. Control Levels
    i. Fixture Level – The LCS must have the ability to integrate, address, and control each fixture or control device (wall controllers, photo sensors, occupancy sensors). Each device must be integrated to the building network and controlled from the central system software interface, in order to facilitate addressable dimming, switching or scene control independent of electrical circuiting and without proprietary ballast.

ii. Circuit Level – The LCS must be capable of line voltage switching of a lighting circuit or circuit segment. Line controllers shall be individually addressed and integrated to the building network for control from the central system software interface, in order to facilitate routine switching, scheduling, load management and reporting.

c. System Features
   i. Integration to Building Automation Systems (BAS) – The LCS must have the ability to communicate information and I/O's via a BACnet interface to the building's existing BAS. Specifically, the LCS must share occupancy status, generate I/O and integrate with other building systems such as fire & life safety, security, HVAC, A/V, shade control, nurse call, etc.
d. Acceptable manufacturers include Lutron, Acuity or approved equal.
e. Lighting control should be grouped as follows:
   i. Exterior
   ii. Hallways
   iii. Offices
   iv. Classrooms/Labs
   v. Conference Rooms
f. All exterior lighting should be controlled by a photocell with an override control.
g. Hallway lights should be zoned by floor.
h. Classrooms/Labs or conference rooms will be equipped with UL-approved occupancy sensors to turn lights on and off.
i. The designer shall evaluate the payback on offices and other types of spaces, as to the use of Ul-approved sensors to turn lights on and off.
j. Locate all lighting hubs/processors in electrical or IT closets. Exceptions shall be approved by PDC and VUMO through the Design Variance process.

8. Dry Type Medium Voltage Delta-Wye Transformers

a. The transformer shall be 3 - phase, 60 hertz, air-cooled dry type mounted in a suitable ventilated enclosure and barriered from the high voltage and low voltage section. Self-cooled capacity (size as required) primary voltage 15kV or dual wound 15kV/4160V; secondary voltage (as required) wye 4 wire. Primary taps shall be full capacity, with a minimum of 2-2.5% above and below rated voltage.
b. The coil design shall be copper modified winding to provide the most efficient, reliable, and compact winding.
c. Acceptable manufacturers are ABB, Eaton, and Square D.
d. Include nameplate diagram with the following ratings:
   i. kVA
   ii. Primary and Secondary Voltage
   iii. Taps
   iv. Basic Impulse Level
   v. Impedance
   vi. Oil Type (Non-PCB)

9. Medium Voltage Fusible Interrupter Switchgear

a. The metal enclosed switchgear shall be ABB, Eaton, or Square D.
b. SF6 switchgear shall be S & C or approved equal.
c. Relays should be Multilin series 800 or approved equal.

d. Provisions shall allow for convenient extension of both the main bus and the ground bus to adjacent bays which may be added in the future.
e. A viewing window shall be installed in the load interrupter switch enclosure and located to enable visible inspection of the switch poles from the enclosure, and so placed that opening the fuse access door is not required to observe the blown fuse indicator on any fused switch.
f. The manufacturer of the switchgear shall be the same as designer manufacturer of the load break switch. The enclosures, fuses, switches and operator shall be coordinated to assure a fully integrated system assembly.

10. Medium Voltage Fuses

a. The high voltage fuses and non-disconnecting fuse mountings shall be accessible only through a separate door mechanically interlocked with the load break switch, to ensure the switch is in the open position when the fuses are accessible. Switch designs with full height fuse access doors shall have a solid barrier covering the area of the main cross bus and/or line side of the switch. Metal screen barriers are not acceptable. No energized parts shall be within normal reach of the opened doorway. Four single full-length inter-phase barriers shall isolate the three phases of the switch from each other and from the enclosure.
b. Furnish one spare set of fuses for each different size fuse provided in the switchgear.

11. Circuit Breaker Distribution Switchboards

a. The power system feeding the Switchboard is either 208 or 480 volts, 60 Hertz, 3 phase, 4 wire, solidly ground wye.
b. Acceptable manufacturers: ABB, Eaton, or Square D.
c. Standard features should include:
    i. Switchboard(s) shall be NEMA 1 for interior, NEMA 3R for exterior deadfront construction.
    ii. Series rated switchboards are not acceptable.
    iii. All covers shall be fastened by hex head bolts.
    iv. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex head bolts.
    v. Bus bars shall be continuously silver-plated copper.
e. Feeder Device
    i. Feeder devices shall be group mount molded case circuit breakers or when larger than 1200 amps shall be individually mounted insulated case circuit breakers.
    ii. Series rated feeders are not acceptable.
f. Molded Case Circuit Breakers
    i. Thermal magnetic molded case circuit breakers may be provided for trip ratings 800 amps and below.
g. Digital Electronic Trip Unit for Circuit Breakers
    i. As a minimum, the trip unit shall have the following protective functions:
        1. Adjustable current setting or long time pickup.
        2. Adjustable long time delay.
        3. Adjustable instantaneous pickup.
    ii. As a minimum, the trip unit shall include the following features:
        1. Long time and short time protective functions, if provided, shall have true RMS sensing technology.
        2. Ground fault protective function, if provided, shall contain a memory circuit to integrate low level arcing fault currents with time, to sum the intermittent ground fault spikes.

3. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.
4. Multi-button keypad to provide local setup and readout of all trip settings on the LCD.
5. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.

iii. An integral test jack for testing via a portable test set and connection to a battery source.

12. Panelboards

a. Install all circuits using a common neutral in accordance with the latest edition of the National Electrical Code. Balance all circuits to achieve not greater than 10% unbalanced neutral current in panel feeders.
b. Provide typed directory cards under plastic on the doors of lighting and branch circuit panelboards
c. Directories shall dictate devices being served including space numbers or space names in which devices or fixtures are located. Space names and numbers shall match the graphics installed.
d. Panel boards shall be labeled with a plastic laminated nameplate which identifies the panel by name. Labels shall be attached to the panel with screws or rivets. Glue is not acceptable.
e. From each flush-mounted panelboard, stub a minimum of two 1" empty conduits into area above ceilings.
f. Where flush-mounted, the fire integrity of the wall in which it is installed must be maintained.
g. Plug all knockouts removed and not utilized.
h. All panelboards shall be phased identically throughout the building.

13. Motor Control Centers

a. All motor control centers shall be equipped with hand-off-automatic switches. Hand position being manually controlled and automatic position being computer controlled. Auxiliary contacts shall be available for monitoring condition of status by the University's centralized BSC. Questions are to be directed to VUMO.
b. Acceptable manufacturers are Square D, ABB, or Eaton.
c. Auxiliary Contacts
   i. Wired to terminal blocks located in a separate section of the Motor Control Center. Terminals shall be appropriately identified for connecting to the BSC.
   ii. Each bucket of MCC should have individual control voltage
   iii. Each bucket shall be individually labeled.

14. Electrical Metering

a. Installed metering must be Modbus/IP Network visible via the existing Niagara/Building Logix by network IP connection. Data accumulation/trending must be setup for maximum storage at 5-minute intervals for kw and kwh.PT and CT ratios must be set up and clearly identified/labeled inside the metering panel. IP address shall be obtained from VUIT and programmed/verified for meter connectivity over the Vanderbilt network.
b. It is the responsibility of the installation/controls contractor, electrical contractor, the project engineer and the commissioning agent to validate the accumulating trend data.
c. Metering Units and Trend Intervals by Utility

i. Electric meters – all electric meters will be made visible Modbus/IPnetwork visible via dedicated IP connection. The meter Modbus point will be identified and integrated into the “Meter Data Warehouse” (BDX).

d. Electric Meters and Metering
   i. For electric meter mains, Electro Industries – Shark 250 Series meters are preferred. The Satec EM/PM model meters are an approved alternate. (NO EXCEPTION) Meters must be connected to the Vanderbilt Facilities Network via Modbus/IP.
   ii. For new installations with new switchgear, the following panel mount models should be used:
      1. Shark Series (preferred)
         a. Panel mount Shark 250-60-10-V1-D2-INS
         b. Remote Mount Shark ENCSHK250 Shark 250 in NEMA 1 Enclosure (Indoor) ENC4XSHK250 Shark 250 in NEMA 4X Enclosure (Outdoor)
      2. Satec Models
         a. PM335
            i. PMPRO335-JIMP-PM335-HACS-60Hz-ACDC-IOS
   iii. For socket mount installations, the following models should be used:
      1. Shark Series (preferred)
         a. Shark 270
      2. Satec Models
         a. EM920
            i. EM920-JIMP-5S-60hZ-5-ETH
            ii. EM920-JIMP-9S-60Hz-5-ETH
e. Sub-metering – gear level sub metering may be provided by the switchgear manufacturer using the approved meters in this section. (NO EXCEPTIONS) All submetering must be reviewed and approved by the Vanderbilt Director - Maintenance and Energy Management and/or the Campus Energy Manager.
   i. These sub meter devices must be Modbus/IP visible to the Vanderbilt Facilities Network.
f. All meters (main and subs) shall be installed in the switchgear where possible. Remote mounting of the meters must be approved by Vanderbilt prior to occurring.
   i. The switchgear enclosure shall be as follow:
      1. (120-240) V AC line powered.
      2. 277/480 V AC line powered - comes equipped with a control power transformer.
      3. (18-60) V DC external powered.
      4. Universal, (120-240) V AC @ 50/60 Hz or (100-370) V DC external powered.
   ii. The enclosure shall come with terminal block/disconnect for meter power, fuses, and a shorting block for use with current transformers.
   iii. The rear and front of the meter shall be accessible and isolated from the medium and high voltage sections of the switchgear in such a way you are not in an arc flash zone.
   iv. The enclosure shall have a lockable door.
g. On all meter connections, pertinent information shall be forwarded to Plant Engineer or Direct Metering Coordinator for review and approval before project is started.

15. Wiring Devices

a. Where lightning arrestors are required provide UL rated type.
b. All lightning arrestors in the substation will be made of porcelain.
c. For switches, provide commercial grade, flush mounted, quiet operating AC type, with toggle operator, heat resistant plastic housing and self-grounding metal strap. Silver alloy contact.

Rated 20A ata 120/277V and capable of full capacity on tungsten or florescent lamp load. Design for side or back wiring with up to Number 10 wire.

d. Switches controlling lighting connected to the emergency power system shall be Red and should be of the illuminated-toggle type - illuminated when the switch is in the off position. Hubbell, Leviton or Pass and Seymour may be used.
e. Switches controlling lighting by way of low-voltage lighting control relays shall be 3-position, momentary-contact, center-off type to match the other switches.
f. Duplex Convenience Receptacles
    i. For duplex convenience receptacles, provide 3-pole commercial grade NEMA configuration with bronze contacts that accept plug with 2 parallel blades and 1 grounding blade. Rated 20 amperes at 125-volt electrical alternating current.
    ii. All devices connected to the emergency system shall be Red in color.
    iii. Dedicated electrical circuits provided for computers or other special equipment shall be Orange in color.
    iv. Receptacles to have separate equipment ground wire from receptacles to equipment ground bus in panelboards (do not use conduit).
    v. Switching receptacles need to be top and bottom switchable.
g. Other Receptacles (Grounding Type)
    i. Commercial grade - NEMA configuration indicated by circuit voltage and capacity shown on drawings.
    ii. When two or more switches or devices are shown in one location, mount under a common plate.
h. Outdoor Locations - Damp Locations
    i. Each receptacle installed outdoors or in a damp location shall be corrosion resistant having all parts from stainless steel or nickel-plated brass
    ii. Surface mounted receptacle boxes or junction boxes shall be stainless steel.
    iii. Recessed receptacle boxes may be plastic with approval of PDC and VUMO..
    iv. Protect exterior switches and those in mechanical rooms which act as plenums by a cast aluminum metal plate with a fiber shield and spring-loaded cover.
    v. Protect exterior receptacles and those in mechanical rooms which act as plenums by a cast aluminum metal plate with a stainless-steel spring loaded, gasketed, double flap lift cover to remain locked in either open or closed position.
    vi. When required, provide Ground-Fault Interrupters (GFI) which will interrupt leakage currents between 4-6 milli-amps having a maximum circuit current of 20 amperes. Employ feed through or non-feed through devices as indicated, or as required by NEC.
i. Mount switches vertically with the "on" position on top, unless noted or specified otherwise. Mount at 4'-0" above finished floor. Coordinate the location of switches to insure locations at the strike side of doors. Furnish and install an engraved faceplate legend for each switch that controls motors, equipment systems, etc., and for lights not located within sight of the controlling switch.
j. Unless otherwise noted, mount receptacle vertically with U-shaped ground position on bottom. Mount at 18" above finished floor, except where indicated otherwise.
k. Ground-Fault Interrupters - swab all conduits clear of moisture. Do not combine G.F.I. protected circuits with other circuits in same raceway. Provide a separate raceway for each G.F.I. protected circuit.

16. Emergency Standby Generator Systems

a. System shall provide for completely automatic unattended operation, for the duration of any loss of normal utility power.
b. Acceptable manufacturers include Caterpillar, Kohler, and Cummins.
c. Engine shall be full diesel, compression ignition, liquid-cooled, domestically manufactured and capable of producing the rated KW at a governed speed of 1800 rpm as specified under job site conditions. Engine to be equipped with electric starting, battery charging generator, electronic governor, fuel filters, oil filters, air cleaners, cooling system, and other equipment to provide a complete operable system. Selling distributor to be a factory authorized distributor of the diesel engine utilized in the standby engine generator system.
d. Generator package shall include stairs, platform, or any other components needed to provide full accessibility to the generator.
e. Mounting: Complete engine/generator and all mounted accessories shall be assembled on a common channel steel base. Fuel oil lines and lube oil drain shall terminate in base. Lube oil drain line shall be brought out to beyond the base to facilitate changing of the oil. Flexible fuel line sections (18" long) to be installed between base and fuel lines. Heavy-duty, steel spring vibration isolators shall be installed between the base and mounting pad. Isolators shall be sized and located as recommended by generator manufacturer
f. Contractor shall provide the services of a factory-trained representative for periodic job site visits during installation to ensure that the system is being installed in accordance with manufacturers' recommendations.
g. Complete engine/generator system shall be tested after installation to ensure that the engine/generator, automatic transfer switch, alarm annunciators, and all other equipment function in accordance with the specifications.
h. After installation, a 4-hour full load test shall be conducted by the distributor's representative. This test shall be conducted using available building load, plus temporary load bank capacity so that full nameplate reading is utilized during test. Temporary load banks shall be furnished by generator distributor and connected by Division 26 contractor.
i. Ground the engine generator frame and enclosure using an equipment grounding conductor sized in accordance with the NEC.

17. Uninterruptible Power System (UPS)

a. Acceptable manufacturers include Eaton, Vertiv, Schneider, or approved substitute.
b. Operating modes
    i. Normal Mode: The critical load shall be continuously supplied with regulated output power without battery backup power even under extreme brownout conditions (-20% of nominal). Line power shall be supplied to the Power Purification System and battery charger simultaneously maintaining a continuous float charge on the batteries.
    ii. Emergency Mode: Upon failure of the commercial AC power, battery power is transferred through the inverter to the Power Purification System. There shall be no interruption of regulated and conditioned power to the critical load upon failure of restoration of the commercial AC power.
    iii. Bypass Mode (Manual and Internal): If a problem occurs within the system due to an overload or internal failure, the manual bypass switch shall be activated to connect the commercial AC power to the Power Purification System. Thus, regulated and conditioned power is still supplied to the critical load until the problem is corrected. The bypass shall be internal to the UPS. System requiring external switchgear shall not be acceptable.

18. Automatic Transfer Switch

a. Acceptable manufacturers include ASCO, Kohler, Zenith, Russelectric, or approved substitute.
b. Operating modes
   i. Transfer switch(es) to be in NEMA-1 wall-mounted enclosures unless otherwise indicated. All control relays to be accessible from front of enclosure for maintenance and repair. Transfer mechanism to be electrically operated, mechanically held. Failure of the emergency source shall result in retransfer to the normal source. The transfer switch to be equipped with a manual operator to allow for manual transfer.
   ii. Engine starting contacts to be provided to start engine, should the voltage of the normal source drop below the preset value, after a time delay of 1-3 seconds to allow for momentary dips.
   iii. After restoration of normal power, transfer switch shall remain in emergency position for an adjustable period of 0-30 minutes (set for 15 minutes unless directed otherwise). After retransfer to normal, engine/generator to continue to run for an adjustable period of 0-20 minutes to allow for cool down. A voltage/frequency relay to be provided to prevent transfer to the emergency source until operating level is attained.
   iv. In addition to position indicating lamps, auxiliary contacts to be provided (one normally open, one normally closed).
   v. Provide test switch to simulate a power failure, under load conditions.
   vi. Provide an automatic exerciser to operate the unit for a period of 30 minutes every 168 hours. During exercise period, transfer switch(es) shall not transfer to the emergency source.
   vii. Transfer switches used with ground-fault equipment, 4-wire systems to be 4-pole switched neutral or 3-pole with overlapping neutral contacts.
   viii. Switch(es) to be double throw actuated by a single operator, momentarily energized. Main contacts may be replaced without major disassembly. Transfer switch(es) with magnetic blow cuts to be provided on each pole.
   ix. Normal voltage sensing to be on 3-phase with pick-up at 95 percent and drop-out at 90 percent of normal voltage.
   x. Interlocked molded case circuit breakers, contactors or transfer devices with dual solenoid operators are not acceptable.
   xi. ATS shall be equipped with a transparent protective cover allowing visual inspection of contacts while inhibiting inadvertent contact with energized components.

19. Interior Lighting

a. All interior lighting shall be LED
   i. Color: 3500K
   ii. Any variance in lighting color shall require approval through the Design Variance
b. Dimmable – 100%
c. Compatible with VU's Encellium and Lutron lighting control systems

DIVISION 27 – COMMUNICATIONS

1. **VUIT Network Infrastructure Standards** – Refer to Appendix D.
2. **VUIT A/V Design Standards –** *(Appendix F - These are being developed as in conjunction with the 2026 Campus Masterplan)*

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

1. **Design Requirements**
   a. Addressable systems should be installed in new buildings and in major remodels of existing buildings.
   b. Voice systems are required in all new construction and upgrades.
   c. On additions or remodels to existing systems, specify new equipment of the same manufacturer as existing equipment.
   d. For new fire alarm systems, equipment should be supplied by a factory-authorized Tennessee-based distributor with service personnel located within 50 miles of campus.
   e. Acceptable manufacturers include Honeywell, Johnson Controls (formerly Simplex Grinnel), and Autocall.
   f. Discuss the following items with PDC and VUMO personnel during Schematic Design:
      i. Location of fire department attack entrances
      ii. Locations where information is available to emergency responders
      iii. Location of the fire alarm control panel and any annunciators
      iv. Basic system configuration, i.e. addressable, zone, voice
      v. HVAC fan shutdown
      vi. Fire rated hinged door hold-open system and voltage
      vii. Fire rated coiling door operating system
      viii. Security/access system
      ix. Atrium detection system
      x. Smoke control system
      xi. Fire extinguishing system
      xii. Chemical spill alert system
      xiii. Severe weather warning system
      xiv. Elevators
   g. Fire alarm systems should typically be provided in all buildings with transmissions supervised by the FM Approved central station, proprietary system or constantly attended public fire service. Installation, operation, and maintenance of the alarm system should be in accordance with FM Global.
   h. Provide smoke detectors in electrical transformer and switchgear rooms. The smoke detectors should be arranged to alarm to a constantly attended location.

2. **Construction Requirements**
   a. When the Contractor is working on operating fire alarm systems, only circuit(s) involved in the work may be bypassed or disconnected and only during working hours.
      i. The system must be operational at the end of the work day.
      ii. The Contractor should cover detectors in construction areas during dust producing operations and uncover detectors at the end of the work day.

3. **Certification Testing**
   a. Acceptance testing must be witnessed by the Owner's Fire Safety technician.
   b. Notification appliance circuits should be measured and recorded on certification documents as follows:
      i. In the alarm condition, the final system operating current and voltage at the fire alarm control panel and voltage at end of line for each horn and strobe circuit.

1. The maximum voltage drop must be less than 10%; correct is needed before certification.

ii. The fire system loop resistance of speaker circuits.
1. The maximum loop resistance must be less than 20 ohms; correct if needed before certification.

4. Documentation

a. Provide an electronic record of the fire alarm system superimposed on the building background.
i. Show a wiring/connection drawing for fire alarm devices where new fire alarm hardware is connected into an existing system.
ii. Specify submitting the completed and signed NFPA 72 certification documents to PDC when the fire alarm is commissioned.
1. If acceptable to the regulating authority, specify submitting manufacturer's standard documentation instead of the NFPA Certificate.

5. Conductors and Cables

a. Design the fire alarm system as a "power limited" system.
i. Specify minimum size #18 AWG conductors, with larger sizes as needed.
ii. Wiring should be 3/4 inch minimum raceway.
iii. Fire alarm cable should be plenum rated, even when used in non-plenum areas or in raceway.
iv. Wire and cable size and type should be as recommended by the fire alarm manufacturer.
v. Where cable shields and conductors are spliced, the splices should be soldered and then insulated.
1. Wire connectors (wire nuts) are acceptable as insulation.
vi. For risers and other splice points with more than three conductors, junction boxes with terminal boards should be used to eliminate soldering and allow easy disconnection for isolation.
1. Wire type, size and manufacturer should be recommended by the equipment manufacturer.

6. Grounding and Bonding

a. Shields should be isolated from ground, except at designated points.
i. For proper circuit monitoring, fire alarm enclosures, boxes and raceways should be grounded, even if they carry only power limited circuits.

7. Identification

a. Junction boxes must be marked by painting them red and stenciling "FA" on the cover.
b. All fire alarm system conduit should be red in color.

8. Fire Alarm Control Panel

a. Locate in a non-public, low traffic area with an annunciator at the fire department attack entrance. Discuss locations with PDC, VUMO, and EH&S personnel.

9. Power Supplies

a. For the main power source, 120 VAC building power should be used with emergency generator backup if available.
    i. For a secondary emergency power source, an internal battery pack should be used.
    ii. Do not specify an inverter backup.
b. In buildings without emergency generators, battery capacity should be as follows:
    i. 24 hours of standby plus 5 minutes in alarm with all notification appliances operating.
    ii. Additional 50% spare capacity.
c. In buildings with emergency generators, battery capacity should be as follows:
    i. 4 hours of standby plus 5 minutes in alarm with all notification appliances operating.
    ii. Additional 50% spare capacity.
d. For pre-action sprinkler systems, batteries with 90-hour standby capacity should be used.
e. For new fire alarm control panels, oversize enclosures should have a minimum of 25% spare initiating zone or addressable point capacity and 25% spare notification appliance capacity.
f. A dedicated circuit should be used for each fire alarm control panel with the breaker installed with a breaker lock and plainly marked.
g. Locate a convenience receptacle for services purposes within 3’ of the fire alarm control panel.

10. Bypass Switches

a. Switches should have an associated light emitting diode (LED) in the control panel programmed for the following bypass functions:
    i. Door holder release bypass
    ii. Air handling unit shutdown bypass
    iii. Alarm and supervisory signal bypass (city disconnect)
    iv. Horn and strobe disable
    v. Elevator capture bypass
b. Enabling any of the above bypass functions should result in a trouble signal.
    vi. Trouble signals cannot be bypassed.

11. Voice Systems

a. Voice systems should be used for all new building and major remodeling, and existing alarm upgrades.

12. Communication with the Campus Emergency Responders

a. A stand-alone fire alarm system should be used in each building that communicates with the BAS.
b. Provide a programmable dry relay contact at the fire alarm control panel for each of the following functions:
    i. General alarm (evacuation)
    ii. System trouble
    iii. Supervisory alarm (when used)
    iv. Chemical spill (when used)
    v. Special alarms (when used)
c. The fire alarm control panel should be configured to provide contacts which open on alarm.
d. A 3/4" inch conduit with 18-2 shielded cables should be used as required between the fire alarm control panel and the nearest building automation panel.
e. The fire alarm control panel should have a digital alarm communicator installed.

13. Initiating Devices and Circuits

a. Where zoned system detectors are located in elevator shafts, attics, crawl spaces, and similar locations, a remote LED should be installed in an accessible location.
   i. A sign should be used to indicate the detector type and location.
   ii. If access to the detector is not apparent, directions must be included on the sign.
   iii. Use black ¼ inch upper case characters on a white background on or adjacent to the LED cover.
b. Do not specify remote LEDs for addressable systems.

14. Pull Stations

a. Locate at every entrance to a stair tower.
b. Single action type should be used with centerline at 42 inches above finished floor.
   i. Discuss the use of double action type with PDC, VUMO, and EH&S personnel.
   ii. Pull stations must have covers at child care areas and areas of potential vandalism.

15. Detectors

a. Photoelectric type smoke detectors should be used for general use.
b. Hardwired, interconnected, NFPA compliant carbon monoxide detectors shall be provided for rooms with a cag or wood burning fireplace, gas stove, or gas water heater.
c. Do not specify ionization type smoke detectors.
d. Where the environment allows, use electronic type heat detectors.
e. Use rate of rise plus fixed heat detectors in laboratories.
f. In stair towers, locate the top detector accessible from a ladder placed on the top landing.
g. Review atrium detection with PDC, VUMO, and EH&S personnel.
h. Air sampling duct detectors should follow NFPA 90A requirements.
   i. Locate upstream from humidification equipment
   ii. Do not specify air handling unit shut down hard wired to relay bases in detectors.

16. Sprinkler System Devices

a. Sprinkler valve tamper switches should be installed to initiate a “supervisory” condition.
b. Tamper switches should be provide for post-indicator, zone shut off and back flow prevention valves.
c. Programming of water flow switches should sound the general alarm and provide time delays as necessary for stable system operation.
d. Locate a transient voltage surge suppression device just inside the building on wiring to remote post indicator valve(s).

17. Notification Appliances and Circuits

a. Where ceiling height permits, locate the centerlines of wall mounted horns, speakers, strobes and combination devices at 92 inches above finished floor.
   i. In all cases, locate the centerline of the device at least 6 inches below the ceiling.
b. Provide adequate circuits for Audible and Visual devices.
   i. Give careful attention to the wire sizing for voltage drop when specifying high current visual devices.
   ii. High current visual devices may require specifying expansion power supplies.

c. In an alarm condition, measure and record the circuit current and the voltage at both the fire alarm control panel and at the end of the line resistor.
    i. If the measured “as built” voltage drop exceeds 10%, make corrections before acceptance.
d. Measure the final loop resistance of speaker circuits at the fire alarm control panel.
    i. If the maximum resistance is more than 20 ohms, make corrections before acceptance.
e. Do not locate audible devices in stairwells.
f. Specify fire resistant, moisture repellent, paper cone type speakers. Ceiling speakers are acceptable.
g. Do not locate strobes or other visual devices in stairwells.

18. End of Line Devices

a. Install inside the last device on the circuit and mark with a 1/4 inch diameter blue dot on the outside of the device.
b. Show all locations on the as-built drawings.

19. Annunciators

a. A liquid crystal display (LCD) type should be located at the fire department attack entrances as determined by discussion with PDC and EH&S personnel.
    i. Do not specify graphic annunciator panels.
b. Locate to prevent sunlight from washing out the LCD display.
c. Operating controls such as reset, acknowledge, and smoke control should be accessible by key only.

20. HVAC Fan Shutdown

a. Locate fan shutdowns where required by current code.
b. Where the fire alarm system is addressable, HVAC fan shutdown should use addressable relay modules.

21. Fire-Rated Hinged Doors

a. Where fire rated doors are held open and released when in alarm, use electromagnetic door holders or closer/holders.

22. Fire Rated Coiling Doors

a. For coiling door systems, obtain approval from the Owner’s Representative before specifying.
b. Carefully review control and operational power.
c. Use an approved door operator that powers the door both up and down. Manual door operation should not be used.
d. Fire alarm system detectors should be used with auxiliary contacts or fire alarm control panel operated relays on both sides of the door, regardless of ceiling height, to release the door in the event of a fire.
    i. If either door detector alarms the building fire alarm system will sound a general alarm and the door will close.
    ii. If a detector elsewhere in the building alarms, it will sound a general alarm, but the doors will not close.

23. Elevators

a. There should be means to monitor shunt trip power.

b. Locate relays and monitor modules in the elevator equipment room for connection to elevator equipment.
c. In new addressable systems, initiate from the fire alarm control panel, no exceptions.
d. In existing buildings, discuss with VUMO for fire alarm system capabilities and details.
e. For smoke and heat detectors at the top of the hoist way, provide access from the top of the car.
f. For non-addressable alarm systems, locate a remote indicator at the top floor elevator lobby.
g. Addressable relays should be used for recall, no base relays in the detector.
    i. Where the fire alarm system is addressable, elevator shutdown should use addressable relay modules.

DIVISION 31 - EARTHWORK

1. Finish Grading

a. General
    i. Have topsoil tested and approved prior to it being moved to the project site. See requirements below.
b. Topsoil
    i. Provide topsoil equivalent to Maury silt loam: 12-27% clay, 20-50% sand, 40-68% permeability 2-6 inches per hour, low shrink-swell potential, pH 6.0-7.0. Topsoil to have a minimum 2% organic material.
    ii. Topsoil shall be tested for sand, silt and clay percentages, organic content, pH and nutrient content.
    iii. Topsoil shall be free of live Bermuda grass roots, stones or roots over 1 inch diameter and other foreign matter. Use topsoil stockpiled on if conforming to these requirements. If inadequate topsoil exists on site, contractor shall be responsible for providing additional topsoil.
    iv. Refer to Planting for topsoil mix specification, including required organic and inorganic topsoil amendments. All imported soil to meet topsoil requirements. If onsite topsoil does not meet specifications, topsoil to be amended as required to meet specifications.
c. Placing Topsoil
    i. Place topsoil in areas where seeding, sodding and planting is to be performed. Place to the following minimum depths, up to finished grade elevations:
        1. 12 inches for seeded or sodded areas or groundcover beds
        2. 24 inches for shrub beds
        3. 36 inches for tree pits
    ii. Use topsoil in relatively dry state. Place during dry weather.
        1. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours indicated on the grading plan.
        2. Remove stone, roots, grass, weeds, debris and other foreign material while spreading.
        3. Manually spread topsoil around trees and plants to prevent damage which may be caused by grading equipment.
        4. Lighting compact placed topsoil.
d. Clean-Up
    i. Upon completion of work, clean up and leave area free of debris, excess material and equipment.
    ii. Any excess earth shall be removed from the area by the contractor, who shall properly dispose of the material.

iii. If any area of acceptable topsoil is disturbed during other construction activities, non-compliant topsoil should be removed and brought into standards.

2. Termite Control

a. In all new construction and major renovation projects, the designer should require preconstruction soil treatment for termite control. Effective subterranean termite control requires the establishment of unbroken vertical and/or horizontal chemical barrier between wood in a facility and termite colonies in the soil. Treated areas should be posted with a written warning until they are covered. Prior to treatment, the Contractor should give PDC one week's notice so that a representative of VUMO may schedule random sampling of the treated soil. The Treatment Contractor will be required to warrant his work for a period not less than five years and bid documents should request a unit price for annual inspection for a ten year period.

b. Approved treatment emulsions are as follows:
   i. 1% Dursban TC
   ii. 1% Demon TC
   iii. 1% Gold Crest Tribute
   iv. .75% Pryfon 6 Insecticide

DIVISION 32 – EXTERIOR IMPROVEMENTS

Refer to Appendix B – Campus Landscape Design Standards for Guidance on appropriate use of fixtures, furniture and site elements.

1. Tree and Shrub Preservation

a. Design and Planning
   i. Vanderbilt University is known for its mature tree canopy. Coordinated planning and design across all trades is crucial to successfully preserving a tree.
   ii. During planning and design, work with VU to identify significant trees to preserve. Grounds should perform a visual inspection to confirm health of tree.
   iii. No more than 20% of root zone (area under canopy) of a tree planned for preservation should be impacted including utility excavation. If more than 20% will be impacted, tree should be considered a high risk of loss and plans made to mitigate impacts with Arborist oversight or concede removal.
   iv. In addition to impacts of project improvements, also consider impact of access paths for construction and routes for rerouting vehicles and pedestrians around the construction site.
   v. Document trees planned for removal and trees planned for preservation.

b. During Construction
   i. Contractor will be held liable for damage to a protected area or any tree not otherwise marked for removal.
   ii. Before mobilization, walk construction site and access areas with PDC/University Landscape Architect to confirm tree and shrub protection. Document protection areas. Do not mobilize before tree protection is installed.
   iii. PDC will determine with arborist which trees need treatments during or after construction, these could include biochar or mycorrhizae injections.
   iv. During summer months, provide deep watering to protected trees once per week during dry weeks.

v. Protect all trees and shrubs not marked for removal inside construction zones.
vi. Install tree protection fencing before demolition or grading. Fence should follow dripline where possible.
vii. Tree protection fencing:
    1. Use galvanized 6 ft. chain-link fencing with steel posts spaced max 10 ft. o.c.
    2. Post signs reading 'TREE PROTECTION ZONE' on all fencing.
viii. Do not move, park, or store equipment/materials within protection zones.
ix. Plan utilities and other site improvements to minimize root disturbance. If work must be performed under tree canopy. Coordinate early with PDC/University Landscape Architect to plan construction methods:
    1. Bore utilities if possible. Hydrovac or hand dig if possible. Open trench excavation is a last resort.
x. If the root zone will be impacted by direct construction work or compaction related impacts, provide air spading and biochar remediation after heavy construction is complete, usually in combination with the landscape installation phase.
xi. Do not raise or lower grade in the root zone of protected trees by more than 3”.
xii. Tree removal:
    1. Flag all trees to be removed for review by PDC/University Landscape Architect prior to removal.
    2. PDC/University Landscape Architect will direct contractor to save particular specimen trunks for reuse.
xiii. Perform root protection trenching (minimum 30 in. depth) where work encroaches on root zone. Fill with topsoil compacted to 85% proctor and 3-4” hardwood mulch.
xiv. Contractor shall employ a ISA Certified Arborist with at least 5 years’ experience for all tree protection work.
xv. Repair or replace damaged trees as directed by PDC/University Landscape Architect. University may withhold assessed value of damaged trees for up to two years pending evaluation.
xvi. Construction Roads over Root Protection Zone
    1. Contact PDC to review and approve a temporary access through root protection zones. Use ½” plywood, filter fabric and 8” crusher run or double ½” plywood for light use.

2. Concrete Walks and Paving

a. Design
    i. Fillet all sidewalk corners with 3’ radius
    ii. Broom finished concrete only acceptable by variance in utilitarian areas.
b. Reviews
    i. Stake paving layout and joint layout for PDC/University Landscape Architect review. Include control joints and expansion joints (can use marking paint)
    ii. PDC to review formwork prior to pouring.
    iii. Mock-up required for all concrete paving types (4'x4' panels). Include example of joint.
    iv. Control joints: max 30' o.c. or as shown on plans.
c. Thickness:
    i. Standard concrete will be minimum of 6” thick.
    ii. Vehicular concrete will be 8” thick with welded wire reinforcement.
d. Mixture

i. 4,000 psi min for 28 days
ii. Air content , 6% ±1%
iii. Water Cement Ratio: Max 0.45
iv. Portland Cement: Type 1L - 470 lbs./C.Y. ASTM C150
v. Stone: (river gravel ½" or less), 1,600 lbs./C.Y. TDOT
vi. Water: 240/C.Y.
vii. Natural Sand: 1,335 lbs./C.Y. TDOT
viii. Fly Ash: Class C 70 lbs./C.Y. ASTM C618

e. Finish
   i. Vanderbilt Old Concrete Finish:
      1. Aggretex “H” retardant, by A.C. Horn, Rugasol C/S/, by Sika, or approved equal.
f. Vanderbilt New Concrete Finish:
   i. Grace Topcast 15, installed per manufacturer recommendations
g. Joints
   i. Control
      1. Provide control joints as indicated by landscape architect. Provide “V Cut” joints with a 3/8” chamfer.
   ii. Expansion
      1. Provide expansion joints with ASTM D1752 filler. 30’ OC. Max. Maintain snap cap until hardscape is cured. Remove before punch.
   iii. Sandblasting: Vertical cast-in-place concrete is not allowed unless by variance and only then in utilitarian areas out of public view. Contractor to provide a 4’ long x 4’ tall vertical panel to demonstrate consistency of exposure and appropriate execution. Contractor to follow all required health and safety protocols.

3. Irrigation

a. Submittals and Drawings
   i. Submit shop drawings, materials list, and as-built CAD drawings before approval and closeout.
   ii. Photograph and document all lateral/mainline pipe installations prior to backfill (with measuring device)
   iii. Contractor must warranty all labor and materials for 1 year; includes first winterization and spring startup.
b. Design and Additional Considerations
   i. No drip irrigation allowed. Only spray.
   ii. Provide full coverage in all irrigated areas; additional heads at Contractor's expense if needed
   iii. Install locator wire on all main and lateral lines.
   iv. Use Schedule 40 or 80 PVC pipe and fittings; risers must have swing joints. Control wiring must follow local code and be waterproof at all splices.
   v. All 24V control lines to be color-coded and buried per code.
   vi. Contractor to provide 4 hours of training to Owner personnel post-startup.
c. Controllers and Control Equipment
   i. Controller: Hydropoint WeatherTrak OptiFlow XR with Ethernet capability. Provide Ethernet connection and power.
   ii. Must include a 3-year subscription to WeatherTrak Central Service

iii. Mounted in a lockable, weatherproof wall box at 48" above grade to be located at an accessible, but out of view. Location to be reviewed and approved by PDC.
iv. Allow for manual operation if timing mechanism is removed
v. Program with “Cycle-Soak” feature for zones with slope or poor drainage

d. Valves and Boxes
i. Automatic Control Valves: Same operation type as controllers; model per drawings
ii. Quick Coupling Valves: Rainbird Model 44-RC; heavy-duty brass, locking rubber cover
iii. Include 3 coupler keys and 3 hose ell adapters
iv. Gate Valves: Brass, non-rising stem, 200 psi min rating; use valve boxes
v. Valve Boxes: Rainbird PVB Professional Series; 10” round; green (or purple for reclaimed water)

e. Sprinkler Heads and Nozzles
i. Acceptable Head: Rainbird 1800-SAM-PRS (Rainbird nozzles)
ii. With Hunter MP Rotators: Use 1800-SAM-P45 heads
iii. Include swing joint assembly with polyethylene swing pipe and barbed/marlex ells
iv. Max 2’ swing pipe length; >4 GPM use PVC triple elbow swing joint

f. Piping and Fittings
i. Pipe burial depth: 2” diameter or greater, 18” depth. Less than 2” diameter, 12-18” depth. All athletics fields, 24” depth. 24” depth max.
ii. PVC Pipe (¾"–1½"): Class 200, Type 1120/1220, conform to CS-256-63
iii. PVC Fittings: Schedule 40, Type 1, domestic manufacture
iv. Swing Joints: PVC triple swing for 6.5–10 GPM heads; Schedule 80/40 fittings
v. Copper Tubing: Type K, domestic only, ASTM B88
vi. Sleeves: Schedule 40 PVC, 12–24" deep, extend 18" beyond paving

g. Wire and Splices
i. All wiring to be in rigid conduit and 12” minimum depth. Do not stack lines.
ii. Control Lines: 24-volt, direct burial UF wire (color-coded); minimize splices
iii. Splice Kits: 3M DBY-6 or Rainbird DB Series; rated for direct burial and submersion
iv. Locator Wire: 16-gauge, continuous from controller to ends; coil 18" in controller box

h. Drainage and Backflow
i. Manual Drain Valves: At all low points; installed in valve box with 24" gravel sump
ii. Automatic Drain Valves: Required if lateral lines do not drain by gravity
iii. Backflow Preventer: Double check valve; comply with local plumbing codes. BACKFLOW SHOULD ALWAYS BE LOCATED WITHIN BUILDING MECHANICAL ROOM. NO EXTERIOR FREESTANDING BACKFLOWS ALLOWED WITHOUT VARIANCE.

i. Testing and Operation
i. Test for leaks at 100 psi for 1 hour minimum before backfilling
ii. Flush all piping prior to head installation
iii. Coverage test must be passed before final inspection
iv. Provide training and keys to Owner after final walkthrough
v. Perform seasonal winterization and spring startup during warranty period

4. Planting

a. Design Considerations
i. Native Plants and Plant Diversity

1. To expand its Arboretum status, designers should prioritize diversity over uniformity. Small groupings of matched trees are desirable, but otherwise, strive to plant a diversity of trees, prioritizing native plants.

ii. Trees
1. Minimum of 3” caliper, B&B trees unless otherwise specified by PDC/University Landscape Architect. PDC will make exceptions for difficult to source, uncommon selections.
2. Trees should be sourced from qualified nurseries. PDC/University Landscape Architect will provide a current list during project design.
3. PDC/University Landscape Architect will attempt, schedule depending, to tag trees in nurseries. If they cannot, photo submittal will be accepted.
4. Large shrubs and trees that can inhibit visibility to cameras and pedestrians are not to be planted next to sidewalks, directly outside of building doorways, or in parking lots. Coordinate during construction documents with PDC and VUPS.

b. Soil Requirements
i. Planting soil mix:
1. 2 parts loam, 2 parts compost or soil conditioner, 1 part sand.
2. Add 3 lbs of 6-12-12 fertilizer per cubic yard.

ii. Loam characteristics:
1. pH 5.5–6.5; 5–10% organic matter; 30–50% sand; 30–50% silt; 10–25% clay.

iii. Compost: From The Compost Company, pH 5.5–8, 100% passing 1" sieve.
iv. Bioretention soil: Must meet Metro Nashville Stormwater specs.

e. Mulch
i. 3” depth pine bark mulch, feathered to 0” at root flare.
ii. No mulch over trunk base.

f. Fertilizer and Amendments
i. Apply per soil test recommendations.
ii. Include:
1. Transplant biostimulant spray for all tree stock.
2. Mycorrhizal injection grid (2’ spacing) in all planting areas.
3. Amendments: feathermeal (25%) + humate + mycorrhizal spores.

g. Herbicide and Fungicide
i. Pre-emergent herbicide: LESCO Ornamental Herbicide 5G or approved equal.
ii. Fungicide and insecticide: Spray all deciduous tree trunks immediately after planting.

h. Tree Watering
i. Use Treegator® 20-gallon slow-release watering system for all trees.

i. Timing and Notification
i. No tree planting from May 1 – Sept 1 without written approval.
ii. Notify PDC at least 2 working days before any delivery.

j. Handling and Storage
i. Transport plant material covered and upright; no storage longer than 3 days.
ii. Reject if soil balls are broken or roots dried out.
iii. Do not prune prior to delivery.

k. Installation
i. Contractor to lay out trees and shrubs, mark out bed edges and perennial groupings with paint to review with PDC/University Landscape Architect prior to installation.

PDC/University Landscape Architect reserves right to move any material after it has been planted before final acceptance.
ii. Scarify container roots; slice bottom if root-bound.
iii. Trees: Remove top of wire basket and all burlap from rootball top and sides.
iv. Tree flare must be visible and set slightly above finished grade.
v. Trees must be tied down with below-grade rootball anchors.
vi. Backfill in 6" lifts with planting soil mix; water thoroughly at ⅔ fill.
vii. Form watering saucers and water twice after planting.

l. Staking and Pruning
i. Stake all trees using underground guying or stake system per drawings.
ii. Prune only at Architect's direction; no geometric pruning.

m. Sod and Seed
i. All irrigated areas to receive Fescue sod unless otherwise noted by PDC.
ii. Lay sod within 72 hours of harvest, never stretched or overlapped.
iii. Water immediately to depth of 1" below sod.
iv. Seed
v. Seed: rake into top ¼" of soil; water to 2" depth without erosion.

n. Maintenance and Warranty
i. Contractor to provide daily watering (1 gal/inch caliper) until final acceptance when site is turned over to VU Grounds .
ii. Maintain plants until Final Acceptance; includes weeding, mulching, fertilizing, pest control, and staking.
iii. Replace failed plants once during the 1-year warranty.
iv. Remove ties, wraps before final inspection.

APPENDIX

A – Architectural Design Standards *(In Development)*
B – Campus Landscape Design Standards
C – Laboratory Safety Design Guidelines
D - VUIT Network Infrastructure Standards
E – VUIT AV Design Standards *(In Development)*
F - Signage and Wayfinding Design Standards *(In Development)*
G - High-Performance and Resilient Infrastructure Design Guidelines