

**SECTION II –
DESIGN PROFESSIONAL AND
CONSULTANT SERVICE
GUIDELINES**

This section contains information to be used by Design Professionals in the planning, design and development of University of Iowa facilities and its infrastructure and by consultants performing specialty services and is structured for design-bid-build delivery method. For alternative delivery, Design-Build (Bridging) or Construction Manager at Risk, changes to this section may be necessary and shall be reviewed with the Owner. Section II does not apply to the University's Utility Operator.

The criteria is presented to compliment the Section III - General Design Standards. The Design Professional shall familiarize themselves and shall be responsible for implementing all criteria and guidelines.

The Design Professional shall plan and design facilities and infrastructure with consideration given to serviceability, maintainability, and sustainability.

The University employs a total-cost-of-ownership decision framework for project designs; considering, on a present value basis, the initial capital cost, annual operating costs, and future expected renewal costs over the life of the facility and/or infrastructure that will yield the lowest total cost.

I. DESIGN GUIDELINES

1. GENERAL

- 1.1. University facilities and infrastructure shall comply with all applicable codes as adopted by the State of Iowa or other governing authorities.
- 1.2. University facilities shall be designed with flood protection/mitigation up to the 500-year flood level plus 2 feet 0 inches.
- 1.3. Codes and standards required by accreditation agencies, such as the Joint Commission for Accreditation of Hospitals (JCAHO), shall also be used unless the International Code Council (ICC) requirements are more stringent.
- 1.4. In the event that special design features and/or construction systems are not covered in the ICC codes, it shall be approved by the [Iowa Department of Inspections, Appeals, and Licensing, Building and Construction division](#). ~~State Building Code Bureau, a division of the State Fire Marshal Office.~~
- 1.5. The University of Iowa is committed to the design and construction of facilities which comply with State and Federal requirements for accessibility. The codes and standards listed herein shall be used in establishing the very minimum requirements (using the most stringent if there are any differences) for the design and construction of accessible facilities. Any design or elements thereof that the Design Professional may question as being aligned with the University's position on universally accessible environments or the ADA's intent, including identification of potential risks associated with code / law interpretations, shall be brought to the attention of the Owner early in the Design Phase to allow for analysis and direction.
- 1.6. Building design, including renovations, shall be based on "Universal Design" concepts and criteria when requested by the Owner. Universal Design is defined as "A process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation." (*Steinfeld & Maisel Universal Design – Creating Inclusive Environments, p. 29*) In short, Universal Design makes life easier, healthier, and friendlier for all."
- 1.7. Alterations: Path of Travel. An alteration that affects or could affect the usability of or access to an area of a facility that contains a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the altered area and the restrooms, telephones, and drinking fountains serving the altered area, are readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs, unless the cost and scope of such alterations is disproportionate to the

cost of the overall alteration. Full carpet replacement (based upon reasons other than standard maintenance practices) in rooms and/or floors containing a primary function shall be considered an alteration.

1.7.1. Kitchenettes serving an altered area are not required to be included within a path of travel scoping schedule however break rooms shall be included.

1.7.2. Areas used exclusively by employees for work are not required to be fully accessible however such areas should be designed to include non-required turning spaces providing accessible features when possible.

1.8. Asbestos-containing materials shall not be used.

1.9. The Design Professional when performing existing condition surveys in UIHC facilities shall adhere to the UIHC Infection Control standards and shall ~~be~~ coordinate access with the Owner. Surveys may be required to be conducted outside of 8 am – 5 pm Monday through Friday.

1.10. The Design Professional shall breakout the costs to bring utilities (steam, chilled water, electric, domestic water, and sanitary sewer) to within 300 feet of the building footprint when utility rates are charged to the university's project customer.

1.11. The University entered a Public Private Partnership (P3) agreement in the spring of 2020 for management of several campus utilities. The ~~U~~niversity's utility operator shall be involved in all projects that are impacted by this agreement.

1.12. During design, unless otherwise directed, meeting minutes shall be issued to the Owner's Representative for review within five (5) working days of a meeting. Following review by the Owner, the Design Professional or Consultant (whichever is applicable) shall distribute the meeting minutes to all project participants.

2. BUILDING AREAS

2.1. Gross Area is the sum of all areas on all floors of a building included within the outside faces of its exterior walls, including all vertical penetration areas, for circulation and shaft areas that connect one floor to another.

2.1.1. Calculate Gross Area by measuring from the outside faces of exterior walls, disregarding cornices, pilasters, buttresses, etc., that extend beyond the wall faces.

2.1.2. Exclude areas having less than a 3-foot clear ceiling height.

2.1.3. In addition to internal floored areas, Gross Area includes:

2.1.3.1. Excavated basement areas

2.1.3.2. Interstitial spaces (i.e., mechanical floor or walkways)

2.1.3.3. Mezzanines

2.1.3.4. Penthouses

2.1.3.5. Attics

- 2.1.3.6. Garages
 - 2.1.3.7. Covered porches, whether walled or not
 - 2.1.3.8. Inner or outer balconies to the extent of a drip line from a roof or balcony immediately above, whether walled or not, if they are used for operational functions.
 - 2.1.3.9. Corridors or walkways, whether walled or not, provided they are either within the outside face lines of the building to the extent of the roof drip line or, if covered, to the extent of their cover's drip line.
 - 2.1.3.10. The footprints of stairways, elevator shafts, and vertical duct shafts are counted on each floor through which they pass.
 - 2.1.3.11. The top, unroofed floor of parking structures where parking is available.
- 2.2. Net Assignable Area is the sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use. Areas defined as building service (i.e., public rest rooms, spaces), circulation, mechanical (including electrical and telecommunications closets) and structural are not included.
- 2.2.1. Calculate net assignable area by measuring from the inside faces of surfaces that form the boundaries of the designated areas.
 - 2.2.1.1. Exclude areas with less than a 3-foot clear ceiling height.
 - 2.2.1.2. Do not make deductions for necessary building columns and projections.
- 2.3. Non-assignable Area is the sum of all areas on all floors not available for assignment to an occupant for specific use, but necessary for the general operation of the building.
- 2.3.1. Areas defined as building service (i.e., public restrooms, custodial spaces).
 - 2.3.2. Circulation areas.
 - 2.3.3. Mechanical areas (including electrical and telecommunications closets).
 - 2.3.4. Measure from the inside faces of surfaces that form the boundaries of the designated areas.
 - 2.3.5. Exclude areas with less than a 3-foot clear ceiling height.

II. BUILDING CODES AND STANDARDS

1. BUILDING CODES

1.1. Codes that apply to University of Iowa design and construction include, but are not limited to:

1.1.1. ICC International Building Code and reference standards, current adopted edition

1.1.2. ICC International Fire Code, current adopted edition

1.1.3. Uniform Plumbing Code

1.1.4. ICC International Mechanical Code

1.1.5. ICC International Energy Conservation Code

1.1.6. NFPA 70 National Electric Code (NEC)

[1.1.7. NFPA 101 Life Safety Code, applicable to only healthcare providing facilities \(UIHC\). Current edition is 2012.](#)
~~1.1.7.~~

1.1.8. American Society of Mechanical Engineers (ASME) Safety Code of Elevators and Escalators A17.1

1.1.9. Facility Guidelines Institute (FGI), Design and Construction of Hospitals and Healthcare Facilities, current adopted edition

1.1.10. The Design Professional is responsible for verifying current codes and editions adopted by the Iowa Department of Inspections, Appeals and Licensing.

2. IOWA ADMINISTRATIVE CODE

2.1. Chapters that apply to University of Iowa design and construction include, but are not limited to:

2.1.1. Environmental Protection Commission [567]

2.1.2. Public Safety [661], Chapter 16, "State of Iowa Building Code – Factory-Built Structures"

2.1.3. Public Safety [661], Chapter 18, "Parking for Persons with Disabilities"

2.1.4. Public ~~Health~~Safety [641], Chapter 25, "State Plumbing Code"

2.1.5. Public ~~Health~~Safety [641], Chapter 61, "State Mechanical Code"

2.1.6. Public Safety [661], Chapter 200, "Fire Marshal Administration"

2.1.7. Public Safety [661], Chapter 201, "General Fire Safety Requirements"

2.1.8. Public Safety [661], Chapter 205, "Fire Safety Requirements for Hospitals and Health Care Facilities"

2.1.9. Public Safety [661], Chapter 300, "State Building Code - Administration"

2.1.10. Public Safety [661], Chapter 301, "State Building Code – General Provisions"

- 2.1.11. Public Safety [661], Chapter 302, “State Building Code – Accessibility of Building and Facilities Available to the Public”
- 2.1.12. Public Safety [661], Chapter 303, “Requirements for Energy Conservation in Construction”
- 2.1.13. Public Safety [661], Chapter 310, “Sustainable Design Standards”
- 2.1.14. Public Safety [661], Chapter 350, “State Historic Building Code”
- 2.1.15. Public Safety [661], Chapter 504, “Standards for Electrical Work”
- 2.1.16. Labor Services [875], Chapter 72, “Conveyances Installed on or After January 1, 1975”
- 2.1.17. Chapter 89A, “Elevators” (Iowa Code)

3. FEDERAL REGULATIONS

- 3.1. CHAPTER 40, PART 112 “OIL POLLUTION PREVENTION” - The Design Professional shall comply with the Owner’s [Spill Prevention Control Countermeasures \(SPCC\)](#) requirements. A copy of the Owner’s SPCC plan is available on request.
- 3.2. Title 10 – Energy, Chapter 1 – Nuclear Regulatory Commission, Part 20 – Standards for Protection against Radiation
- 3.3. Title 42 – Public Health, Chapter IV – Centers for Medicare & Medicaid Services, Department of Health and Human Services, Subchapter G – Standards and Certification, Part 482 – Conditions of Participation for Hospitals.

4. CODE CHANGE ADMINISTRATION AND VARIANCES

- 4.1. For any new editions of applicable codes adopted during the course of the design, the Design Professional shall obtain Owner direction on whether the new codes apply to the project.
- 4.2. The Design Professionals shall list the applicable codes on code check / fire life safety drawings. When a project does not include a code check / fire life safety drawing, the list of applicable codes shall be placed on the cover page of drawings.
- 4.3. Design Professional shall request approval to seek Code Variances in writing from the Owner.
 - 4.3.1. A Code Variance request must include:
 - 4.3.1.1. Explanation of the situation
 - 4.3.1.2. Applicable codes
 - 4.3.1.3. Reason why code compliance is not possible
 - 4.3.1.4. Referenced codes
 - 4.3.1.5. Informational sketches
 - 4.3.1.6. Drawings
 - 4.3.1.7. Calculations

4.3.1.8. Supporting material

4.3.1.9. Discussion and recommendation related to the impact on building use and occupant safety.

4.3.1.10. Discussion and recommendation of equivalent systems available and cost implications of each.

5. STANDARDS

5.1. Standards that apply to University of Iowa design and construction include, but are not limited to:

5.1.1. 2010 ADA Standards for Accessible Design (ADA)

5.1.2. American Association of State Highway and Transportation Officials (AASHTO) “Green Book” — A Policy on Geometric Design of Highways and Streets, current edition

5.1.3. American Concrete Institute (ACI)

5.1.4. American National Standards Institute (ANSI)

5.1.4.1. ANSI/SPRI (Single Ply Roofing Industry) – ES-1

5.1.4.2. ANSI/IWCA (International Window Cleaning Association) 14.1

5.1.5. American Refrigeration Institute (ARI)

5.1.6. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

5.1.7. American Society for Testing and Materials (ASTM)

5.1.8. Architectural Sheet Metal Manual (SMACNA)

5.1.9. Architectural Woodwork Standards (AWS)

5.1.10. Building Industry Consulting Service International’s (BICSI)

5.1.11. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA), Building Wiring Standards

5.1.12. Factory Mutual Insurance Company

5.1.13. Guidelines for Environmental Infection Control in Health-Care Facilities

5.1.14. The Joint Commission Standards - Hospital Accreditation, [Current 2018](#) Edition

5.1.15. Manual on Uniform Traffic Control Devices (MUTCD), current edition

5.1.16. National Electrical Manufacturers Association (NEMA)

5.1.17. National Electrical Safety Code, (NEC)

5.1.18. National Fire Protection Association (NFPA) standards including current version of 70E

- 5.1.19. National Institute of Building Science
- 5.1.20. New York State Office of Mental Health – Patient Safety Standards, Materials and Systems Guidelines; applicable to healthcare facilities providing psychiatric care.
- 5.1.21. NRCA Roofing Manual
- 5.1.22. Telecommunications Design Methods Manual (TDMM)
- 5.1.23. Underwriter’s Laboratories, Inc. (UL), Federal Specifications
- 5.1.24. United States Pharmacopeia (USP) Reference Standards 797 and 800
- 5.1.25. William Steiger’s Act 1970 - The Occupational Safety and Health (OSHA) Law

III. COMMISSIONING (Cx) GUIDELINES AND SERVICES

The objective of commissioning is to establish and document the Owner's criteria for system function, performance, and maintainability throughout the design, construction, occupancy, and operation phases of a project.

1. MECHANICAL, ELECTRICAL, PLUMBING, & TECHNOLOGY SYSTEMS (MEPT Cx) SERVICES

1.1. General:

- 1.1.1. The primary role of the successful MEPT Commissioning [Provider-Agent \(CxACxP\)](#) is to develop and coordinate the execution of a quality assurance plan pertaining to commissioned equipment, components, and systems, observe and document performance, and determine whether equipment, components and systems are functioning in accordance with the Owner's Project Requirements (OPR), the Bid Documents, and manufacturer's recommendations and/or requirements. Additionally, the successful [CxPA](#) will assist in identifying solutions to non-conforming work. Final resolution will remain the responsibility of the Constructor and Design Professional.
- 1.1.2. Projects with a construction budget over \$1 million shall include MEPT [CxCommissioning](#) activities.
- 1.1.3. MEPT Equipment, Components and Systems to be Commissioned by the [CxPA](#) shall be outlined in the Agreement Between Owner and Consultant.
 - 1.1.3.1. As design phases progress, the Owner shall establish the equipment, components, and systems to be commissioned. The final list of equipment, components, and systems to be commissioned shall be included in the Construction Documents.
 - 1.1.3.2. MEPT equipment, components, and systems selection shall be based on the following guidelines:
 - 1.1.3.2.1. Can the facility afford a system or component malfunction without endangering safety, health or significant comfort of occupants or research?
 - 1.1.3.2.2. Is the system unique when compared to other installations across campus?
 - 1.1.3.2.3. Does the system operate interdependently with other building or campus systems?
 - 1.1.3.2.4. Will there be significant impact on energy consumption to operate or maintain the system?
 - 1.1.3.3. Med Gas Verification requirements (per NFPA 99) shall be outlined in the Agreement Between Owner and Consultant when incorporated into the Services.
- 1.1.4. MEPT Equipment, Components, and Systems Commissioned by the Owner unless otherwise identified in the Agreement Between Owner and Consultant include:
 - 1.1.4.1. Fire Suppression and Fire Alarm Systems
 - 1.1.4.2. Access Controls
 - 1.1.4.3. Security Systems

1.1.4.4. Audio/Visual Systems

1.1.4.5. ITS equipment

1.1.4.6. Campus Utility Interface Metering

1.1.5. Cx Testing Equipment:

1.1.5.1. The Constructor shall provide all tools required to start, checkout, and functionally test equipment and systems.

1.1.5.2. CxPA shall provide specialized supplemental testing equipment, such as supplemental portable data for logging purposes, but not required for testing.

1.1.5.3. Data logging equipment, monitoring devices, specialized equipment, and software not required in the Contract Documents to be provided by the Constructor, and provided by the CxPA to monitor, confirm, or verify the Constructor's testing procedures, shall remain the property of the CxPA.

1.1.5.4. Equipment provided shall meet the minimum accuracy, calibration, and performance standards required by specification section 01 91 13 the performance test.

1.2. Design Development and Construction Documents Phase Services:

1.2.1. The CxPA shall complete the following:

1.2.1.1. Coordinate with the Owner and oversee the commissioning process during design.

1.2.1.2. Ensure that the OPR is documented and captured within the Contract Documents for the equipment, components, and systems to be Commissioned and review project Design Summary (Basis of Design or Alternative Delivery Method equivalent) document, for clarity and completeness. Comments shall be via Bluebeam Studio.

1.2.1.3. Develop and implement a Cx Plan. The Cx Plan shall consist of a summary memo outlining an overview of the commissioning process activities from Design Development Documents through Construction Phase. The Cx Plan shall include commissioning process activities when Seasonal and/or Deferred Testing is included in the Services. The roles, responsibilities, and deliverables shall be documented in the project Commissioning specification, 01 91 13 MEPT COMMISSIONING (MEPTCx), found <https://www.facilities.uiowa.edu/design-construction-specification-documents>

1.2.1.4. Perform a quality control design review of the Design Development Documents and Construction Documents. Refer to ASHRAE Guideline latest accepted edition for expected standard of care. Comments shall be via Bluebeam Studio.

1.2.1.5. Participate in design review meetings. The CxPA shall note deviations and conflicts between the OPR, UI Design Standards & Procedures, and industry best practices and provide correspondence to the Owner regarding deviations and conflicts.

1.2.1.6. Perform a back-check of each subsequent design documents (Design Development Documents and Construction Documents) submittal to verify the agreed upon commissioning-related corrections were implemented.

- 1.2.1.7. Edit Specification Section 01 91 13 MEPT COMMISSIONING (MEPTCx) for incorporation into the Construction Documents. The commissioning specification shall be transmitted to the Design Professional in electronic format and shall include the following:
 - 1.2.1.7.1. List of equipment, components, and systems included in the commissioning scope of work, including sampling rates.
 - 1.2.1.7.2. Cross-references to all applicable and related specification sections.
 - 1.2.1.7.3. References for inclusion in individual equipment and system specification sections.
 - 1.2.1.7.4. Pre-installation meeting requirements.
 - 1.2.1.7.5. Acceptance testing criteria, including testing agent requirements.
 - 1.2.1.7.6. Deferred and seasonal testing requirements.
- 1.2.1.8. Med Gas Verification requirements for the Contractor shall be provided to the Design Professional for incorporation into the Construction Documents.
- 1.2.1.9. Provide Functional Performance checklists and testing sample forms for all equipment, components, and systems to be commissioned.
- 1.2.1.10. Create System Sequencing Flowchart.
 - 1.2.1.0.1. Flowchart shall graphically indicate the logical system, equipment, and component startup and commissioning sequence to maximize efficiency.
 - 1.2.1.0.2. Transmit flowchart to the Design Professional for coordination with the Construction Documents.
- 1.2.1.11. Constructor shall be responsible for task durations and shall provide information during Construction Phase for CxPA to incorporate into Cx Plan.
- 1.2.2. CxPA reviews shall:
 - 1.2.2.1. Verify compliance with the OPR; noting deviations and conflicts between OPR, UI Design Standards and industry best practices.
 - 1.2.2.2. Verify system control sequences against one-line diagrams, flow diagrams, and equipment details and specifications.
 - 1.2.2.3. Identify opportunities for building operations and maintenance efficiencies (i.e., Equipment Accessibility, System Control, etc.) and to improve project quality.
 - 1.2.2.4. Identify opportunities for efficiencies in utility usage.
 - 1.2.2.5. Identify Cx activities for inclusion into the contractor's project schedule.

1.3. Construction Phase Services:

1.3.1. Commissioning during the Construction Phase shall verify that the project achieves the objectives of the OPR, as expressed by the Bid Documents.

1.3.2. The CxPA shall complete the following tasks:

1.3.2.1. Shall use the Owner's project communications website, BuildUI, to access Submittals and other documents as required and review applicable Constructor submittals concurrent with the Design Professional's review.

1.3.2.2. Shall use the Owner's project communications website, BuildUI, for correspondence (Meeting Minutes, Reports, Daily Logs, Schedules, and Punch lists).

1.3.2.3. Conduct a kick-off meeting with the Constructor, including installation subcontractors, to discuss commissioning scope, systems flow chart, coordination, and schedule, as identified in the commissioning specifications.

1.3.2.4. Prepare Commissioning meeting minutes and distribute using the Owner's project communications website, BuildUI.

1.3.2.5. Review Constructor's Construction Schedule and verify the schedule indicates the logical system, equipment, and component startup, testing and commissioning sequence required to maximize schedule efficiency while ensuring quality.

1.3.2.6. Update project specific ~~construction functional performance~~ checklists and ~~function performance~~ testing scripts as required following submittal process.

1.3.2.7. Incorporate the manufacturer's pre-start and start-up checks into the checklists.

1.3.2.8. Provide finalized checklists to the Owner and Constructor for each equipment item, component, and system to the Constructor within two (2) weeks of any finalized submittal marked reviewed, reviewed as noted or partial reviewed & resubmit.

1.3.2.9. Review the Controls Submittal upon receipt focusing on how the selected sequences of operation interact with the MEPT systems. If necessary, meet with the Owner, Design Professional, Constructor, Controls subcontractor, Mechanical subcontractor, and Electrical subcontractor to align requirements with OPR and Bid Documents.

1.3.2.10. Functional Performance ~~Tests-Checklists~~ shall:

1.3.2.10.1. be repeatable for use in subsequent existing building commissioning efforts,

1.3.2.10.2. contain unambiguous pass/fail acceptance criteria,

1.3.2.10.3. be fully customized for the project; and

1.3.2.10.4. shall not contain items that do not apply to the project.

1.3.2.11. Perform Med Gas Verification when required by the project.

1.3.2.12. Perform site visits at the onset of MEPT rough-in as needed to ensure proper components and systems installation (monthly at a minimum).

- 1.3.2.13. Review Requests for Information (RFIs) and Instructions to Contractor (ITCs) for items relating to the OPR and Bid Documents.
- 1.3.2.14. As requested by Owner, attend planning and job-site meetings to obtain information on construction progress.
- 1.3.2.15. Assist in resolution of discrepancies.
- 1.3.2.16. In conjunction with required site visits, conduct on-site Cx meetings to review progress, coordination, and issues resolution. Prepare and distribute meeting minutes and Cx Issues Log.
- 1.3.2.17. Maintain Commissioning Issues Log thoroughly documenting any items that do not meet the OPR and Bid Documents.
- 1.3.2.18. CxPA shall update and issue the Cx Issues Log within two (2) days following a site visit and two (2) days prior to Cx meeting.
- 1.3.2.19. Commissioning during the Construction Phase shall demonstrate the performance of the equipment, components and systems installed during the Construction Phase meet the requirements of the Bid Documents. The acceptance of equipment, components and systems shall occur prior to Substantial Completion. The CxPA shall complete the following prior to the Owner acceptance of equipment, components, and systems ~~to be commissioned~~:
- 1.3.2.19.1. Conduct functional performance testing to demonstrate equipment, systems and components are operating according to the Owner's Project Requirements, Bid Documents, and applicable industry standards.
 - 1.3.2.19.2. Functional performance testing shall include operating the system and components through each of the written sequences of operation, and verification of proper integration to other system or systems as required.
 - 1.3.2.19.3. Review the preliminary and the final Testing and Balancing (TAB) reports to verify equipment is included and performance is per the Bid Documents' requirements.
 - 1.3.2.19.4. Update Cx Issues Log with acceptance testing items that do not meet the OPR or Bid Documents.
 - 1.3.2.19.5. Provide the Cx Issues Log, acceptance test results, and recommendations to the Owner and Constructors.
 - ~~1.3.2.19.6. Verify Owner training schedule and format.~~
 - ~~1.3.2.19.7.~~ 1.3.2.19.6. Review Operation and Maintenance Manuals submitted by the Constructor; verifying the sections for each commissioned system, piece of equipment, and component contains the information specified by 01 78 23 OPERATION AND MAINTENANCE MANUAL.

~~1.3.2.19.8~~.1.3.2.19.7. Submit electronic copy of Final Commissioning Report (at completion of Substantial Completion). Report shall not contain material previously submitted, such as meeting minutes, closed issues items, etc.

~~1.3.2.19.9~~.1.3.2.19.8. Participate in Owner's "Lessons Learned" meeting. Submit a Project Observation Memo to Owner.

1.4. Seasonal and Deferred Systems Testing Services

1.4.1. Commissioning following Substantial Completion and after occupancy of space and/or operations of the system is intended to assist the Owner in identifying any defects in the installed equipment or system operation during another season or at another time.

1.4.2. The CxPA shall complete the following:

1.4.2.1. Identify which commissioned systems (excludes med gas) are to be tested and timing of tests.

1.4.2.2. Conduct seasonal and/or deferred systems testing. Deliver completed functional test reports conducted during seasonal and/or deferred system testing to Owner.

1.4.2.3. Submit electronic copy of Final Commissioning Report (at completion of Seasonal and Deferred System Testing). Report shall not contain material previously submitted, such as meeting minutes, closed issues items, etc.

1.5. Warranty Walkthrough

1.5.1. Schedule and lead a warranty walkthrough with owner, end user, stakeholders as identified by project team, of the systems commissioned (excludes med gas) two (2) months prior to end of the one-year warranty period. Submit a Warranty Walkthrough Report to the Owner following the walkthrough.

2. BUILDING ENVELOPE COMMISSIONING (BECx) SERVICES:

2.1. General:

2.1.1. The primary role of the successful Building Envelope Commissioning Agent (BECxA) is to develop and coordinate the execution of a quality assurance plan pertaining to the materials, systems, and assemblies that provide shelter and environmental separation between environmentally distinct spaces (both internal and external), observe and document performance, and determine whether systems are functioning in accordance with the OPR and the Bid Documents. Additionally, the successful BECxA will assist in identifying solutions to non-conforming work. Final resolution will remain the responsibility of the Constructor and Design Professional.

2.1.2. Areas of specific focus include transitions between systems, transitions in elevations, and changes in direction including corners.

2.1.3. Control Barriers include air barriers, thermal barriers, vapor barriers and moisture barriers. BECx process shall ensure Control Barriers' continuity and compatibility and protection from physical and UV damage.

- 2.1.4. BECx materials, systems, and assemblies to be Commissioned by the CxA shall be outlined in the Agreement Between Owner and Consultant and may include:
 - 2.1.4.1. Roof systems
 - 2.1.4.2. Flashing, trim, and roof penetrations
 - 2.1.4.3. Skylights and sloped glazing
 - 2.1.4.4. Exterior walls
 - 2.1.4.5. Windows and glazing
 - 2.1.4.6. Doors, including overhead and specialty doors
 - 2.1.4.7. Louvers
 - 2.1.4.8. Sealants and expansion joints
 - 2.1.4.9. Control joints
 - 2.1.4.10. Curtain walls, window walls, and storefronts
 - 2.1.4.11. Plaza decks
 - 2.1.4.12. Below grade waterproofing
 - 2.1.4.13. Slab on grade floors
 - 2.1.4.14. Wet spaces, i.e., Showers, sterilizer rooms, etc.
 - 2.1.4.15. Animal spaces
- 2.1.5. Refer to ASTM E2813 latest accepted edition for expected standard of care. Services shall include mandatory fundamental testing as listed under Annex A2.
 - 2.1.5.1. BECxA shall review lab system testing and enhanced testing with Owner to determine if additional testing is required.
- 2.1.6. BECxA Testing Equipment:
 - 2.1.6.1. The Constructor shall provide all tools required to start, checkout, and functionally test equipment and systems.
 - 2.1.6.2. BECxA shall provide specialized testing equipment, such as supplemental portable data loggers or infrared imaging equipment.
 - 2.1.6.3. Equipment provided shall meet the minimum accuracy, calibration, and performance standards required by the performance test.

2.2. Design Development and Construction Documents Phase Services:

- 2.2.1. The BECxA shall complete the following:

- 2.2.1.1. Ensure that the OPR is documented and captured within the Contract Documents for the components and systems to be Commissioned and review project Design Summary (Basis of Design or Alternative Delivery Method equivalent) document, for clarity and completeness. Comments shall be via Bluebeam Studio.
- 2.2.1.2. Ensure that the OPR for Control Barriers are clear and complete and the requirements are documented within the Bid Documents for the materials, systems, and assemblies to be commissioned.
- 2.2.1.3. Develop and implement a BECx Plan. BECx Plan shall outline an overview of the BECx process activities from Design Development through Construction Phase. The BECx Plan shall include Deferred Testing commissioning activities when Deferred Testing is included in the Services. The roles, responsibilities, and deliverables shall be documented in the project commissioning specification, 01 91 23 BUILDING ENVELOPE COMMISSIONING (BECx) found at <https://www.facilities.uiowa.edu/design-construction-specification-documents>.
- 2.2.1.4. Edit Specification Section 01 19 23 BUILDING ENVELOPE COMMISSIONING BECx for incorporation into the Construction Documents. The BECx specification shall be transmitted to the Design Professional in electronic format and shall include review of the following:
 - 2.2.1.4.1. List of materials, systems, and assemblies included in the commissioning scope of work, including sampling rates.
 - 2.2.1.4.2. Cross-references to all other applicable and related technical specification sections.
 - 2.2.1.4.3. Pre-installation meeting requirements.
 - 2.2.1.4.4. Acceptance testing criteria, including testing agent requirements.
 - 2.2.1.4.5. Deferred testing requirements.
- 2.2.1.5. Provide Construction Checklists (how tests are to be documented) for all material, systems, and assemblies to be commissioned and a testing matrix for inclusion into Specification Section 91 19 23 BUILDING ENVELOPE COMMISSIONING.
- 2.2.1.6. Provide testing matrix which shall include:
 - 2.2.1.6.1. Required types and sampling rates of testing for mockup(s) and installed materials, systems, and assemblies
 - 2.2.1.6.2. Required standardized test protocol for each test, i.e., ASTM, AAMA, etc.
 - 2.2.1.6.3. When each test shall be performed
 - 2.2.1.6.4. Whom is to perform each test
 - 2.2.1.6.5. Criteria for test acceptance
 - 2.2.1.6.6. Who shall perform each test

2.2.1.7. Participate in design review meetings and perform a quality control design review of the Design Development Documents and Construction Documents, focusing on the continuity, constructability, and sequencing of Control Barriers.

2.2.1.7.1. The BECxA design reviews shall

2.2.1.7.1.1. Note deviations and conflicts between the OPR, UI Design Standards & Procedures, and industry best practices and shall provide correspondence to the Owner regarding such deviations and conflicts.

2.2.1.7.1.2. Verify complete and detailed Air, Vapor, Thermal, and Moisture Barriers in the Bid Documents.

2.2.1.7.1.3. Recommend mockup(s) and first works of specific materials, systems, and assemblies, including testing requirements.

2.2.1.7.1.4. Identify opportunities for building operations and maintenance efficiencies and improving project quality.

2.2.1.7.1.5. Identify BECx activities for inclusion into the Contractor's project schedule.

2.2.1.7.2. Perform a back-check of each subsequent design documents (Design Development Documents and Construction Documents) submittal to verify the agreed upon commissioning-related corrections were implemented.

2.2.1.7.3. BECxA design review comments shall be via Bluebeam Studio.

2.3. Construction Phase Services:

2.3.1. Commissioning during the Construction Phase shall verify that the project achieves the objectives of the OPR for the Control Barriers, as expressed by the Bid Documents.

2.3.2. The BECxA shall complete the following tasks:

2.3.2.1. Conduct a kick-off and BECx coordination meeting(s) with the Constructor, including installation subcontractors, to discuss commissioning scope, testing matrix, coordination and schedule as identified in the commissioning specifications. Ensure below grade and above grade assemblies are included and consider separate meetings when applicable.

2.3.2.2. Prepare and distribute BECx meeting minutes.

2.3.2.3. Review Constructor Construction Schedule and verify the schedule indicates the logical material, system and assembly installation, inspections, testing, and commissioning sequence required to maximize schedule efficiency while ensuring quality.

2.3.2.4. Shall use the Owner's project communications website, BuildUI, to access submittals and other documents as required and review applicable Constructor submittals concurrent with the Design Professional's review. Review shall focus on the performance, durability, sequencing, compatibility and constructability of the materials, systems, and assemblies, regarding the project Control Barriers.

- 2.3.2.5. Shall use the Owner’s project communications website, BuildUI, for Correspondence (Meeting Minutes, Reports, Daily Logs, Schedules, and Punch lists).
- 2.3.2.6. Participate in pre-installation meetings for materials, systems, and assemblies, as identified in the Bid Documents. Meetings shall include review of testing requirements.
- 2.3.2.7. Document and review construction and performance testing of mockup(s)/first works. Jobsite Observation Report(s) shall be uploaded to the Owner’s project communications website, BuildUI.
- 2.3.2.8. Perform site visits as needed during construction to observe materials, systems, and assembly installations. Attend planning and job-site meetings to obtain information on construction progress as requested by Owner. Review construction meeting minutes for revisions and substitutions relating to the OPR and materials, systems, and assemblies to be commissioned. Assist in resolving any discrepancies identified during regular site inspections. Begin site visits at onset of building foundation installation. Deliver to the Owner the Jobsite Observation Report.
- 2.3.2.9. In conjunction with required site visits, facilitate on-site BECx Progress Meetings to review progress, coordination, and issues resolution.
- 2.3.2.10. Conduct, interpret, and document BECx tests performed and are operating in accordance with OPR, Bid Documents and applicable industry standards. Review, interpret, and document results of test performed by others on materials, systems, and assemblies to be commissioned.
- 2.3.2.11. Maintain Cx Issues Log containing any items that do not appear to comply with the Bid Documents. The Cx Issues Log shall be detailed enough to provide clarity and point of future reference for comment and photographic support. BECx shall update and issue the Cx Issues Log within two (2) business days following a site visit and two (2) days prior to BECx meeting. The updated Cx Issues Log shall be uploaded to the Owner’s project communications website, BuildUI.
- 2.3.2.12. Provide guidelines to the Owner for routine evaluation and maintenance.
- 2.3.2.13. Participate in Owner’s “Lessons Learned” meeting. Submit a Project Observation Memo to Owner.

2.4. Deferred Testing Services

- 2.4.1. Commissioning following Substantial Completion and after occupancy of space is intended to assist the Owner in identifying any defects in the installed equipment or system operation at another time.
- 2.4.2. The BECx shall complete the following:
 - 2.4.2.1. Conduct deferred systems testing. Deliver completed test reports conducted during deferred system testing to Owner.
 - 2.4.2.2. Submit electronic copy of Final Commissioning Report (at completion of Deferred Testing). Report shall not contain material previously submitted, such as meeting minutes, closed issues items, etc.

2.5. Warranty Walkthrough

- 2.5.1. Schedule and lead a warranty walkthrough two (2) months prior to end of the one-year warranty period. Submit a Warranty Walkthrough Report to the Owner following the walkthrough.

IV. TESTING AND BALANCING SERVICES

1. GENERAL

- 1.1. The Consultant shall be directed by the Owner as to the specific scope of work related to a Testing and Balancing Services. Service details shall be specifically outlined within the Agreement.

V. SPECIAL INSPECTIONS AND TESTING SERVICES

1. GENERAL

- 1.1 The Consultant shall be directed by the Owner as to the specific scope of work related to Special Inspections and Testing Services. Service details shall be specifically outlined within the Agreement.

VI. ARCHITECTURAL HARDWARE CONSULTANT SERVICES

1. GENERAL

1.1 Design Phase Services

- 1.1.1 Participate in the preparation of architectural and engineering specifications; providing consultation related to mechanical keying systems, access control, and security systems.
- 1.1.2 Participate in planning stage meetings and solicit information from stakeholders to aid in developing the design.
- 1.1.3 Participate in design reviews and meetings. Perform a quality review of the Design Development documents and Construction Documents, including schematics, schedules, layouts, and details.
- 1.1.4 Note deviations and conflicts between the Owner's Project Requirements (OPR), UI Design Standards & Procedures, Building and Life Safety Codes, and industry best practices. Provide correspondence to Key and Access Services and UI Design Project Manager regarding such deviations and conflicts.
- 1.1.5 Perform a back check of each subsequent design document submittal to verify the agreed upon corrections were implemented.

1.2 Construction Phase Services

- 1.2.1 Consult on selection of materials and equipment for all door hardware, keying, and access control systems.
- 1.2.2 Review door, frame, and hardware submittals to ensure compliance with project documents and UI Design Standards.

- 1.3 When applicable, recommend changes to University of Iowa Design Standards in coordination with Key and Access Services and customers.

VII. GEOTECHNICAL ENGINEERING GUIDELINES

Services to be provided by the Geotechnical Engineering Consultant hired by the Owner.

1. GENERAL

1.1 Evaluate the subsoil conditions and provide a report discussing the findings and general discussions regarding the geotechnical aspects of the project site.

1.1. The Consultant shall attend meetings with the Owner as required.

2. Site Access

2.1. Site access shall be as directed by the owner's representative.

2.2. Depending on access requirements, ground conditions or potential utility conflicts, consultant may alter the boring locations from those proposed to facilitate accessibility.

2.3. Drilling activities may also impact the vegetation and turf and may rut the surface to access boring locations. Restoration of vegetation and turf is not required.

3. Staking

3.1. Consultant shall stake prospective subsurface exploration locations, as selected by the Owner.

3.2. Consultant shall extrapolate the latitude and longitude of boring locations from aerial imagery or site plan provided by the Owner with a horizontal accuracy of +/- 10 feet.

3.2.1 If the development of the plans and specifications requires exploration locations with a higher degree of accuracy the Owner shall have the boring locations staked by a licensed surveyor

3.3. The Consultant shall be responsible for locating all existing utilities before Work begins.

3.3.1 Utility locates may be arranged through Iowa One Call, 1-800-292-8989 or <http://iowaonecall.com> .

3.4. The Consultant shall obtain the ground surface elevations at the boring locations using readily available topographic information.

3.4.1 If the development of the plans and specifications requires exploration elevations with a higher degree of accuracy the Owner shall have the ground surface elevations obtained by a licensed surveyor.

4. Penetration Test Borings

4.1. Consultant shall drill standard penetration test borings and shall review depth and number of borings with the Owner, which may include boring to auger refusal on bedrock and bedrock cores.

4.2. Tests shall be standard penetration or thin-walled tube sampling at 2½-foot vertical intervals to a depth of about 10 feet, and at 5-foot intervals at greater depths.

4.3. Core samples of bedrock shall be drilled until at least 5 feet of rock with a Rock Quality Designation (RDG) of 50 percent or greater have been sampled, or to a minimum of 15 feet beyond refusal depth.

4.4. Consultant shall be responsible for removing asphalt or concrete paving as required to drill at specified locations.

4.5. If the borings encounter groundwater during or immediately after drilling of each boring, consultant shall record the observed depth on the boring logs.

4.5.1 Consultant shall leave select boreholes open for a period of 24-hours to perform groundwater level rechecks.

4.6. If the intended boring depths do not extend through unsuitable material, Consultant shall extend the borings at least 5 feet into suitable material at greater depths.

4.6.1 The additional information will help evaluate such issues as excavation depth, consolidation settlement, and foundation alternatives, among others.

4.6.2 If Consultant identifies a need for deeper (or additional) borings, the Owner shall be contacted prior to increasing the total estimated drilled footage.

5. Borehole Abandonment

5.1. Consultant shall backfill the boring locations immediately after completing the drilling and water level measurements with auger cuttings from the drilling process.

5.2. Consultant shall be responsible for replacing bituminous or concrete patches.

6. Sample Review and Laboratory Testing

6.1. Consultant shall transport recovered samples to their laboratory, for visual classification by a Geotechnical Engineer, in accordance with the Unified Soil Classification System (USCS).

6.1.1 Samples shall be logged to classify the materials encountered and estimate the engineering properties necessary for analyses.

6.2. Consultant shall anticipate performing moisture content and density determinations and unconfined compressive strength tests.

6.3. Consultant shall determine the actual number and type of tests based on the results of the borings.

7. Engineering Analyses

7.1. Consultant shall use data obtained from the boring and laboratory tests to evaluate the subsurface profile and groundwater conditions, and to perform engineering analyses related to structure and pavement design and performance.

8. Report

The Final Report shall include:

8.1. A Boring Location Plan detailing locations of all borings.

8.2. Logs of the borings describing the materials encountered and presenting the results of the groundwater measurements and laboratory tests.

8.3. A summary of the subsurface profile and groundwater conditions.

8.4. Discussion identifying the subsurface conditions that will impact design and construction including dewatering considerations.

8.5. Discussion regarding the reuse of on-site materials during construction.

8.6. Recommendations for preparing structure and pavement subgrades, and the selection, placement, and compaction of fill.

8.7. Seismic Site Classification in accordance with the IBC and ASCE-7

8.8. Allowable soil bearing pressures and anticipated deflections for any foundation systems being considered

8.9. Lateral soil pressures (if project has basement walls or retaining walls).

8.10. Recommendations for the design and construction of the proposed building foundations and pavements.

~~1.3~~1.2 The Final Report shall be signed and sealed by a Professional Engineer currently registered in the State of Iowa.

VII.VIII. FEASIBILITY STUDY AND PRE-DESIGN PHASE SERVICES

1. GENERAL

1.1. The Design Professional and/or Consultant shall be directed by the Owner as to the specific scope of work related to a Feasibility Study Services and/or Pre-Design Services. Services details shall be specifically outlined within the Agreement.

1.2. The Design Professional and/or Consultant shall develop the Owner's Project Requirements (OPR) document from the template provided by the Owner. The OPR shall be developed during the pre-design phase and updated at each subsequent stage of design. The content of the OPR shall be developed from meetings and discussions with the Client and appropriate project stakeholders. The OPR shall detail the functional requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, budgets, schedules, owner's directives and supporting information.

2. Owner's Project Requirements (OPR)

2.1. The Design Professional and/or Consultant shall update the Owner's Project Requirements (OPR) document from the template provided by the Owner. The OPR shall be developed during the pre-design phase and updated at each subsequent stage of design.

2.2. The OPR shall define the project intent, functional requirements, and operation expectations. The OPR along with room data sheets, shall contain the qualitative objectives necessary to inform the project design and Basis of Design (BOD) document. Specific information included in the room data sheets are not to be repeated in the OPR.

~~1.2.~~

VIII.IX. SCHEMATIC DESIGN PHASE SERVICES

1. GENERAL

1.1. The Design Professional shall prepare Schematic Design options illustrating the scale and relationship of project components for approval by the Owner.

1.2. The number of Schematic Design options prepared will vary with the complexity of the project. The Design Professional shall continue generating options until the requirements of the project are met and a Schematic Design is approved by the Owner.

1.3. The Design Professional shall not proceed into the Design Development Phase until the requirements of the Schematic Document Phase Services are met, and the Owner provides written approval.

2. Owner's Project Requirements (OPR)

2.1. The Design Professional and/or Consultant shall ~~update~~develop the Owner's Project Requirements (OPR) document from the template provided by the Owner. The OPR shall be developed during the pre-design phase and updated at each subsequent stage of design.

2.2. The OPR shall define the project intent, functional requirements, and operation expectations. The OPR along with room data sheets, shall contain the qualitative objectives necessary to inform the project design and Basis of Design (BOD) document. Specific information included in the room data sheets are not to be repeated in the OPR.

3. DESIGN SUMMARY (BASIS OF DESIGN)

3.1. The Basis of Design (BOD) includes all information necessary to accomplish the Owner's Project Requirements (OPR), including:

3.1.1. Site data

3.1.2. Pertinent design assumptions and limitations

3.1.3. Cost goals

3.1.4. References to applicable codes, standards, regulations, and guidelines

3.2. The Design Professional shall provide general programmatic information identifying programs and activities directly benefiting the University. Include a table of assignable square footage that clearly illustrates the proposed assignments of space.

3.2.1. The Design Professional shall provide programmatic information required for completing the BOR Program Statement form when the estimated project budget is \$2 million or more.

3.3. The Design Professional shall use the template provided by the owner for all new buildings and major renovations.

4. SCHEMATIC DESIGN BOOKLET

4.1. The Design Professional shall produce a Schematic Design Booklet for a project when the estimated project budget is \$2 million or more and may be required to present the Schematic Design Booklet to the Board of Regents.

4.1.1. The Schematic Design Booklet is intended to be distributed to Board of Regent members, University administrators, and other officials. The booklet may also be used in conjunction with development activities by the University.

4.1.2. It is imperative this document be accurate and of professional quality.

4.1.3. The Schematic Design Booklet shall be submitted in electronic (word format).

4.1.4. The following outline, along with any supplementary directions given by the Owner, shall be used in developing the booklet:

4.1.4.1. Schematic Design drawings shall include a site plan, floor plans, primary elevations, and other drawings necessary to adequately convey important features of the proposed project. The Schematic Design Booklet template is available at <https://www.facilities.uiowa.edu/projects/design-professionals>.

5. ENERGY INCENTIVES AND ENERGY AND LIFE CYCLE COST ANALYSIS

5.1. The Design Professional shall assist the Owner in determining if the project will be enrolled in the MidAmerican Energy or Alliant Energy Commercial New Construction Program.

6. ARC FLASH, SHORT CIRCUIT AND COORDINATION ANALYSIS

6.1. Not applicable.

7. PROJECT COST ESTIMATE

- 7.1. The Design Professional shall provide a project cost estimate, formatted to the Owner's guidelines, to include:
 - 7.1.1. Written quantitative estimate of construction developed from complete Schematic Design Documents,
 - 7.1.2. Construction cost estimate broken down into Architectural, Civil, Structural, Mechanical, and Electrical building components, by major divisions of work, excluding the construction related services and procedures which are to be performed or provided directly by the Owner,
 - 7.1.3. Design Professional's design contingency, if applicable, and
 - 7.1.4. Path of Travel associated costs.

8. PROJECT SCHEDULE

- 8.1. The Design Professional shall provide an estimate for the project period (schedule) that shall include the following milestones:
 - 8.1.1. Project Kickoff Meeting (date)
 - 8.1.2. Design Review Meeting(s) (date)
 - 8.1.3. Schematic Design / Project Description and Budget Approval (date)
 - 8.1.4. Bid (date)
 - 8.1.5. Contract Award (date)
 - 8.1.6. Construction Substantial Complete (date)
 - 8.1.7. Lead time estimates for special items required for construction.

9. PROJECT MANUAL

- 9.1. Not applicable.

10. DRAWINGS

- 10.1. Site Drawings (as applicable to the project)
 - 10.1.1. Review site drawing requirements with Owner, location map required as a minimum.
- 10.2. Architectural Drawings (as applicable to the project)
 - 10.2.1. Floor Plans
 - 10.2.1.1. Floor plans shall have rooms identified by the Program Room Numbers and Program Room Name. Design Professional to work with Owner to obtain room numbers (provided by Facilities Management – Facility Information Services for all projects.)

10.2.1.2. Net Assignable and Gross Area of each floor and total Gross Area of the building shall be noted on the floor plan Drawings.

10.2.2. Path of travel accessibility scoping recommendations

10.2.3. Primary elevations

10.2.4. Minimum of one (1) primary building section

10.2.5. Roof Plans

10.2.6. Other drawings necessary to adequately convey important features of the proposed building.

IX.X. DESIGN DEVELOPMENT PHASE SERVICES

1. GENERAL

- 1.1. All items listed under Schematic Design Phase shall apply to the Design Development Phase requirements and shall be updated and submitted to the Owner.
- 1.2. There should be no duplication between portions of the Construction Documents; instead, they should be complementary.
- 1.3. Structural, mechanical, electrical, communication systems, audiovisual equipment, and access and security shall be developed to a degree that illustrates the building systems, materials, final appearance, and nature of the structure of the building and systems.
- 1.4. The Design Professional shall design the entire project, (architectural, civil, mechanical, electrical, and structural) unless otherwise agreed to by the Owner. Providing performance specifications for a delegating design to the Constructor is not considered equal to design.
- 1.5. The Design Professional shall verify with the Owner the level of involvement ~~that~~ Facilities Management - Building & Landscape Services (BLS) will take in site design and site restoration work. It must be determined if BLS will accept the entire site design and/or site work. Facilities Management – BLS shall provide design review and assist in inspecting landscape work for General Education Facilities and surrounding grounds regardless of their involvement with site design or site work.
- 1.6. The Design Professional shall perform a project code analysis.
 - 1.6.1. Design Professional shall reference applicable codes and editions and note the occupancy, construction type, egress conditions, and other information necessary.
 - 1.6.2. The code analysis shall note any potential nonconforming construction.
 - 1.6.3. Failure of design work to meet the established building codes shall result in redesign at no cost to the Owner and reimbursement by the Design Professional to the Owner for non-value-added modifications.
- 1.7. The Design Professional shall review all project permit requirements with the Owner.
- 1.8. The Design Professional shall provide finish samples as requested by Owner to support decision making during design.

- 1.9. The Design Professional shall use Openings Studio™ software tools and processes to produce Door Hardware Specifications to support project reviews and quality assurance during all phases of design, construction, and facility management. Door and hardware schedules and associated Building Information Modeling product data and parameters shall be integrated and updated with Openings Studio™. Design Professionals shall contact UI Security Engineering Services to obtain access to Openings Studio™.
 - 1.9.1. The use of Openings Studio™ software, does not apply to UIHC projects.
- 1.10. The Design Professional shall provide 3D project renderings (as required).
- 1.11. The Design Professional shall not proceed into the Construction Document Phase until the requirements of the Design Development Phase Services are met, and the Owner provides written approval.
- 1.12. Design Professional shall consider energy efficiency in all designs. Principal considerations are capital cost, operational cost, maintenance cost, climatic conditions, site configuration, building orientation, building functional arrangement, building envelope, and mechanical and lighting systems to minimize the use of energy. Energy efficiency criteria shall be followed by the Design Professional.
 - 1.12.1. Energy Star rated equipment shall be utilized over non-rated equipment where available.
- 1.13. Energy conservation criteria shall be followed by the Design Professional to achieve a high-performance building and / or system that will:
 - 1.13.1. Reduce the total ownership cost of facilities.
 - 1.13.2. Improve energy efficiency and water conservation.
 - 1.13.3. Provide safe, healthy, and productively built environments.
 - 1.13.4. Promote sustainable environmental stewardship.
 - 1.13.5. Coordinate energy analysis with utility rebate opportunities.
- 1.14. Measurement and Verification:
 - 1.14.1. A measurement and verification (M&V) plan, using the International Performance Measurement and Verification Protocol (IPMVP) Option D – Calibrated Simulation, is required for all new GEF buildings and GEF building addition projects greater than 20,000 Gross Square Feet. M&V principles are outlined below:
 - 1.14.2. Utility revenue metering: steam, chilled water and electricity at the building level is available for data and calculations and shall not be duplicated.
 - 1.14.3. There shall be no steam sub-metering for new buildings. Main steam feeds to building additions shall be sub-metered. Heating loads on the hot water side shall be sub-metered.
 - 1.14.4. Layout of lighting and receptacle electric panels shall be done to minimize the amount of metering required.
 - 1.14.5. Lighting and plug loads shall be metered separately only when requested by the Owner.

- 1.14.6. Small loads (e.g., fan coils under one (1) kw load, a booster pump (fire), a piece of equipment with low run times, or condensate pumps) shall be evaluated during the design development phase to determine if a separate meter is justified.
 - 1.14.7. Refer to MEASUREMENT AND VERIFICATION SCHEDULE AND DIAGRAM in Appendices.
 - 1.14.8. The Sub-meter BACnet Communication Schedule shall be discussed at a pre-installation meeting during Construction with electrical contractor, controls contractor, and Principal Contractor in attendance.
- 1.15. **For UIHC:** The Design Professional shall develop a risk assessment and infection control strategy. The UIHC Project Risk Assessment procedure shall be followed, and a completed risk assessment form shall be presented to the Project Risk Assessment Committee twice for approval prior to bidding.

2. OWNER'S PROJECT REQUIREMENTS (OPR)

- 2.1. The Design Professional and/or Consultant shall update the Owner's Project Requirements (OPR) document template provided during the pre-design or Schematic design phase. The OPR shall be updated at each subsequent stage of design.
- 2.2. The OPR shall define the project intent, functional requirements, and operation expectations. The OPR along with room data sheets, shall contain the qualitative objectives necessary to inform the project design and Basis of Design (BOD) document. Specific information included in the room data sheets are not to be repeated in the OPR.

3. DESIGN SUMMARY (BASIS OF DESIGN)

- 3.1. The Design Professional shall provide to the Owner design summary documentation with all assumptions and references stated as applicable to the project scope of work. Summary shall include:
 - 3.1.1. Architectural design calculations provided to the Owner shall include:
 - 3.1.1.1. Occupancy classifications
 - 3.1.1.2. Type of construction
 - 3.1.1.3. Fire resistive ratings
 - 3.1.1.4. Exiting calculations
 - 3.1.1.5. Allowable building height and area
 - 3.1.1.6. Toilet fixture calculations
 - 3.1.1.7. Any unusual provisions or exceptions applicable to the project
 - 3.1.2. Path of travel accessibility scoping recommendation, including specific elements and associated costs.
 - 3.1.3. Submit to the Owner calculations used by Design Professional to determine the width and spacing of the roof control and expansion joints.
 - 3.1.4. Finish and furniture documentation (as required by the project.)
 - 3.1.5. List major equipment and material information (e.g., catalog material, charts, tables, performance curves, etc.).
 - 3.1.5.1. Locations of moveable items of furniture and equipment shall be listed in space description sheets.
 - 3.1.5.2. Differentiate between built-in furniture and equipment.
 - 3.1.6. Space-by-space comparison of preliminary Net Assignable Area with program Net Assignable Areas.
 - 3.1.6.1. Tabulate by floor and include totals for the building.

- 3.1.7. Structural design calculations provided to the Owner shall include:
 - 3.1.7.1. Live load
 - 3.1.7.2. Roof load
 - 3.1.7.3. Snow load
 - 3.1.7.4. Wind load
 - 3.1.7.5. Lateral soils load
 - 3.1.7.6. Seismic load calculations
 - 3.1.7.7. Any unusual provisions, special loads, or exceptions applicable to the project
- 3.1.8. Mechanical information and design calculations provided to the Owner shall include:
 - 3.1.8.1. Building loadings
 - 3.1.8.2. Equipment sizing
 - 3.1.8.3. Steam pipe stress analysis
 - 3.1.8.4. Annual energy usage
 - 3.1.8.5. Any unusual provisions or exceptions applicable to the project.
- 3.1.9. Electrical information and design calculations provided to the Owner shall include:
 - 3.1.9.1. Fault current calculations
 - 3.1.9.2. Transformer loading
 - 3.1.9.3. Circuit sizing
 - 3.1.9.4. Building energy usage
 - 3.1.9.5. Any unusual provisions or exceptions applicable to the project.
- 3.1.10. Civil design calculations provided to the Owner shall include:
 - 3.1.10.1. Storm drainage
 - 3.1.10.2. Sanitary sewer
 - 3.1.10.3. Domestic water service
 - 3.1.10.4. Transportation
 - 3.1.10.5. Any unusual provisions or exceptions applicable to the project demonstrating systems have capacity to support the project.

3.1.11. Clear indication of the types of utilities to be measured / metered (when applicable to the project.)

3.1.12. Clear indication of the MEPT and BE commissioning project requirements.

3.1.13. Verification of compliance with university standards, guidelines, and codes.

~~3.2. The Design Professional shall use the template provided by the owner for all new buildings and major renovations.~~

4. ENERGY INCENTIVES AND ENERGY AND LIFE CYCLE COST ANALYSIS

4.1. The Design Professional shall assist the Owner in determining if the project will be enrolled in the MidAmerican Energy or Alliant Energy Commercial New Construction Program.

4.2. Energy Analysis and Life Cycle Cost Analysis

4.2.1. Energy analysis shall be required for projects with estimated construction budget equal to and greater than \$1 million.

4.2.2. The Design Professional shall submit energy analysis information to the Owner in electronic format including the following:

4.2.2.1. Project/Building Narrative: Provide a brief narrative describing the operational needs of the building, including, but not limited to:

4.2.2.1.1. Gross square footage

4.2.2.1.2. Space use type(s) (office, lab, classroom, etc.)

4.2.2.1.3. Hours of operation

4.2.2.1.4. Utilities required

4.2.2.1.5. Mechanical systems description

4.2.2.1.6. Lighting systems description

4.2.2.1.7. Building shell description.

4.2.2.2. Methods and Assumptions: Describe methods and assumptions used to calculate estimated quantities for each of the following categories and discuss significant energy-consuming equipment as follows. Utilize the Energy Impact Statement, Refer to ENERGY IMPACT STATEMENT in Appendices.

4.2.2.2.1. Electrical

4.2.2.2.2. Low Pressure Steam

4.2.2.2.3. High Pressure Steam

4.2.2.2.4. Chilled Water

4.2.2.2.5. Domestic Cold Water

4.2.2.2.6. Domestic Hot Water

4.2.2.2.7. Natural Gas

4.2.2.2.8. Storm Drainage System

4.2.2.3. Calculations, including electronic copies of spreadsheets, energy models, equipment data sheets, etc.

4.2.2.4. Written summary of the results clearly indicating assumptions employed.

4.2.3. The Design Professional shall design the project to reduce the energy cost budget a minimum of 20 percent below ASHRAE 90.1, version adopted by the State of Iowa, and shall demonstrate compliance using the energy cost budget method as described in ASHRAE 90.1 when projects add new gross square footage or when projects are enrolled in the (MidAmerican Energy or Alliant Energy) Commercial New Construction rebate/incentive program.

4.2.4. The Design Professional shall demonstrate compliance with ASHRAE 90.1 using either the energy cost budget method or the prescriptive method as described in ASHRAE 90.1 for projects not enrolled in the (MidAmerican Energy or Alliant Energy) Commercial New Construction Program.

4.2.5. Lighting Energy Analysis

4.2.5.1. Interior Lighting

4.2.5.1.1. The Design Professional shall ensure Interior Lighting Power Densities (LPD) are 30 percent less than allowed by ASHRAE 90.1 and meet the IESNA recommendations for foot candle lighting levels and shall provide photometrics of the interior lighting associated with the project for review and approval.

4.2.5.1.1.1. The Design Professional shall use the Owner's LPD compliance form <https://www.facilities.uiowa.edu/design-standards-and-procedures> to outline the following:

4.2.5.1.1.1.1. Specific space types involved on the project according to the LPD classifications for the space-by-space method per ASHRAE 90.1.

4.2.5.1.1.1.2. "Typical" foot candle lighting level calculations for all of the spaces listed in the table above. Foot candle levels shall be based on current Illuminating Engineering Society (IES) recommended levels as published in the current IES handbook or the Recommended Practice (RP) associated with the building type.

4.2.5.1.1.2. The Design Professional shall use lighting calculation software to complete the foot candle calculations. Photopia or other lighting simulation files may not be used.

4.2.5.1.1.2.1. Calculation shall identify the room geometry including ceiling height and fixtures and room reflectance values.

4.2.5.1.1.2.2. Light loss factors shall be clearly noted.

4.2.5.1.1.2.3. Initial lighting levels are not acceptable.

4.2.5.1.1.2.4. Manufacturer photometric data (IES file) is required.

4.2.5.1.2. The Design Professional shall submit a lighting controls narrative or spreadsheet showing space use, hours of occupation, specific needs (dimming, manual overrides, etc.) and stating whether the lighting controls will be integrated with the A/V or HVAC systems for all space identified on the LPD compliance form.

4.2.5.2. Exterior Lighting:

4.2.5.2.1. For UI Housing: Exterior lighting power densities shall comply with ANSI/ASHRAE 90.1-2010 for Exterior Lighting Zone 2.

4.2.5.2.2. The Design Professional shall submit photometrics to the Owner for review.

4.2.6. Life cycle cost analysis required by Iowa Administrative Code 661, Chapter 303:

4.2.6.1. The Design Professional shall provide a life cycle cost analysis for all projects constructing new floor space 20,000 sf or more which is heated or cooled by a mechanical or electrical system or for any renovation project where additions or alterations exceed 50 percent of the value of the facility and affect an energy system.

4.2.6.2. The life cycle cost analysis shall be prepared in compliance with Iowa Code chapter 470 and shall be submitted to the state building code commissioner before construction commences.

4.2.7. Life cycle cost analysis required for investment payback calculations of energy options (required by this section) shall use the following 2-pronged analysis:

4.2.7.1. The Simple Payback: Each investment alternative shall be calculated using *Payback Period = Annual Energy Savings / Capital Cost of the ECM*.

4.2.7.2. Modified Life Cycle Cost: Where the expected life of two (2) or more alternative systems are significantly different from each other, include the replacement cost of the shorter-lived system(s) in the analysis.

4.2.7.3. The service life shall be in accordance with ASHRAE Service Life and Maintenance Cost Database found at: <http://xp20.ashrae.org/publicdatabase>.

5. ARC FLASH, SHORT CIRCUIT AND COORDINATION ANALYSIS

5.1. For projects when an Arc Flash Analysis model is required, the Owner shall furnish equivalent short-circuit values of the primary side of the building utility transformer(s) including primary protection device ratings, transformer ratings, and impedances when required. If the primary system is not a university system, the Design Professional shall contact the utility provider to obtain the short-circuit values.

5.2. For renovation projects, the Owner shall furnish the existing SKM Power*Tools model for the building when it exists. In the event the existing SKM Power*Tools model is not in sufficient condition to be used by the Design Professional, the Owner shall have the model updated before issuing the model to the Design Professional.

5.2.1. Assumption is that the SKM Power*Tools model is accurate outside of the project scope and thus the Design Professional is only updating the model for the project scope.

5.3. For projects where there is no existing model or a model is not required to be developed, the Design Professional shall provide a one-line diagram at the completion of the project that summarizes all information required for input into a future SKM model and the Design Professional shall provide requirements in the Construction Documents for the contractor to install generic arc flash labeling for all modified and new electrical equipment.

6. PROJECT COST ESTIMATE

6.1. The Design Professional shall provide a project cost estimate, to include:

6.1.1. Written quantitative estimate of construction developed from complete Design Development Drawings and Specifications.

6.1.2. Construction cost estimate shall be broken down into Architectural, Civil, Structural, Mechanical, and Electrical building components by major divisions of work.

6.1.3. Construction cost estimate shall exclude the construction related services and procedures which are to be performed directly by the Owner.

6.1.4. Construction cost estimate shall show the Constructor overhead and profit.

6.1.5. Design Professional's design contingency, if applicable.

7. PROJECT SCHEDULE

7.1. The Design Professional shall provide an estimate for the project period (schedule) that shall include:

7.1.1. Updates regarding lead time estimates for special items required for construction.

7.2. If phasing is applicable to the project, provide a project phasing schedule in bar chart and/or outline (narrative) form and/or a phasing floor and/or site plan.

8. PROJECT MANUAL

8.1. The Design Professional shall assist the Owner in preparing the following documents when the budgeted cost of construction for a project is equal to or greater than \$100,000:

8.1.1. The Design Professional shall use the Owner's Division 00 documents.

8.1.1.1. Cover Page

8.1.1.2. 00 01 07 Seals & Signatures

8.1.1.3. 00 01 10 Table of Contents

8.1.1.4. 00 21 13 Instructions to Bidders

8.1.1.5. 00 43 13 Bid Bond

8.1.1.6. 00 43 25 Substitution Request Form

- 8.1.1.7. 00 43 36 Subcontractor List
- 8.1.1.8. 00 45 14 Telecommunication Qualifications Requirements, as required
- 8.1.1.9. 00 45 36 EEO Data Reporting Form
- 8.1.1.10. 00 45 37 Certificate of Reporting
- 8.1.1.11.00 45 40 Targeted Small Business (TSB) Participation Form
- 8.1.1.12. 00 72 13 Board of Regents State of Iowa General Conditions
- 8.1.1.13. 00 73 13 Institution Requirements
- 8.1.1.14. 00 74 13 Project Requirements
- 8.1.2. The Design Professional shall use the following Owner’s Division 01 documents as applicable to the project:
 - 8.1.2.1. 01 33 23 Submittals
 - 8.1.2.2. 01 35 33 Infection Control Risk Assessment (ICRA) Project Requirements (For UIHC)
 - 8.1.2.3. 01 77 19 Contract Closeout
 - 8.1.2.4. 01 78 23 Operation and Maintenance Manual
 - 8.1.2.5. 01 78 39 As-Built Documents
 - 8.1.2.6. 01 91 13 MEPT Commissioning (MEPT Cx), as required
 - 8.1.2.7. 01 91 23 Building Envelope Commissioning (BECx), as required
- 8.2. The Design Professional shall use the Owner’s technical specification template for Fire Alarm and Detection Systems, UIHC Fire Alarm and Detection Systems and Emergency Responder Radio Coverage System (ERRCS), as applicable to the project.
- 8.3. The Design Professional shall assist the Owner in preparing Informal Bid Docs for projects when the budgeted cost of construction is less than \$100,000 for a project. Informal Bid Docs may be found at <https://www.facilities.uiowa.edu/design-construction-specification-documents>
- 8.4. For consistency in format, the following rules shall be observed:
 - 8.4.1. The term “Design Professional,” when it refers to the Architect or Engineer who prepares the Documents, shall always be capitalized, and always in the singular.
 - 8.4.2. The term “Owner” shall always be capitalized, and no other term shall be used in reference to the University as the Owner.
 - 8.4.3. Reference to the “Drawings” shall be that, and not to less inclusive term “plans.” “Drawings” shall be capitalized when the reference is to those included in the Construction Documents.

- 8.4.4. "Specifications" shall be capitalized when reference is made to those trade sections generally so designated, but the term "Specifications" shall not be used when it is intended to include other portions of the Construction Documents.
- 8.4.5. "General Conditions," "Institution Requirements" and "Project Requirements" are conditions of the Contract and are not part of the Technical Specifications. See website for the latest versions; <https://www.facilities.uiowa.edu/design-construction-specification-documents>.
- 8.4.6. The term "Constructor and/or Contractor" are interchangeable and shall be capitalized when referring to the principal contractor, but not when referring to a subcontractor.
- 8.4.7. "Contract" shall be capitalized when referencing the agreement between a Constructor and the Owner.
- 8.4.8. The term "Contract Documents" shall be used when reference is made to all documents so identified in the FORM OF AGREEMENT BETWEEN CONSTRUCTOR AND OWNER.
- 8.5. The Design Professional shall carefully check that the Specifications include all items pertaining to the project and exclude items not incorporated in the project.
- 8.6. The Specifications shall include a complete list of extended warranty / guarantee items and list of items for which operations and maintenance data are required.
- 8.7. References to industry standards shall be checked to verify correct identification of numbers and date of issue.
- 8.8. The terms "to be," "must be," "will be" and "will" are not acceptable when referring to the Constructor. The mandatory "shall" or "shall be" are the only forms with full legal force.
- 8.9. Competitive bidding is required by State of Iowa Law. See Iowa Code 262.
 - 8.9.1. Throughout the Specifications, the Design Professional shall use a performance-type description as far as possible, meeting certain established and recognized industry standards (e.g., ASTM).
 - 8.9.2. Where it is not feasible to use a performance-type description because such standards have not been established, specify three (3) equally acceptable manufacturers or suppliers.
 - 8.9.2.1. Name of one (1) type followed by "or equal" or "or approved equivalent" is not considered to be an adequate specification.
 - 8.9.2.2. As a possible alternative to this procedure, the statement "equivalent to item 'X' as manufactured by 'ABC Company'" will be acceptable as a means of establishing the quality desired.
- 8.10. Specific vendor contact information shall not be included, unless by reference through an Allowance.

9. DRAWINGS

- 9.1. Title Sheet(s):

9.1.1. The title sheet or sheets in each set of drawings shall contain the following and shall be provided for each bound set (as applicable to the project):

9.1.1.1. Project title and project number

9.1.1.2. Owner's name: (The University of Iowa)

9.1.1.3. Design Professional Firm name

9.1.1.4. Design Professional's Seal

9.1.1.5. Design Standards edition and approved deviations.

9.1.1.6. Building Code edition and variances.

9.1.1.7. Drawing index

9.1.1.8. Site location map (including street address)

9.1.1.9. Abbreviations and symbols used on the drawings in a key or legend.

9.1.1.10. Advertisement/issue date

9.1.1.11. Fire Life Safety Plan including:

8.1.1.11.1 Codes/Standards used

8.1.1.11.2 Occupancy – Designation and number of occupants

8.1.1.11.3 Infection Control Risk Assessment (For UIHC projects only)

8.1.1.11.4 Fire/Smoke wall rating

8.1.1.11.5 Fire/Smoke marking

8.1.1.11.6 Sprinkler hazard level (density)

8.1.1.11.7 Fire zones

8.1.1.11.8 Extinguishment system(s)

9.2. Site Drawings shall contain the following (as applicable to the project):

9.2.1. Overall dimensions of the proposed building(s) or work area, benchmark and baseline, property lines and easements.

9.2.2. Location and extent of existing structures on the site within 300 feet (measured from the exterior walls of the proposed building) or as directed by the Owner. Identify structures and streets by proper names.

9.2.3. Existing and proposed topographic contours.

- 9.2.4. Include exterior elements, e.g., outdoor facilities, streets, service drives, parking areas, walks (identifying ADA), covered walks, landscape development, stairs, pools, retaining walls, terraces, etc., and any elements to be demolished.
 - 9.2.5. Section(s) through site, explaining changes in level within the proposed building as related to the adjacent site.
 - 9.2.6. Existing and proposed underground utilities and structures. Show verified capacity at points of connection to existing utilities.
 - 9.2.7. Locations of any anticipated snowmelt systems.
 - 9.2.8. Proposed landscape materials and location.
 - 9.2.9. Existing plant material to remain, including plant material, type, variety, size, and condition. Identify any significant plant material to be protected and/or remain on the site.
 - 9.2.10. Existing and final site grading and identify any surface water drainage issues that shall be corrected as part of the project.
 - 9.2.11. Method of general drainage of the site as affected by the proposed building and concepts for mitigating site runoff.
- 9.3. Architectural Drawings shall contain the following (as applicable to the project):
- 9.3.1. Floor Plans
 - 9.3.1.1. Extent of demolition work, site access, and dust barriers.
 - 9.3.1.2. Locations, sizes (dimensions), and space numbers of programmed spaces and other required gross areas, including:
 - 8.3.1.2.1 Corridors (width)
 - 8.3.1.2.2 Stairs
 - 8.3.1.2.3 Restrooms
 - 8.3.1.2.4 Locker Rooms
 - 8.3.1.2.5 Custodial Spaces
 - 8.3.1.2.6 ITS Spaces
 - 8.3.1.2.7 Mechanical Spaces
 - 8.3.1.2.8 Storage Rooms
 - 8.3.1.2.9 Classrooms
 - 8.3.1.2.10 Lecture Halls
 - 8.3.1.2.11 Kitchens and related service areas

- 9.3.1.3. All floor plans and room finish schedules shall indicate room numbers.
- 9.3.1.4. Interior finish schedule indicating floor, wall, ceiling, door, window, and casework finishes together with special items of finish.
- 9.3.1.5. Location of doors and windows. Indicate door swings.
- 9.3.1.6. Overall dimensions of each area of the building(s).
- 9.3.1.7. Location of plumbing fixtures such as lavatories, floor drains, water closets, urinals, service sinks, drinking fountains, fire hose cabinets, fire extinguishers, sprinkler systems, etc.
- 9.3.1.8. Principal built-in features, such as:
 - 8.3.1.8.1 Fixed auditorium seats
 - 8.3.1.8.2 Kitchen equipment
 - 8.3.1.8.3 Display cases
 - 8.3.1.8.4 Casework
 - 8.3.1.8.5 Counters
 - 8.3.1.8.6 Shelves
 - 8.3.1.8.7 Lockers

9.3.2. Construction Project Signage

- 9.3.2.1. All projects shall include construction project signage
- 9.3.2.2. Based on project size and complexity, one of the following three sizes shall be used.
 - 8.3.2.2.1 12 inches x 20 inches
 - 8.3.2.2.2 18 inches x 30 inches
 - 8.3.2.2.3 36 inches x 60 inches
- 9.3.2.3. Based on project size and complexity, multiple signs and sizes may be required.
- 9.3.2.4. Signage shall include the Owner’s standard formatting, including project title and season of completion.
- 9.3.2.5. Only projects receiving donor funding shall include the “Hawkeyes Give Back” logo.
- 9.3.2.6. Signage drawings shall include detail and description and location for installation (construction fencing, dust barriers, project entrance, etc.).
- 9.3.2.7. Signage shall be maintained in an “as-installed” state for the duration of the project and removed only by the Constructor upon project completion.

9.3.2.8. Refer to *CONSTRUCTION PROJECT SIGNAGE* in Appendices.

9.3.3. Interior Signage

9.3.3.1. Locations shown on floor plan keyed by code number.

9.3.4. Roof Plans

9.3.4.1. A roof plan and detail of existing conditions (reroof) or other components and penetrations (new).

9.3.4.2. Photographs of overall roof condition and locations of inspection openings (reroof project only).

9.3.4.3. Outline of proposed reroofing method including a narrative report discussing major design features and options (reroof).

9.3.4.4. Identification of existing components and methods of attachment.

9.3.4.5. Simple sketches showing method of detailing new system.

9.3.5. Elevations and Sections

9.3.5.1. Exterior elevations for the building shall show the following:

8.3.5.1.1 Windows

8.3.5.1.2 Doors

8.3.5.1.3 Louvers

8.3.5.1.4 Solar Screening Systems

8.3.5.1.5 Stairs

8.3.5.1.6 Platforms

8.3.5.1.7 Retaining Walls

8.3.5.1.8 Grades, Paved Areas, etc.

8.3.5.1.9 Typical configuration and integration of the air and weather barrier into adjacent building envelope materials

9.3.5.2. Indicate floor heights and windowsill heights.

9.3.5.3. Include longitudinal and transverse sections for each major area, indicating:

8.3.5.3.1 Floor elevations

8.3.5.3.2 Finish exterior grades

8.3.5.3.3 ceiling heights

8.3.5.3.4 Pipe tunnels

8.3.5.3.5 Unexcavated areas

8.3.5.3.6 Basement and areaways

8.3.5.3.7 Rooflines, Parapets, etc.

9.3.5.4. Various floor and grade elevations, including those for interior and exterior stairways, walls, terraces, walk, etc.

9.3.6. **For UIHC:** Infection Control Risk Assessment (ICRA) Project Requirements

9.4. Structural Drawings shall contain the following (as applicable to the project):

9.4.1. Design loadings (dead, live, wind, snow, seismic),

9.4.2. Material specifications

9.4.3. Design stresses (steel, concrete, masonry, soil bearing, etc.) assumed during the design, plus assembly stresses where applicable.

9.4.4. Structures employing a beam-column framework shall utilize a grid reference system using alphabetic and numeric symbols.

9.4.5. When additions are made to existing structures; the original reference system shall be extended where practical.

9.5. Mechanical Drawings shall contain the following (as applicable to the project):

9.5.1. Metering schematics for each utility shall be included in the Construction Documents.

9.5.2. Plumbing:

9.5.2.1. Demolition drawings.

9.5.2.2. Locations of main wastes and vents, as well as service mains. Include water, air, gas, vacuum, etc.

9.5.2.3. Pieces of equipment, showing location and required piping connections. Include pumps, tanks, backflow preventers, generators, etc.

9.5.2.4. Equipment schedules for plumbing fixtures.

9.5.2.5. Isometrics for water, sanitary, and gas piping.

9.5.3. Heating, Ventilating, Air Conditioning and Piping:

9.5.3.1. Demolition drawings and associated capping of piping and duct runs.

9.5.3.2. Service mains, including steam, condensate, compressed air, hot water, chilled water, condenser water, gas, etc.

- 9.5.3.3. Air moving equipment and double line duct runs to all outlets including supply and exhaust fan systems, fume hoods, etc.
- 9.5.3.4. Pieces of equipment, showing locations and required piping connections including pumps, tanks, converters, etc.
- 9.5.3.5. Equipment schedules indicating sizes, capacities, and operating characteristics.
- 9.5.3.6. Provide air and water flow diagrams for supply and exhaust air and water distribution systems.
 - 8.5.3.6.1 Diagrams shall indicate flow rates in mains and branches to assist in balancing.
- 9.5.3.7. Control schematics and sequence of operations.
- 9.5.4. Equipment Rooms:
 - 9.5.4.1. Layout of equipment to assure adequate space allowance.
 - 9.5.4.2. Elevations of built-up fan units to assure proper air flow and access to component parts of the units.
 - 9.5.4.3. Pump layout and piping runs.
 - 9.5.4.4. Room section cuts showing room accessibility for maintenance personnel.
- 9.5.5. Fire Protection and Detection
 - 9.5.5.1. Pipe runs, sprinkler locations, standpipes, crossties, pumper connections, and test connections.
 - 9.5.5.2. Coverage rate of sprinklers.
 - 9.5.5.3. Special equipment.
 - 9.5.5.4. Control schematic.
 - 9.5.5.5. Fire alarm panel locations.
- 9.6. Electrical Drawings shall contain the following (as applicable to the project):
 - 9.6.1. Metering schematics for each utility
 - 9.6.2. Demolition drawings
 - 9.6.3. Location of electrical system components requiring arc flash labels.
 - 9.6.3.1. Include protection devices upstream of primary transformation device(s) through secondary service protection devices to building main(s) substations, switch gear or switchboard to distribution switchboards, motor control center, and panel boards for power and lighting.
 - 9.6.4. Arc Flash Analysis Documents including:

- 9.6.4.1. Electrical Equipment Plans (*.pdf).
- 9.6.4.2. Arc Flash Report (*.pdf)
- 9.6.4.3. SKM PowerTool TCCs (*.pdf)
- 9.6.4.4. SKM PowerTool Model Output One-Line Diagram (*.pdf)
- 9.6.5. Power and control layouts shall be on one (1) set of drawings. The lighting layouts shall be on a different set of drawings, using standard symbol conventions.
 - 9.6.5.1. Show all conduit sizes and the size and number of conductors.
 - 9.6.5.2. Show electrical and data on one (1) sheet and electrical, data, and furniture/casework on a separate sheet.
- 9.6.6. Electrical One-Line Diagrams
 - 9.6.6.1. Diagrams shall schematically show the interconnections of equipment including emergency generators, switchboards, motor control centers, transformers, disconnect switches, local motor starters, variable-frequency drives, and distribution panels.
 - 9.6.6.2. Diagrams shall show bus ratings, breaker settings, and motor horse powers.
 - 9.6.6.3. Diagrams shall begin at the connection to utility service, including protection devices upstream of primary transformation device(s) through secondary service protection devices to building main(s) substations, switch gear or switchboard to distribution switchboards, motor control center, and panel boards for power and lighting.
- 9.6.7. Provide utilization schedule for each load center unit substation, motor control center, distribution and switchboards, telephone equipment rooms, and closets.
- 9.6.8. Provide a schedule with details of types and locations of lighting fixtures in typical offices, laboratories, corridors, examination rooms, etc.
- 9.6.9. Provide a photometric drawing with types and locations of all exterior lighting fixtures, for Owner review and approval.
- 9.6.10. Fire Alarm and Detection
 - 9.6.10.1. Fire alarm and detection system drawings shall not be incorporated into the electrical or communications drawings.
 - 9.6.10.2. Location of all control modules and test switches shall be shown on drawings (fan shutdown modules, damper control modules, etc.)
 - 9.6.10.3. Location of damper indicator lights
 - 9.6.10.4. Identify the estimated quantity of dry contacts required for the fire alarm system.
 - 9.6.10.5. Outline of sequence of operation for auxiliary controls from fire alarm system (smoke purge, damper control, HVAC control, etc.).

~~X~~XI. CONSTRUCTION DOCUMENTS PHASE SERVICES

1. GENERAL

- 1.1. All items listed under Design Development Phase shall apply to the Construction Documents Phase requirements and shall be updated and submitted to the Owner.
 - 1.1.1. Construction Documents shall be completed and ready for Design Professional certifications, seals and signatures and shall be submitted for approval by the State Building Code Bureau (when required by code) and Factory Mutual Insurance Company (the Owner's Insurance Company).
- 1.2. All corrections to Drawings and Specifications identified during Design Development and subsequent intermediate reviews shall be completed and incorporated prior to issuing Construction Documents for bid.
- 1.3. No Allowances shall be included in the Construction Documents, unless approved by the Owner.
- 1.4. Ensure all deviation requests have been approved prior to Construction Documents being issued for bid.
- 1.5. Warranties:
 - 1.5.1. Prior to bidding, Design Professional shall review with Owner all product installation and manufacturer warranty requirements and any recommended extended warranty and/or guarantee periods.
 - 1.5.1.1. The General Conditions cover all one-year warranties and guarantees.
 - 1.5.1.2. Warranties and guarantees other than one-year (starting at Substantial Completion) shall be stated in the applicable specification section(s), including 01 77 19 Contract Closeout. Do not repeat one-year warranties and guarantees in the specifications unless the start date of the warranty is not at Substantial Completion.
 - 1.5.1.2.1. The Design Professional shall upload the complete list of extended warranties and guarantees from section 01 77 19 Contract Closeout to the warranty menu within the Owner's project management website, BuildUI.
 - 1.5.1.2.2. The Design Professional shall review and verify extended warranties and guarantees uploaded to BuildUI by the Constructor.
 - 1.5.1.3. For UIHC: Extended warranties shall be required for:
 - 1.5.1.3.1. Variable frequency drives (2 years).
 - 1.5.1.3.2. Pumps (2 years).
 - 1.5.1.3.3. Air handling units over 5,000 cfm (2 years).
 - 1.5.1.3.4. Sheet metal flashings for roofs and wall systems (10 years).
 - 1.5.1.4. Minimum roof system warranties shall be as follows:
 - 1.5.1.4.1. 15-year, no-dollar-limit, non-prorated, total system, labor, and material warranty from the primary roof membrane manufacturer. Warranty shall

include membrane, membrane flashings, roof membrane adhesion, membrane flashing adhesion, roof insulation and coverboard, roof insulation and coverboard attachment, and all accessories supplied by the membrane manufacturer.

1.5.1.4.2. Review if special warranty provisions are required for wind uplift, hail resistance, or incidental puncture resistance, and negotiate with the roof membrane manufacturer during the schematic design phase.

1.5.1.4.3. 20-year warranty for Kynar 500/Hylar 5000 paint finish for sheet metal flashings.

1.6. Training:

1.6.1. Product and system training requirements shall be reviewed with the Owner prior to final review of Construction Documents.

1.7. Furniture Documentation:

1.7.1. Project furniture binders and color boards may be required based on project scope. The following documents are required during the construction document phase when required by the professional services agreement. If the project is broken into multiple bid packages or furniture shall be designed following issuance of construction documents, review timing requirements for submission of the finish and furniture documentation with Owner.

1.7.2. Furniture Binder documents:

1.7.2.1. Review format, quantity of binders (hardcopies and electronic) and schedule expectation with Owner.

1.7.2.2. The binder shall include the following items, unless indicated otherwise by the Owner (Design Professional shall utilize Owner templates.):

1.7.2.2.1. Cover: including project name, project number, date issued and Design Professional's name.

1.7.2.2.2. Table of Contents

1.7.2.2.3. Furniture Specifications. The final specifications are required for furniture procurement by Owner. Each furniture specification sheet shall include the following items:

1.7.2.2.4. Project name and number

1.7.2.2.5. Issue date

1.7.2.2.6. Furniture manufacturer's representative contact information

1.7.2.2.7. Furniture product number and description

1.7.2.2.8. Furniture photos

1.7.2.2.9. Furniture finish photos

1.7.2.2.10. Furniture floor plan code

1.7.2.2.11. Room number with location name and quantities

1.7.2.3. Furniture floor plans keyed to specifications.

1.7.2.4. Final furniture finish samples shall be:

1.7.2.4.1. Labeled with keyed identification of product information (manufacturer and product name).

1.7.2.4.2. Labeled with location of use.

1.7.2.4.3. Loose samples shall be placed in plastic sleeves with label.

1.7.2.4.4. Electronic format of samples shall include an image from the manufacturer's website or a photo of the actual sample.

1.7.2.5. 3D rendering and plan view of typical workstation layout, as required.

2. OWNER'S PROJECT REQUIREMENTS (OPR)

2.1. The Design Professional and/or Consultant shall update the Owner's Project Requirements (OPR) document template provided during the pre-design or Schematic design phase. The OPR shall be updated at each subsequent stage of design.

2.2. The OPR shall define the project intent, functional requirements, and operation expectations. The OPR along with room data sheets, shall contain the qualitative objectives necessary to inform the project design and Basis of Design (BOD) document. Specific information included in the room data sheets are not to be repeated in the OPR.

3. DESIGN SUMMARY (BASIS OF DESIGN)

3.1. All items listed under Design Development Phase, Design Summary (Basis of Design) apply to the Construction Documents Phase, Design Summary (Basis of Design) requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner prior to issuing Construction Documents for Bid.

4. ENERGY INCENTIVES AND ENERGY AND LIFE CYCLE COST ANALYSIS

4.1. All items listed under Design Development Phase, Energy Incentives and Energy and Life Cycle Cost Analysis apply to the Construction Documents Phase, Energy Incentives and Energy and Life Cycle Cost Analysis requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner prior to issuing Construction Documents for Bid.

5. ARC FLASH, SHORT CIRCUIT AND COORDINATION ANALYSIS

5.1. All items listed under Design Development Phase, Arc Flash, Short Circuit and Coordination Analysis apply to the Construction Documents Phase, Arc Flash, Short Circuit and Coordination Analysis requirements.

5.2. The Design Professional shall not delegate design when arc flash analysis is required for a project.

- 5.3. The Design Professional shall perform an Arc Flash Analysis in accordance with OSHA 29 Part 1910, IEEE 1584, and NFPA 70E, Adopted Edition when existing electrical equipment is modified, or new electrical equipment is added to a facility.
 - 5.3.1. The Design Professional shall not utilize the NFPA 70E Table 130.7C(9) Hazard/Risk Category Classifications to estimate arc flash potential.
 - 5.3.2. The Design Professional shall develop and provide a model, using SKM Power*Tools for Windows (PTW) software.
 - 5.3.3. The Arc Flash Analysis shall begin at the primary side of the utility transformer(s) and continue through the secondary service protectors to include normal utility power and emergency power electrical distribution.
 - 5.3.4. The analysis of the electrical distribution shall consist of switchboards, distribution panels, branch panels, transformers, generators, motor control centers, facility motors with a horsepower of 5 HP or larger, and associated feeders.
 - 5.3.5. The analysis will not include receptacles, outlets, switch devices, lighting contactors, control panels, and single-phase equipment.
- 5.4. For renovation projects in buildings that do not have an existing arc flash SKM Power*Tools model, the Design Professional shall provide a one-line diagram at the completion of the project that summarizes all information applicable to the project scope required for input into a future SKM model and the Design Professional shall provide requirements in the Construction Documents for the contractor to install generic arc flash labeling for all modified and new electrical equipment.
- 5.5. The Design Professional shall perform Electrical System Selective Coordination of the following:
 - 5.5.1. Assumption is any new or modified equipment is coordinated without necessarily requiring an arc flash analysis. Renovation projects for example would require short-circuit and coordination evaluation at a minimum. When models are available, a full arc flash analysis is required.
 - 5.5.2. Selective coordination between separate components of the electrical distribution system including switchboards, distribution panels, branch panels, generator, transformers, and motor control centers (including emergency distribution equipment).
 - 5.5.3. All electronic trip-type circuit breakers in the existing electrical distribution system with a combination of field-adjustable long-time, short-time, instantaneous, and ground fault trip settings.
 - 5.5.4. The Design Professional shall develop Time Current Curves of overcurrent protection devices as follows:
 - 5.5.4.1. Evaluate the main Overcurrent Protection Device (OCP) and the largest 3-phase branch OCP in each switchboard, distribution panel, branch panel, and motor control center.
 - 5.5.4.2. Evaluate ground fault trip settings serving 3-pole (neutral not switched) automatic transfer switches of the emergency power distribution system.
 - 5.5.4.3. Evaluate generator OCP with emergency power distribution equipment.
- 5.6. When an arc flash analysis is provided, the Design professional shall:

- 5.6.1. Propose revisions such as changing breakers settings or fuse types, to improve system coordination from primary protection through the new electrical equipment added by the project when connecting to existing electrical systems.
- 5.6.2. Evaluate available fault currents and ampere interruption capacity for new and/or modified equipment, including existing equipment downstream of new and modified equipment.
- 5.6.3. Provide performance of system short-circuit calculations and equipment evaluations to verify the existing and proposed equipment interruption and withstand ratings are not exceeded.
- 5.6.4. Calculate arc flash incident energy levels for all modified and new equipment.
- 5.6.5. Provide an Arc Flash Report that documents the findings of field investigation, analysis, and recommendations based on the electrical system selective coordination and arc flash assessment. The Arc Flash Report shall include the following:
 - 5.6.5.1. The edition of the NFPA 70E, IEEE 1584 and the version of SKM Systems Analysis, Inc. Power Tools for Windows (PTW) software used for the analysis.
 - 5.6.5.2. An overview of the electrical system; scenarios analyzed; and other assumptions used for the analysis.
 - 5.6.5.3. Time Current Curves Equipment schedule showing all modified or added equipment having an incident energy level Category 3 (8 cal/cm²) or greater.
 - 5.6.5.4. SKM Power*Tools output showing all equipment, setting, cable types, and cable lengths. Bus colors shall identify incident energy level arc flash hazard categories as follows:
 - 5.6.5.4.1. Category 1 (≤ 4 cal/cm²): Blue.
 - 5.6.5.4.2. Category 2 (≤ 8 cal/cm²): Green.
 - 5.6.5.4.3. Category 3 (≤ 25 cal/cm²): Yellow or Gold.
 - 5.6.5.4.4. Category 4 (≤ 40 cal/cm²): Orange.
 - 5.6.5.4.5. Dangerous (> 40 cal/cm²): Red.
- 5.7. **Additional Services:** When NFPA 70E, Current Edition, PPE Arc Flash Category 3 or higher is discovered the Design Professional shall provide options to reduce the Arc Flash level including:
 - 5.7.1. List of options for proposed revisions by equipment.
 - 5.7.2. Cost estimate(s) for implementing proposed revisions.
 - 5.7.3. New resulting arc flash categories resulting from proposed revisions by equipment.
- 5.8. The Design Professional shall incorporate all Contractor required arc flash assessment requirements into the Construction Documents including the installation of labels in compliance with NFPA 70E labeling requirements and the Owner's template.
 - 5.8.1. Arc Flash Labels (Category Specific)

- 5.8.1.1. Refer to ARC FLASH LABELS in Appendices for arc flash labels when a model is developed or modified.
- 5.8.1.2. Equipment labels files shall indicate asset tag of equipment, source of power including equipment, and circuit number as well as differentiate by color type of power and voltage.
- 5.8.1.3. Arc flash label shall indicate the latest information required by NFPA 70E and as coordinated with the University. Label information shall include date, device name, arc flash boundary, and incident energy level (*.xls format).
- 5.8.2. Arc Flash Labels (Generic Warning)
 - 5.8.2.1. When a model is not required, the contractor to install generic arc flash labeling for all modified and new electrical equipment.
- 5.9. The Design Professional shall include an electrical one-line riser diagram showing preliminary breaker settings, ratings, available fault current, hazard levels within Construction Documents.
- 6. PROJECT COST ESTIMATE
 - 6.1. All items listed under Design Development Phase, Project Cost Estimate apply to the Construction Documents Phase, Project Cost Estimate requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner prior to issuing Construction Documents for Bid.
 - 6.2. The construction cost estimate shall become the basis for the Owner's construction estimate to be used at bid opening. The Design Professional shall provide separate estimated costs for any bid alternates included in the Bid Documents.
- 7. PROJECT SCHEDULE
 - 7.1. All items listed under Design Development Phase, Project Schedule apply to the Construction Documents Phase, Project Schedule requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner.
 - 7.2. The Design Professional shall provide a final schedule for project construction and identify the critical path. The schedule shall include purchase and delivery activities and durations for all major equipment and building components.
- 8. PROJECT MANUAL
 - 8.1. All items listed under Design Development Phase, Project Manual apply to the Construction Documents Phase, Project Manual requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner.
 - 8.2. The Project Manual shall use CSI MasterFormat™ Current Edition numbering conventions.
 - 8.3. The date of issue for the Project Manual shall be the same date as on the Drawings.
 - 8.4. The Project Manual shall be brief and consistent. Information contained in the General Conditions, Institution Requirements, or the Project Requirements shall not be repeated in any other section. Information contained in the specifications shall not be repeated except in equipment schedules.

- 8.5. The Design Professional shall list all required submittals, shop drawings, operation and maintenance manuals, warranties and certifications required.
- 8.6. Each technical specification section shall be marked “End of Section” at the end of the last page.
- 8.7. The geotechnical report, if applicable, shall be included for reference only.

9. DRAWINGS

- 9.1. All items listed under Design Development Phase, Drawings apply to the Construction Documents Phase, Drawings requirements. Changes shall be denoted, tracked, highlighted, and submitted to the Owner.

9.2. General

- 9.2.1. Drawings shall be carefully checked by the Design Professional to achieve coordination between architectural, structural, mechanical, electrical, and fixed equipment Drawings.
- 9.2.2. Pertinent information shall be shown only on discipline drawings applicable to that division of work. If information must be located on Drawings of a different discipline, Drawings shall be cross-referenced.
- 9.2.3. Notes and dimensions on Drawings shall be large enough to be easily read; including if Drawings are to be reproduced at half size.
- 9.2.4. Schedules for mechanical equipment, electrical equipment, doors, door hardware, and windows, and room finishes (including manufacturer and product names.)
- 9.2.5. Symbols and abbreviations shall be defined and shown on legends.
- 9.2.6. Design details, sketches and drawings shall be shown on the drawings, not in the Project Manual.
- 9.2.7. Sections and details shall be numbered and cross referenced.
- 9.2.8. Provide building code information, such as occupancy and construction type. A life safety plan indicating fire rated walls and means of egress shall be prepared for each level of the building affected by the project.

9.3. Title Sheets: No additional requirements

9.4. Site Drawings shall contain the following:

- 9.4.1. Project construction limits, construction fencing, and Constructor access,
- 9.4.2. Tree protection or special requirements,
- 9.4.3. Sections and Elevations of utility profiles,
- 9.4.4. Landscape planting schedule, and
- 9.4.5. Site details.

9.5. Architectural Drawings (as applicable to the project):

9.5.1. Interior Signage Drawings:

9.5.1.1. Shall be to-scale.

9.5.1.2. Sign schedule referencing location code number, sign type designation, and sign message.

9.5.1.3. Sign art shall be created in vector format to be used as mechanical art for sign fabricator.

9.5.1.4. Map art shall be created full color in vector format to be used as mechanical art for sign fabricator.

9.5.2. Roofing Drawings:

9.5.2.1. Roof drawings shall include all features and elements of the roof, including roof slope and drainage, penetrations, and mechanical equipment. The following items shall be drawn to scale on the roof plans:

9.5.2.1.1. Mechanical units, exhaust fans, vents

9.5.2.1.2. Piping, conduit, and related supports

9.5.2.1.3. Roof walkways, screens, hatches, and ladders

9.5.2.1.4. Roof drains, overflow drains and scuppers

9.5.2.1.5. Miscellaneous penetrations

9.5.2.1.6. Expansion joints and area divided curbs

9.5.2.1.7. Gutters and downspouts

9.5.2.1.8. Valley, ridges, saddles, and crickets

9.5.2.2. Details of roof system and components including:

9.5.2.2.1. Roof perimeter condition

9.5.2.2.2. Penetration condition, including vent flashing

9.5.2.2.3. Roof-related sheet metal fabrication

9.5.2.2.4. Equipment curbs, skylight curbs, and roof hatches

9.5.2.2.5. Roof expansion joints and area dividers

9.5.2.2.6. Piping and equipment supports

9.5.2.2.7. Typical roof drain and overflow drain, including sumps and flashings

9.5.2.2.8. Scuppers

9.5.3. Roof flashing details shall indicate, as a minimum, the following components:

- 9.5.3.1. Roof deck and wall substrate and other adjacent materials,
- 9.5.3.2. Insulation including separate layers and vapor retarders,
- 9.5.3.3. Roof and flashing membrane,
- 9.5.3.4. CANT strips,
- 9.5.3.5. Flashing attachment,
- 9.5.3.6. Counter flashing and reglets,
- 9.5.3.7. Sealants,
- 9.5.3.8. Wood nailers and blocking, including adequate attachment, and
- 9.5.3.9. Roofing system interface(s) with rest of building envelope(s), including details indicating how penetrations are to be handled.

9.6. Structural Drawings (as applicable to the project):

- 9.6.1. Detail junctions between floors, roof, and exterior wall assuring continuity and load path.
- 9.6.2. Drawings shall clearly dimension and accurately describe non-standard details and construction requirements. Including but not limited to:
 - 9.6.2.1. Construction and expansion joints
 - 9.6.2.2. Special jacking and lifting procedures
 - 9.6.2.3. Protective cover (concrete)
 - 9.6.2.4. Anchor bolt material and projection
 - 9.6.2.5. Special connection details
 - 9.6.2.6. Shoring requirements, including soil nails
 - 9.6.2.7. Construction sequence
 - 9.6.2.8. Bolt torque
 - 9.6.2.9. Concrete reinforcing details
 - 9.6.2.10. Connection capacity
 - 9.6.2.11. Water stops
 - 9.6.2.12. Rebar splices
 - 9.6.2.12.1. Type
 - 9.6.2.12.2. Placement

9.6.2.12.3. Location

9.7. Mechanical Drawings (as applicable to the project):

9.7.1. Ductwork drawings shall be double lined, minimum 1/4-inch scale.

9.7.1.1. All ductwork and piping 3 inches and larger shall be shown double lined.

9.7.1.2. Clearly identify locations for valves and dampers on drawings, including sections and installation details.

9.7.2. Details, cross-sectional and elevation views.

9.7.3. Equipment schedules

9.7.4. Control schematic

9.7.5. Point listing

9.7.6. Sequence of operation information

9.8. Electrical Drawings (as applicable to the project):

9.8.1. Completed equipment, lighting, and power panel schedules.

9.8.2. Details, cross-sectional and elevation views.

9.8.3. Identify circuits

9.8.4. Equipment schedules.

XII. BIDDING PHASE SERVICES

1. GENERAL

1.1. Prior to bid opening, the Design Professional shall provide to the Owner an update (verbal or written) on Bidder interest and efforts to ensure competitive bids.

1.2. The Design Professional shall evaluate bids received and submit a Letter of Evaluation of Bids.

1.2.1. The Letter of Evaluation of Bids shall include:

1.2.1.1. An analysis of the bidder's qualifications to determine if the apparent low bidder is responsible [qualified].

1.2.1.2. An analysis of the apparent low bidder's breakdown of cost against the scope of work to determine if the bid is responsive.

1.2.1.3. An analysis of the bid spread and its comparison to the Design Professional's pre-bid construction estimate.

1.2.1.4. An analysis of variations in the bids.

- 1.3. The Design Professional shall deliver a complete set of the Architectural Floor Plan Drawings including any Architectural Floor Plan Drawings issued via addenda in single page .dwg format to the Owner within five (5) days after the project's bid opening; the Drawings shall have individual information blocks with dates.
- 1.4. The Design Professional shall provide a complete set of Construction Documents (Drawings) in single page .dwg format to the Owner upon request for Constructor's use; the Drawings shall have individual information blocks with dates.
- 1.5. The Design Professional shall ensure all Construction Documents (Drawings and Specifications) and Addenda certificates, seals and signatures are provided to the Owner using DocuSign. Owner to initiate DocuSign envelope with Bid Documents submitted to Owner.
2. DESIGN SUMMARY (BASIS OF DESIGN)
 - 2.1. No additional requirements
3. ENERGY INCENTIVES AND ENERGY AND LIFE CYCLE COST ANALYSIS
 - 3.1. No additional requirements
4. ARC FLASH, SHORT CIRCUIT AND COORDINATION ANALYSIS
 - 4.1. No additional requirements
5. PROJECT COST ESTIMATE
 - 5.1. The Design Professional shall provide the latest construction estimate for base scope and any alternates to the Owner prior to the project being advertised for bid.
 - 5.2. The Design Professional shall notify the Owner if the construction estimate changes during the bidding period.
6. PROJECT SCHEDULE
 - 6.1. No additional requirements
7. PROJECT MANUAL
 - 7.1. Addenda
 - 7.1.1. The Design Professional shall prepare all required addenda and submit to the Owner for distribution. Upon approval from Owner, The Design Professional shall upload the addenda to the Owner's Printing Vendor.
 - 7.1.2. Addenda items shall be approved by the Owner prior to issuance.
 - 7.1.3. Addenda shall be issued a minimum of seven (7) calendar days prior to the bid date.
 - 7.1.3.1. If Addenda occurs six (6) or fewer days before the bid date, the bid date shall be extended, or the Design Professional shall verify each plan holder has a copy of the addenda no less 48 hours prior to the bid opening.

8. DRAWINGS

8.1. Addenda

- 8.1.1. The Design Professional shall prepare all required addenda and submit to the Owner for review. Upon approval from Owner, The Design Professional shall upload the addenda to the Owner's Printing Vendor.
- 8.1.2. Addenda items shall be approved by the Owner prior to issuance.
- 8.1.3. Addenda shall be issued a minimum of seven (7) calendar days prior to the bid date.
 - 8.1.3.1. If Addenda occurs six (6) or fewer days before the bid date, the bid date shall be extended, or the Design Professional shall verify each plan holder has a copy of the addenda no less 48 hours prior to the bid opening.

XII.XIII. CONSTRUCTION PHASE SERVICES

1. GENERAL

- 1.1. Meeting minutes shall be issued to the Owner's Representative for review within three (3) working days of a construction progress meeting. Following review by the Owner, the Design Professional shall distribute the meeting minutes to all PROJECT participants.
- 1.2. Project Finishes Documents:
 - 1.2.1. When required, the Finishes Binder shall include the following items, unless indicated otherwise by the Owner (Design Professional shall use Owner templates for cover and sample forms):
 - 1.2.1.1. Cover: including project name, project number, date issued and Design Professional's name.
 - 1.2.1.2. Table of Contents
 - 1.2.1.3. Finish schedule including 11 x 17 finish plan of each floor
 - 1.2.1.4. Final finish samples including:
 - 1.2.1.4.1. Product information (manufacturer and product name).
 - 1.2.1.4.2. Product location of use.
 - 1.2.1.4.3. Loose samples provided in plastic sleeves with label.
 - 1.2.2. Electronic format of samples shall include an image from the manufacturer's website or a photo of the actual sample.
 - 1.2.3. The Finishes Binder shall be submitted electronically through the Owner's project management website, BuildUI.
- 1.3. Shop drawings and submittals

- 1.3.1. The Design Professional shall consolidate all reviewers' comments per submittal into one (1) file and respond to the consolidated list of comments.
 - 1.4. Operation and Maintenance Manual(s):
 - 1.4.1. The Design Professional shall review the Operation and Maintenance Manual(s) via BuildUI Submittal system or Submittal Exchange prior to Final Completion of the project Work.
 - 1.4.2. If not approved, return to the Contractor with review comments.
 - 1.5. Punchlist and Final Completion:
 - 1.5.1. The Design Professional shall send the Owner's Representative the punch list, organized by room, system, or area.
 - 1.5.2. Upon verification by the Design Professional of Contractor's completion of the punch list items, the Design Professional shall provide a letter to the Owner's Representative certifying the completion of the project and recommending Final Completion.
 - 1.6. Record Documents:
 - 1.6.1. The Design Professional shall produce Record Documents within thirty (30) days following Owner's Final Completion of the project or thirty (30) calendar days from receipt of the Contractor's As-Built documents whichever is earlier and shall send Record Documents in electronic format to Facilities Management – Design & Construction, Attn: Facilities Managt. Document Ctr facilities-doc-ctr@uiowa.edu .
 - 1.6.2. Record Documents shall incorporate all Addenda, Post-Bid changes, including changes made via submittal review, supplemental documents (incorporated into the Contractor's Contract by Change Order), and Constructor's field changes (As-Built Documents).
2. OWNER'S PROJECT REQUIREMENTS (OPR)
 - 2.1. The Design Professional and/or Consultant shall update the Owner's Project Requirements (OPR) document template provided during the pre-design or Schematic design phase. The OPR shall be updated at each subsequent stage of design.
 - 2.2. The OPR shall define the project intent, functional requirements, and operation expectations. The OPR along with room data sheets, shall contain the qualitative objectives necessary to inform the project design and Basis of Design (BOD) document. Specific information included in the room data sheets are not to be repeated in the OPR.
3. DESIGN SUMMARY (BASIS OF DESIGN)
 - 3.1. No additional requirements.
4. ENERGY INCENTIVES AND ENERGY AND LIFE CYCLE COST ANALYSIS
 - 4.1. No additional requirements.
5. ARC FLASH, SHORT CIRCUIT AND COORDINATION ANALYSIS

- 5.1. The Design Professional shall review the contractor installed arc flash labels for compliance with Contract Documents.
- 5.2. **Additional Services:** When Services include evaluation of reducing category levels, the Design Professional shall update the model and review impacts with the Owner. The Design Professional shall update the SKM Power*Tools model with final as-installed equipment and conditions.
- 5.3. For projects where there is no existing model or a model is not required to be developed, the Design Professional shall provide a one-line diagram at the completion of the project that summarizes all information required for input into a future SKM model and the Design Professional shall provide requirements in the Construction Documents for the contractor to install generic arc flash labeling for all modified and new electrical equipment.
- 5.4. The Design Professional shall provide Arc Flash Analysis Record Documents showing final as-installed equipment and conditions prior to Substantial Completion including:
 - 5.4.1. Final Arc Flash Report (*.pdf)
 - 5.4.2. SKM PowerTool System Model (native format)
 - 5.4.2.1. The model should detail the coordinated breaker sizing and setting requirements for the service protector, including all downstream circuits and protective devices in the building.
 - 5.4.3. SKM PowerTool DAPPER Input file (*.pdf)
 - 5.4.4. SKM PowerTool TCCs (*.pdf)
 - 5.4.5. SKM PowerTool Model Output One-Line Diagrams (*.pdf)
 - 5.4.6. Arc Flash Labels File (*.xls)
6. PROJECT COST ESTIMATE
 - 6.1. The Design Professional shall review all change order pricing and issue written responses within five (5) working days following receipt. Change orders exceeding \$10,000 shall require a detailed and itemized estimate to include labor, equipment, material, and overhead and profit margins, if applicable.
7. PROJECT SCHEDULE
 - 7.1. No additional requirements
8. PROJECT MANUAL
 - 8.1. The Design Professional shall update the Project Manual for a record of final conditions, see Record Documents above.
9. DRAWINGS
 - 9.1. The Design Professional shall update the Drawings for a record of final conditions, see Record Documents above.

**END SECTION II –
DESIGN PROFESSIONAL AND CONSULTANT SERVICE GUIDELINES**

**SECTION III –
GENERAL DESIGN STANDARDS
and OUTLINE SPECIFICATIONS
AND DETAILS**

This section contains information to be used by Design Professionals in the design of The University of Iowa facilities and infrastructure.

These criteria represent minimum levels of performance, quality, and/or standards, which are sometimes different than those accepted in private and commercial industry. This is in recognition that these facilities must survive longer than normal service lives, without undue cost, while still supporting academic, research, and service missions of The University of Iowa.

Any conflicts between the requirements in listed reference documents shall be resolved by the Owner.

1) SPECIAL DETAILED REQUIREMENTS

1. ACCESSIBILITY

- 1.1. In new construction, all public entrances to the building shall be designed for universal accessibility.
 - 1.1.1. Entrances on an accessible route, including the main entrance, shall be provided with one (1) door, or set of power operated doors.
 - 1.1.2. If an entrance to the building other than the main entrance is located closer to the parking designated for persons with disabilities, that entrance shall also be power operated.
 - 1.1.3. The main floor or centrally located Men's and Women's restroom shall include a power operated door or be designed without doors.
 - 1.1.4. Power operated doors that are sequentially operated shall allow for a one-second-per-foot delay.
- 1.2. In existing buildings, a minimum of one (1) entrance shall provide universal accessibility. The accessible entrance shall be power operated and shall be the main entrance unless otherwise approved by the Owner. Whenever it is physically and economically feasible, all entrances shall be made accessible.
- 1.3. Door and gate closer push/pull force and closing speed shall be confirmed to ensure compliance with ADA Standards.
- 1.4. Avoid or eliminate grates or other openings in traveling surfaces.
- 1.5. Employee spaces used for purposes other than job-related tasks (break rooms, tea rooms, kitchen/kitchenettes, copy rooms, conference rooms, lounges, showers, and locker rooms, etc.) are considered "common use" and are required to be fully accessible. Sinks shall be accessible with the requirements for a forward approach.
- 1.6. Reception and Service Counters are to be designed for universal accessibility and at a minimum, be accessible as required by the ADA Standards for Accessible Design.
- 1.7. Induction hearing loop systems shall be the system installed for spaces requiring assistive listening systems.
- 1.8. Guardrails or permanent barriers shall be provided where the vertical clearance is less than 80 inches high in pedestrian circulation pathways. Areas located under open stairs require access by means of a self-closing gate.

2. ENVIRONMENTAL COMPLIANCE

- 2.1. Hazardous Materials

2.1.1. Projects involving hazardous waste, universal waste, and other environmental waste shall coordinate with the Owner and/or Utility Operator to ensure proper storage, handling, and disposal.

2.1.1.1. Hazardous waste includes, but is not limited to PCBs, lead, mercury, and solvents.

2.1.1.2. Universal waste includes, but is not limited to batteries, mercury-containing equipment, fluorescent tubes, and ballasts.

2.1.1.3. Environmental waste includes, but is not limited to household hazardous waste, electronic waste, potential for lead-based paint, oil, and hydraulic fluids.

2.1.2. Polychlorinated Biphenyl (PCB):

2.1.2.1. PCB containing ballasts shall not be discarded.

2.1.2.2. The Constructor shall remove PCB containing ballasts, containerize on site, and notify Owner for pickup.

2.1.3. Mercury:

2.1.3.1. The Constructor shall remove mercury containing lamps (including fluorescent, high intensity discharge (HID), and neon/argon), containerize on site, and notify Owner for pickup.

2.1.3.2. Lamps containing mercury shall not be discarded.

2.1.4. Mold:

2.1.4.1. Notify Owner if the presence of mold is discovered or suspected.

2.1.4.2. Reference EPA Publication 402-K-01-001, Mold Remediation in Schools and Commercial Buildings, September 2008.

2.1.5. Acid:

2.1.5.1. Underground acid neutralization tanks shall not be used.

2.2. Asbestos:

2.2.1. Projects involving demolition or renovation require an asbestos inspection. The Design Professional shall coordinate with the Owner and/or Utility Operator to ensure proper inspection, handling, and disposal and to determine permitting requirements.

2.3. Contaminated Soils:

2.3.1. Design Professional shall coordinate with the Owner and/or Utility Operator for proper handling and disposal of known contaminated material and reporting.

2.4. Clean Air Act Compliance:

2.4.1. All sources of emissions, permitted and non-permitted, shall be documented by the Owner.

- 2.4.2. If project includes an air emission source Design Professional shall coordinate with the Owner to ensure exchange of required information. Permitting, monitoring, pollution control, and dispersion modeling shall be coordinated and completed with the assistance of the Owner.
- 2.4.3. The construction, installation, or alteration of any equipment capable of emitting air contaminants requires that an air construction permit from the Iowa Department of Natural Resources be obtained prior to the initiation of construction. Exemptions from the pre-construction permit requirements are provided under Iowa Department of Natural Resources (DNR) rules. Common emissions sources requiring a construction permit include, but are not limited to:
 - 2.4.3.1. Boilers
 - 2.4.3.2. Generators
 - 2.4.3.3. Incinerators
 - 2.4.3.4. Fuel burning equipment
 - 2.4.3.5. Pollution control equipment
- 2.5. Spill Prevention Control and Countermeasures (SPCC) 40CFR112:
 - 2.5.1. For projects which include installation of any oil storage container or equipment, including cooking oil, with capacity of 55 gallons or larger (including stand-alone drums):
 - 2.5.1.1. Provide double-walled container or secondary containment.
 - 2.5.1.2. Design Professional shall coordinate with the Owner and/or Utility Operator to ensure exchange of required information prior to final review of drawings and specifications.
- 2.6. Underground Storage Tanks (UST):
 - 2.6.1. If the project includes installation of an underground storage tank, Design Professional shall coordinate with the Owner for proper notice and registration with IDNR.
 - 2.6.2. If the UST is 19,812 gallons or more, an air construction permit is required. Coordinate with Owner for proper permitting.
 - 2.6.3. For removal of an underground storage tank, Design Professional shall coordinate with Owner for proper tank closure procedures and reporting.
- 2.7. National Pollutant Discharge Elimination System (NPDES):
 - 2.7.1. Municipal Separate Storm Sewer System (MS4) NPDES Permit:
 - 2.7.1.1. The Owner's National Pollutant Discharge Elimination System (NPDES), Phase II, Municipal Separate Storm Sewer System (MS4) (NPDES Permit No. 52-25-0-06) permit is available on request.
 - 2.7.1.2. The Owner's MS4 Permit requires implementation and enforcement of a Construction Site Runoff Control Policy Statement (Condition II-D) and a Post-Construction Runoff

Control Policy Statement (Condition II-E). This Section of The University of Iowa Design Standards and Procedures constitutes the policy statements required in the MS4.

- 2.7.1.3. For projects disturbing the land or landscape, consult with Owner to determine applicable permit requirements.
 - 2.7.1.4. Design shall minimize the post-construction storm water runoff to prevent or minimize water quality impacts and minimize the quantity of storm water runoff.
 - 2.7.1.5. The site shall be designed to manage the water quality volume of 1.25 inches, following practices approved by the Iowa Storm Water Management Manual.
 - 2.7.1.6. The site shall be designed to manage the water quantity such that post-construction peak discharge does not exceed existing site peak discharge, based on peak discharges for 2, 5, and 100-year rain events, following practices consistent with the Iowa Storm Water Management Manual and the Iowa Department of Natural Resources rules.
 - 2.7.1.7. Best Management Practices (BMP) include, but are not limited to, storm water detention, retention, grass swales, bio retention swales, and riparian buffers. BMPs shall be included in the project design.
 - 2.7.1.8. Design Professional shall submit a narrative describing BMP features, including operation and maintenance requirements no later than 50 percent Construction Documents, and such BMP shall be approved and reviewed by University Environmental Services.
 - 2.7.1.9. If a BMP is not included in the project design, a Deviation Request is required to explain why, listing considerations other than, or in addition to, budgetary concerns.
- 2.7.2. NPDES General Permit No. 2 – Storm Water Discharge Associated with Industrial Activity for Construction Activities:
- 2.7.2.1. Comply with the requirements of NPDES General No. 2. Consult with Owner to ensure compliance with all applicable permit requirements.
 - 2.7.2.2. Construction Site Runoff Control:
 - 2.7.2.2.1. For construction sites of one (1) acre or more:
 - 2.7.2.2.1.1. Owner is responsible for obtaining the Iowa NPDES General Permit No. 2 for the project.
 - 2.7.2.2.1.2. Consultants shall use Shive-Hattery, Inc. to develop a Storm Water Pollution Prevention Plan (SWPPP) for projects of one (1) acre or more.
 - 2.7.2.2.1.3. Design Professional shall include Owner’s permitting requirements in the documents.
 - 2.7.2.2.2. For construction sites less than one (1) acre:
 - 2.7.2.2.2.1. Constructor shall provide sediment and erosion control measures to prevent sediment from leaving the site.

2.7.2.2.2. Design Professional shall include Owner's MS4 Permit requirements in the documents.

2.7.3. NPDES General Permit No. 1 – Storm Water Discharge Associated with Industrial Activity:

2.7.3.1. Comply with the requirements of NPDES General No. 1. Consult with Owner and/or Utility Operator to ensure compliance with all applicable permit requirements.

2.7.4. Direct Discharge: If the project includes a direct discharge into waters of the U.S., coordinate with Owner for proper permitting and compliance with requirements.

2.8. Flood Plain Permits: For projects with any activity within a 100-year flood plain, coordinate with Owner and or Utility Operator for proper permitting.

2.9. Water Use Permits: For projects drawing water from a well or surface water (e.g., pond or river), coordinate with Owner and/or Utility Operator for proper permitting.

3. DEMOLITION

3.1. Permits, hazardous materials, and salvaging of equipment or fixtures shall all be reviewed with the Owner.

3.1.1. A permit shall be required for abandonment of a well. Design Professional shall coordinate with the Owner and/or Utility Operator.

3.1.2. Refer to ENVIRONMENTAL COMPLIANCE for removal of underground storage tanks.

~~3.1.3. For UIHC: Demolition of Lead Shielding shall be removed intact and shall not be damaged (torn, drilled, sanded, or abraded.) If the lead is not separable from the regular construction waste, the UIHC Health Protection Office shall be notified.~~

3.2. Prior to completion of final Review Documents, Owner shall identify material removed by demolition which is to remain on property.

3.3. Demolition materials other than those required to complete the construction project and designated for return to Owner, shall become the property of the Constructor and shall be removed from the site and off Owner's property in accordance with the Owner's instructions. The material shall be disposed of in a legal manner.

3.4. All asbestos materials shall be removed prior to general demolition.

3.5. Computer-based systems with removed electronic components shall be deprogrammed / decommissioned prior to removal of electrical / IT.

3.6. For UIHCospitals and Clinics:

~~3.5.3.6.1. Demolition of Lead Shielding shall be removed intact and shall not be damaged (torn, drilled, sanded, or abraded.) If the lead is not separable from the regular construction waste, the UIHC Health Protection Office shall be notified.~~

4. GENERAL STRUCTURAL DESIGN GUIDELINES

4.1. Load Criteria:

4.1.1. Load criteria for all structural systems shall be noted on the drawings.

4.1.2. Roof Loadings:

4.1.2.1. Minimum ground snow load design is 30 psf.

4.1.2.2. Snow load design shall also account for drift-loading on lower roof surfaces.

4.1.3. Floor Loadings:

4.1.3.1. Shall account for program requirements.

4.1.4. Wind Design:

4.1.4.1. Wind load design criteria shall be 90 mph wind load, Importance Factor 1.15, Exposure B for East and West Campuses, Exposure C for Research Park, Hawkeye and Finkbine Campuses.

4.2. Separate additions from existing structures with an expansion joint.

4.3. Vertical loads shall not be transferred through horizontal expansion joints.

4.4. Expansion joint assemblies in floors shall be semi-recessed, creating a smooth floor finish, and rated for cart traffic.

4.5. Facilities shall be constructed of fire-resistant materials.

4.6. Facilities shall be designed to withstand flooding up to 500-year flood plus 2 feet grade elevation. Design shall include measures to withstand hydraulic pressures on the structure(s).

4.7. Any cored holes in concrete slabs shall be patched using non shrink grout and pins anchored into the slab in the existing opening to tie the new patch into the existing slab and a steel plate shall be used below the slab to support the new patch being installed.

4.8. Use current geotechnical investigation to establish soil profiles, design parameters, compaction requirements, and foundation design options.

4.9. Concrete duct banks, tunnels, and other concrete masses shall be attached to foundation walls with steel pins in epoxy capsules.

5. GENERAL BUILDING ENVELOPE DESIGN GUIDELINES

5.1. General:

5.1.1. The building envelope shall comply with ASHRAE/IES Standard 90.1.

5.1.2. All above grade vertical opaque elements of the building envelope continuous thermal control barrier shall have a minimum R-Value of 24 (not averaged).

5.1.3. All above grade horizontal opaque elements of the building envelope continuous thermal control barrier shall have a minimum R-Value of 30 (not averaged) except as required to tie into roof drains.

5.1.4. All below grade elements (vertical and horizontal) of the building envelope thermal control barrier shall have a minimum R-Value of 10 (not averaged), to a minimum below grade depth of four (4) feet.

5.1.5. Crawl spaces shall have concrete floor slabs, floor drains, ventilation, and lighting.

5.2. Exterior Building Materials:

5.2.1. Exterior building materials shall be selected to maintain and/or compliment the harmonious nature of the campus. Care shall be given to provide a consistent image to the character of the campus.

5.2.2. Materials shall be practical, maintenance free, durable, and cost effective.

5.2.3. Exterior walls systems of brick or stone are preferred over metal.

5.2.4. Block backup is preferred over the use of steel stud backup.

5.2.5. Exterior insulation and finish systems (EIFS), stucco, and plaster shall not be used as the primary finish of a building or renovation.

5.3. Exterior Enclosure Performance Requirements:

5.3.1. Materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.0002 cfm/ft² under a pressure differential of 0.3-inches water (1.57 psf) (0.02 L/s.m² @ 75 Pa), when tested in accordance with ASTM E 2178.

5.3.2. Materials used for the weather barrier system in the opaque envelope shall be vapor impermeable with a water vapor permeance not to exceed 0.08 perms when tested in accordance with ASTM E96 – method B. Water absorption shall not exceed 0.1 percent maximum when tested in accordance with ASTM D570.

6. General Finishes Guideline

6.1. Paint colors utilized within prominent, public spaces shall be neutral or highlight the Iowa brand.

6.2. Utilize preapproved paint colors in alignment with:

6.2.1. the existing **Interior Color Palettes by Building appendix document** for the building if available,

6.2.2. the existing colors within the building identified by color match, or, if an existing color palette does not exist and color matching is not feasible,

~~5.3.2.~~ the **Interior Color Palettes by Architectural Classification appendix document** that aligns with the architectural classification of the building in accordance with the **Architectural Classification Database appendix document**. NOTE: See the **Architectural Classification Examples appendix document** for sample classifications of university buildings.

7. Utility Operator System Design

7.1. Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping.

7.2. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance--like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.

2) SPACE GUIDELINES

1. Lactation Rooms:

- 1.1. Minimum room size shall be 6-feet by 9-feet.
- 1.2. Room shall be accessed directly from the women's restroom where possible.
- 1.3. Lactation Rooms shall have painted walls.
- 1.4. Door shall have access control, be keyed with storage room lock with deadbolt, and occupancy indicator if single use.
- 1.5. Counter shall be 6-feet by 2-feet, no lower storage, with a small sink and gooseneck faucet located at one (1) end of the counter.
- 1.6. One (1) electrical outlet shall be installed for pump. Locate outlet on the side wall above the counter, at opposite end of the counter from the sink.
- 1.7. Provide mirror, 4-foot high by 3-foot wide minimum, mounted above the non-sink side of the counter.
- 1.8. ~~No bulletin board is required.~~Provide 4 foot by 4 foot bulletin board.
- 1.9. Provide one (1) non-upholstered, non-caster chair with arms.
- 1.10. Provide wall-mounted clock.
- 1.11. Soap dispenser and paper towel dispenser shall be wall-mounted next to the sink.
- 1.12. Minimum of three (3) single or two (2) double coat hooks shall be installed on wall.
- 1.13. Mount ~~bulletin board and~~ clock so visible from the seated position.

1.14. For UI Housing:

1.14.1. Ceramic floor tile shall be used in lactation rooms.

1.14.1.15. For UI-Hospitals and Clinics:

1.15.1. Lactation rooms shall not be accessed directly from restrooms. Where possible, they shall be accessed off public areas and/or hallways.

1.15.2. Rooms designated primarily for staff use shall include a small under counter refrigerator.

1.15.3. Badge access required.

1.15.4. Sink required.

1.15.5. Sitting height counter required next to sink.

~~1.14.1. Chair shall not be upholstered.~~

~~1.14.2. No bulletin board is required.~~

~~1.14.3. Door shall have access control.~~

~~1.15. For UI Housing:~~

~~1.15.1. Ceramic floor tile shall be used in lactation rooms.~~

2. Restrooms

2.1. Restrooms shall have ceramic tile wainscot minimum of 54 inches. Wet walls (sinks, urinals, water closets, etc.) shall have ceramic tile from floor-to-ceiling.

~~2.2. For UI Housing:~~

~~2.2.1. Resinous flooring and stainless-steel wall paneling up to 54" shall be used in restrooms.~~

~~2.3.2.2.~~ Drywall ceilings shall not be used in public restrooms.

~~2.4.2.3.~~ Provide floor drains and centrally located hose bibbs.

~~2.5.2.4.~~ Locate hose bibb adjacent to lavatory such that it is reachable without reaching under lavatory counter, 18 inches above finished floor.

~~2.6.2.5.~~ Floor drains shall be installed as required to maintain a minimum ratio of one (1) floor drain for every 500 square feet of floor area.

~~2.7.2.6.~~ Single User Restrooms:

~~2.7.1.2.6.1.~~ New facilities and additions shall include an accessible single user restroom.

~~2.7.2.2.6.2.~~ Remodel projects impacting, or adjacent to, existing restroom facilities shall include an accessible single user restroom.

~~2.7.3.2.6.3.~~ Accessible single user restrooms shall not be used as a substitute for accessible multi-user restrooms.

~~2.7.4.2.6.4.~~ Restroom shall be located on the main floor of the facility within the main circulation path.

~~2.8.2.7.~~ Restroom shall contain one (1) baby changing station.

~~2.9.2.8.~~ Restroom entrance shall not have open sight lines.

~~2.10.2.9.~~ Restrooms shall have electric hand dryers located to minimize water in the walking path.

~~2.10.1. Locate electric hand dryers to minimize water in walking path.~~

~~2.10.2. For Athletics:~~

~~2.10.2.1. Coordinate use of paper towel dispensers, in addition to or in lieu of electric hand dryers, with Owner.~~

~~2.10.3. For UIHC:~~

~~2.10.3.1. UIHC facilities shall use Paper towel dispensers in lieu of electric hand dryers.~~

~~2.11-2.10.~~ Hand-operated flush controls within accessible toilet stalls shall be located on the open side of the water closet.

~~2.12-2.11.~~ Lavatories shall be installed in countertops and not as separate wall-hung fixtures.

~~2.13-2.12.~~ Mirrors shall be the full width of the counter, without a shelf, not to exceed 7-feet above finished floor

~~2.14-2.13.~~ A narrow shelf shall be located near the entrance of restroom.

~~2.15-2.14.~~ Coat hooks shall be included either below or near the shelf.

~~2.16-2.15.~~ Provide coat hook in each restroom stall.

~~2.16.1-2.15.1.~~ Locate hooks on wall or partition to prevent injuries to Owner staff when cleaning or maintaining the space.

~~2.17-2.16.~~ Ceramic toilet accessories shall not be used.

~~2.18-2.17.~~ Built-in or metal waste receptacles shall not be used.

~~2.19-2.18.~~ All restrooms shall have a sharps container.

~~2.20-2.19.~~ Sanitary disposal containers shall be wall mounted. However, single user bathrooms may be different.

~~2.21-2.20.~~ Sanitary napkin and tampon dispensers shall not be installed in restrooms.

~~2.22-2.21.~~ All accessible toilet stalls shall have the toilet paper dispensers installed above the side wall grab bar.

~~2.22.~~ The outlet of the toilet paper dispenser shall be 4 feet 0 inches above finished floor and the top of the gripping surface of the grab bar shall be minimum 2 feet 9 inches and maximum 3 feet 0 inches above finished floor.

2.23. For UI Athletics:

~~2.23-2.23.1.~~ Coordinate use of paper towel dispensers, in addition to or in lieu of electric hand dryers, with Owner.

2.24. For UI Housing:

2.24.1. Resinous flooring and stainless-steel wall paneling up to 54" shall be used in restrooms.

~~2.24.1-2.24.2.~~ Provide the following restroom accessories:

~~2.24.1.1-2.24.2.1.~~ A diaper changing station in public restrooms on non-sleeping floors.

~~2.24.1.2-2.24.2.2.~~ An 18-inch length towel bar per bed in sleeping rooms.

~~2.24.1.3-2.24.2.3.~~ In bathroom/ restrooms with showers provide:

~~2.24.1.4-2.24.2.4.~~ a shower curtain track, curtain rod and shower curtain

~~2.24.1.5-2.24.2.5.~~ folding shower seat (ADA bathrooms only)

~~2.24.1.6-2.24.2.6.~~ wall-mounted soap dish

~~2.24.1.7-2.24.2.7.~~ towel bar and towel pin

~~2.24.1.8-2.24.2.8.~~ robe hook

~~2.24.2.9.~~ sanitary napkin and tampon disposal container.

2.25. For UI-Hospitals and Clinics:

2.25.1. Drywall ceilings are permitted in in-patient restrooms.

2.25.2. Hose bibbs are not permitted in any UI-Hospitals and Clinics restrooms.

2.25.3. Remodel projects impacting, or adjacent to, existing restroom facilities on the main floor and within the main circulation path shall include an accessible single user restroom where feasible.

2.25.4. Baby changing stations are not required in in-patient restrooms. They may be installed at the owner's request based on patient population. They shall be installed in public restrooms.

2.25.5. Paper towel dispensers shall be used in lieu of electric hand dryers.

2.25.6. Mirrors are not required to be the full width of the counter.

2.25.7. Restrooms shall not include an over the sink vanity light fixture.

~~A narrow shelf is only not required near the entrance of the public restrooms.~~

~~Coat hooks are only not required near the entrance of the public restrooms.~~

2.25.8. Built-on or metal waste receptacles shall not be used unless there are space constraints.

2.25.9. Sharps containers shall only be installed in public restrooms within the main circulation path. They are not permitted in in-patient restrooms.

2.25.10. Sanitary napkin and tampon dispensers may be installed in public restrooms.

2.25.11. All accessible toilet stalls within public restrooms and all in-patient restrooms shall have side wall vertical grab bars.

~~2.24.1.9-2.25.12.~~The outlet of the toilet dispenser shall be below the grab bar.

3. Shower and Locker Rooms:

3.1. Accessible showers shall have a floor drain, located outside of the shower.

4. Recycle and Landfill (Trash) Receptacles:

4.1. Design Professional shall identify and account for the space for the collection, transport, and disposal of the expected waste streams from each space.

4.2. Waste streams include recycling, landfill, composting, biohazardous materials (red bins), batteries, electronics, and other specialized materials.

4.3. Collection points shall be identified on the floor plans.

- 4.4. Recycle and landfill containers shall exist in pairs.
- 4.5. Restrooms shall contain landfill container(s) only. Use Small or Slim Jim container based on anticipated volume of waste.
- 4.6. Printing and copy equipment stations shall have recycling container(s) and a Tiny Trash container for waste such as staples.
- 4.7. Containers:
 - 4.7.1. Containers, other than listed below, require written approval from Owner.
- 4.8. Products:
 - 4.8.1. Tiny Trash Container: Busch Systems BC1500 (container), BC1500L (lid)
 - 4.8.2. Small Containers: 7- gallon Rubbermaid 2956-73
 - 4.8.3. Slim Jim Container: 23-gallon Rubbermaid 3540-75
 - 4.8.4. 32-gallon: Rubbermaid 2632-00 (container), 2640 (casters)
 - 4.8.5. 40-gallon: Rubbermaid 3536-00 (container), 3530 (casters)
 - 4.8.6. 64-gallon: Toter ACC64
- 4.9. Color:
 - 4.9.1. Recycle containers and/or signage shall be blue.
 - 4.9.2. Compost containers and/or signage shall be green.
 - 4.9.3. Landfill containers shall not be blue, green, or red.
- 4.10. Signage:
 - 4.10.1. Containers shall have signage indicating "Recycle," "Landfill," or "Compost" on the container or enclosure.
 - 4.10.2. Signage shall indicate the waste stream details as indicated below and be located on or above the container or enclosure.
 - 4.10.2.1. Recycle: Plastic containers, paper, cans, cardboard
 - 4.10.2.2. Landfill: Plastic bags, wrappers, glass, Styrofoam
 - 4.10.2.3. Compost: Food scraps, coffee grounds/filters, paper towels/napkins
 - 4.10.2.4. Tiny Trash containers and blue small containers with the recycle logo do not require signage.
- 4.11. Openings:
 - 4.11.1. Recycle container openings shall be Saturn-top or lidded.

- 4.11.1.1. Diameter of opening: 5-inches to 6-inches
- 4.11.1.2. Width of ring: 2 ½-inches to 3-inches
- 4.11.1.3. Length of opening: 10-inches to 14-inches
- 4.11.2. Compost container openings shall be rectangular or lidded.
 - 4.11.2.1. Width of opening: 5-inches to 8-inches
 - 4.11.2.2. Length of opening: 10-inches to 14-inches
- 4.11.3. Openings shall be ADA accessible.
- 4.12. The following shall apply where containers are installed in enclosure, including cabinetry or casework:
 - 4.12.1. Containers shall be capable of being rolled into cabinetry.
 - 4.12.2. Design shall not require the lifting of containers.
 - 4.12.3. Enclosures shall accommodate standard, 40-gallon containers as listed above.
 - 4.12.4. Enclosure opening shall be ADA accessible.
 - 4.12.5. Signage shall be visible to public.
- 4.13. Locations:
 - 4.13.1. Containers at an individual office or workstation shall consist of a Small recycle container and a Tiny Trash container. Office suites or groups of workstations may have a common set of larger containers.
 - 4.13.2. Public gathering spaces, such as corridors, concourses, and atria, shall be primary collection points. Corridors serving classrooms shall have containers.
 - 4.13.3. Staff breakrooms and lounges shall be primary collection points.
 - 4.13.4. Classrooms shall not have containers.
 - 4.13.5. Conference and meeting rooms shall have containers.
 - 4.13.6. Wet lab spaces shall have containers.
 - 4.13.7. Mailrooms shall have containers.

~~4.13.8.~~ **4.14.** For UI-Hospitals and Clinics:

~~4.13.8.1.~~ 4.14.1. Refer to table below.

Description	Manufacturer	Item #	Location	Dimensions
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Trash Container, 23 Gallon, Open Top	Tough Guy	4PGU8 (Gray), 4PGV1 (Beige)	Inpatient Rooms, Exam Rooms, Procedure Rooms, Work Rooms, Public Restrooms	20-inch wide by 10 ¾- inch deep by 30-inch high
Bulk Recycling Container, Wheeled, 96 Gallon Blue; 10-inch / 4-inch casters	Toter, Inc.	ACC96	Either Recycling Holding or General Soiled Holding	30-inch wide by 36-inch long by 46-inch high
Cage Cart, Bulk Cardboard/Trash/Soiled Linens	C & H Distributors, LLC	4731503	Either Recycling Holding or General Soiled Holding	62-inch wide by 27 ½-inch deep by 72-inch high
UI Laundry Bin (provided by UI Laundry Services)			Only in Inpatient Areas: One in Clean Linens, One in Soiled Holding	39-inch wide by 29-inch deep by 36-inch high

5. Vending Spaces:

5.1. Vending Machines available for use on Campus by Coca-Cola (The University of Iowa approved beverage supplier).

5.2. Design Professional shall account for vending space needs and utility requirements.

5.2.1. Royal 660

5.2.1.1. All-can machines, non-glass front bottle machine.

5.2.1.2. Dimensions shall be 72-inches high by 37-inches wide by 34-inches deep.

5.2.1.3. Power shall be 115 volts, 12 amps.

5.2.2. Royal 804

5.2.2.1. Taller version of Royal 660.

5.2.2.2. Dimensions shall be 80-inches high by 37-inches wide by 34-inches deep.

5.2.2.3. Power shall be 115 volts, 12 amps.

5.2.3. RVV500

5.2.3.1. Smaller glass front - may hold cans or bottles.

5.2.3.2. Dimensions shall be 72-inches high by 37-inches wide by 35 ½-inches deep.

5.2.3.3. Power shall be 115 volts, 12 amps.

5.2.4. D5000

5.2.4.1. Large glass front.

5.2.4.2. Dimensions shall be 72-inches high by 52-inches wide by 35-inches deep.

5.2.4.3. Power shall be 115 volts, 12 amps.

5.2.5. Vendo Vue

5.2.5.1. Mid-size glass front.

5.2.5.2. Dimensions shall be 72-inches high by 41 ½-inches wide by 35-inches deep.

5.2.5.3. Power shall be 115 volts, 10 amps.

5.3. For UI Athletics:

5.3.1. Vending spaces content does not apply. If a UI Athletics project includes vending spaces, capture Owner requirements through the Owner Project Requirements process.

5.4. For UI Housing:

5.4.1. Vending spaces content does not apply. If a UI Housing project includes vending spaces, capture Owner requirements through the Owner Project Requirements process.

5.5. For UI-Hospitals and Clinics:

~~5.2.5.3.~~5.5.1. Vending spaces content does not apply. If a UI-Hospitals and Clinics project includes vending spaces, capture Owner requirements through the Owner Project Requirements process.

6. Custodial Spaces:

6.1. Custodial Work Control Center: The main gathering place for custodial and maintenance operations activities.

6.1.1. Locate on the ground floor near the Supplies Storage and Delivery room.

6.1.2. Room shall be 20-feet by 20-feet for a custodial group of four (4) and shall increase in length by 2-feet for each additional person above four (4). Minimum room width of 20-feet for any size group.

6.1.3. Provide the following:

6.1.3.1. Fire rated ceilings.

6.1.3.2. Lighting levels at 20-foot candles.

6.1.3.3. Minimum of four (4) duplex outlets above countertop and two (2) duplex outlets near the floor on each open wall, with one (1) outlet on each wall.

- 6.1.3.4. All receptacles to be GFCI.
- 6.1.3.5. Two (2) telecom-data telephones.
- 6.1.3.6. 3-foot 0-inch door. Door shall open outwards.
- 6.1.3.7. Built-in 5-foot 0-inch kitchen unit with double sink, water supply line to ice machine in refrigerator, and storage cupboard above the sink.
- 6.1.3.8. Light fixture(s) shall have safety guards.
- 6.1.3.9. Provide smooth floor transition from hall to room.

6.2. Supply Storage and Delivery Room (the main storage room for cleaning supplies):

- 6.2.1. Room shall be a minimum of 10-feet by 14-feet for a four (4) person custodial group and shall increase in length by 2-feet for each additional person above four (4).

6.2.2. Provide the following:

- 6.2.2.1. Three (3) 1-foot 6-inch wall shelves on adjustable brackets and standards.

- 6.2.2.2. One-half (1/2) of the shelving in this room shall be enclosed with doors and locks.

6.2.2.3. The bottom shelf shall be 2-feet 6-inches above finished floor. Shelves shall be spaced 1-foot 8-inches apart, running the full length of long wall.1.2

~~6.2.2.3-6.2.2.4.~~

~~6.2.2.4-6.2.2.5.~~ HVAC to maintain 60-degree F minimum.

~~6.2.2.5-6.2.2.6.~~ Lighting levels at 20-foot candles.

~~6.2.2.6-6.2.2.7.~~ Light fixture(s) shall have safety guards.

~~6.2.2.7-6.2.2.8.~~ Two (2) duplex electrical outlets (GFCI) on shelving wall.

~~6.2.2.8-6.2.2.9.~~ 3-foot 6-inch door which opens outwards.

~~6.2.2.9-6.2.2.10.~~ Door shall have closer and armor plate.

~~6.2.2.10-6.2.2.11.~~ Provide smooth floor transition from hall to room.

6.3. Equipment Storage Room:

- 6.3.1. Room is used to store large equipment including vacuums, carpet extractors, carpet drying fans, ladders, etc.

- 6.3.2. Room shall be a minimum 12-feet by 18-feet for up to a four (4) person custodian group and shall increase in length by 3-feet 0-inches for additional custodians up to eight (8).

- 6.3.2.1. Increase in length an additional 3-feet 0-inches for any group larger than eight (8) custodians.

6.3.3. Provide the following:

- 6.3.3.1. 24-inch by 36-inch by 10-inch utility slop sink.
 - 6.3.3.1.1. Install in the rear corner of the room with hot and cold water blended into a single hose bibb.
 - 6.3.3.1.2. Maintain a clear path from door to sink even when equipment is parked.
 - 6.3.3.1.3. 2-foot 0-inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.
- 6.3.3.2. Floor sink with strainer basket to empty equipment, slope floor to the drain.
- 6.3.3.3. Two (2) adjustable shelves,
 - 6.3.3.3.1. Shelves shall be 1-foot 0-inch in width, 9-feet 0-inches in length.
 - 6.3.3.3.2. Shelves to be on brackets, at the rear of the room.
 - 6.3.3.3.3. Bottom shelf shall be 3-feet 4-inches above finished floor.
- 6.3.3.4. Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold-water hose bibb. (Not applicable to UI Housing facilities.)
 - 6.3.3.4.1. Chemical dispensing unit shall be hard piped with cold water feed.
- 6.3.3.5. Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker.
 - 6.3.3.5.1. Install minimum 6-inches above the expected point of use.
- 6.3.3.6. Emergency eye wash station.
- 6.3.3.7. Minimum of three (3) wall-mounted shelves 4-feet 0-inches above finished floor to support charging units for battery-powered machinery.
- 6.3.3.8. Four (4) duplex outlets (GFCI), a minimum of two (2) outlets per circuit. Outlets to be located 6-inches above shelf.
- 6.3.3.9. Heating and ventilation for recharging battery-powered machinery.
- 6.3.3.10. One (1) duplex electrical outlet (GFCI) for each charger unit, located 4-feet 0-inches above finished floor, installed on wall next to the battery charger shelves.
- 6.3.3.11. One (1) duplex electrical outlet (GFCI) near the floor by the door.
- 6.3.3.12. Washer/dryer hook-up.
- 6.3.3.13. Door shall be 3-foot 6-inches and shall open outwards.
 - 6.3.3.13.1. Door shall have closer and armor plate.
- 6.3.3.14. Lighting levels at 20-foot candles.

- 6.3.3.15. Light fixture(s) shall have safety guards.
- 6.3.3.16. Enamel painted concrete walls. Gypsum board walls with 18-inch-high metal plating may be used with Owner approval.
- 6.3.3.17. Provide smooth floor transition from hall to room.

6.4. Custodial Service Room:

- 6.4.1. Minimum of one (1) Custodial Service Room per floor or one (1) closet per 20,000 square feet.
- 6.4.2. Locate within 50 feet of main traffic restrooms.
- 6.4.3. Access to Custodial Service Room shall be from public hallways.
- 6.4.4. Room shall be a minimum 7-feet by 9-feet.
- 6.4.5. Utility panels, gauges, meters, or pipes shall not be placed in the custodial service room.
- 6.4.6. Provide the following:
 - 6.4.6.1. Three (3) white painted or laminated ¾-inch by 12-inches deep plywood shelves mounted on adjustable brackets and standards, bottom shelf 30-inches above finished floor, top shelf 60-inches above finished floor.
 - 6.4.6.2. Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold-water hose bibb.
 - 6.4.6.3. Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker. Install minimum 60-inches above finished floor.
 - 6.4.6.4. Emergency eye wash station.
 - 6.4.6.5. Wall bracket to support a 6-foot 0-inch stepladder.
 - 6.4.6.6. Lighting levels at 20-foot candles.
 - 6.4.6.7. Light fixture(s) shall have safety guards.
 - 6.4.6.8. One (1) duplex electrical outlet (GFCI) located on shelving wall.
 - 6.4.6.9. 3-foot 6-inch door. Door shall open outwards.
 - 6.4.6.10. 24-inch by 36-inch by 10-inch utility slop sink.
 - 6.4.6.10.1. Install in the rear corner of the room with hot and cold water blended into a single hose bibb.
 - 6.4.6.10.2. Maintain a clear path from door to sink even when equipment is parked.
 - 6.4.6.11. 2-feet 0-inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.

- 6.4.6.12. Door shall have closer and armor plate.
 - 6.4.6.13. Provide smooth floor transition from hall to room.
- 6.5. Heavy Equipment Room (houses rider scrubbers and sweepers):
- 6.5.1. The approach hallways shall be wide enough to maneuver the scrubbers in and out of the storage room, and a nearby egress shall be large enough to serve the installation and removal of the machinery. Access to heavy equipment room shall be from public hallways.
 - 6.5.2. Room shall be a minimum 15-feet by 15-feet.
 - 6.5.3. Utility panels, gauges, meters, or pipes shall not be placed in the custodial service room.
 - 6.5.4. Provide the following:
 - 6.5.4.1. Heating and ventilation for recharging battery-powered machinery.
 - 6.5.4.2. One (1) 1-foot 0-inch-wide adjustable shelf mounted on the wall 3-feet 4-inches above finished floor.
 - 6.5.4.3. Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold-water hose bibb.
 - 6.5.4.4. Emergency eye wash station.
 - 6.5.4.5. 24-inch by 36-inch by 10-inch utility slop sink.
 - 6.5.4.5.1. Install in the rear corner of the room with hot and cold water blended into a single hose bibb.
 - 6.5.4.5.2. Maintain a clear path from door to sink even when equipment is parked.
 - 6.5.4.6. One (1) floor drain with cleanout trap and 12-inch by 12-inch removable grate. Location to be coordinated with Owner.
 - 6.5.4.7. 4-feet 0-inch high Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.
 - 6.5.4.8. Wall-mounted shelf 4-feet 6-inch above finished floor to support charging units for battery-powered machinery.
 - 6.5.4.9. Four (4) duplex outlets (GFCI), a minimum of two (2) outlets per circuit. Outlets to be located 6-inches above shelf.
 - 6.5.4.10. Lighting levels at 20- foot candles.
 - 6.5.4.11. Light fixture(s) shall have safety guards.
 - 6.5.4.12. One (1) duplex electrical outlet (GFCI) near the floor by the door.
 - 6.5.4.13. Enamel painted concrete walls.

6.5.4.13.1. Gypsum board walls with 18-inch-high metal plating may be used with Owner approval.

6.5.4.14. 7-foot double door. Door shall open outwards.

6.5.4.15. Door shall have closer and armor plate.

6.5.4.16. Provide smooth floor transition from hall to room.

6.6. ~~For UIH~~ Cospitals and Clinics:

6.6.1. ~~Custodial Closets:~~ The above stipulations regarding custodial spaces do not apply to UI Health Careospitals and Clinics.

~~6.6.1.1-6.6.2.~~ Shelving shall be coordinate with Owner during Design to determine the number of shelves required.

~~6.6.1.1.1-6.6.2.1.~~ Shelves shall be ~~wooden,~~ set on metal standards and brackets.

~~6.6.1.1.2-6.6.2.2.~~ Dimensions: 18-inch deep by ¾-inch thick; cut to fit the designated area.

~~6.6.1.1.3-6.6.2.3.~~ Typically, two (2) to four (4) shelves.

~~6.6.1.2-6.6.3.~~ Utility mop sink maximum of 10-inches deep.

~~6.6.1.3-6.6.4.~~ Closets shall include a minimum of two (2) S-Grip-all mop handle holders installed 78-inches above finished floor.

~~6.6.1.4-6.6.5.~~ Closets shall include three (3) ~~Coat~~ hooks. The location shall be coordinated with the Owner.

~~6.6.1.4.1.~~ S-Grip-All mop handle holders, minimum two (2), installed 78 inches above finished floor.

~~6.6.1.4.2.~~ Three (3) coat hooks. Coordinate locations with Owner.

~~6.6.1.5-6.6.6.~~ Locker set: Closets shall include a minimum of one (1) double locker set: 15-inch wide by 76-inch high by 18-inch deep.

~~6.6.1.5.1.~~ A minimum of one (1) double locker set: 15-inch wide by 76-inch high by 18-inch deep.

7. Maintenance Rooms:

7.1. Building Maintenance Work Control Center:

7.1.1. Center shall house building control workstation, maintenance staffing, and general computer access.

7.1.2. Center shall be located separately from Building Maintenance Shop and Building Maintenance Material / Equipment Storage Room.

- 7.1.3. Room shall be 20-feet by 20-feet for a maintenance group of four (4) and shall increase in length by 2-feet for each additional person above four (4).
- 7.1.4. Minimum room width of 20-feet for any size group.
- 7.1.5. Provide the following:
 - 7.1.5.1. 3-foot 0-inch door. Door shall open outwards.
 - 7.1.5.2. Fire rated ceilings
 - 7.1.5.3. Lighting levels at 20-foot candles.
 - 7.1.5.4. Light fixture(s) shall have safety guards.
 - 7.1.5.5. Minimum of four (4) duplex outlets above countertop and two (2) duplex outlets near the floor on each open wall, with one (1) outlet on each wall. All receptacles to be GFCI.
 - 7.1.5.6. Minimum of one (1) three-phase outlet.
 - 7.1.5.7. Two (2) telecom-data telephones.
 - 7.1.5.8. Provide smooth floor transition from hall to room.

7.2. Building Maintenance Shop:

- 7.2.1. Shop shall housework benches, tools, equipment, carts, barrels, and supplies.
- 7.2.2. Room shall be minimum 400-square feet.
- 7.2.3. ~~For UI Housing: room size determined with Owner input.~~
- 7.2.4. Located adjacent to the Building Maintenance Material / Equipment Storage Room.
- 7.2.5. Provide the following:
 - 7.2.5.1. 3-foot 0-inch door. ~~(UI Housing: door shall be 3 feet 6 inches).~~ Door shall open outwards.
 - 7.2.5.2. Fire rated ceilings
 - 7.2.5.3. Lighting levels at 20-foot candles.
 - 7.2.5.4. Light fixture(s) shall have safety guards.
 - 7.2.5.5. Minimum of four (4) duplex outlets above countertop and two (2) duplex outlets near the floor on each open wall, with one (1) outlet on each wall.
 - 7.2.5.5.1. All receptacles to be GFCI.
 - 7.2.5.6. Two (2) telecom-data telephones.
 - 7.2.5.7. Provide smooth floor transition from hall to room.

7.2.6. For UI Housing:

7.2.6.1. Room size determined with Owner input.

~~7.2.5.7.~~

7.3. Building Maintenance Material / Equipment Storage Room

7.3.1. Room shall be main storage room for building maintenance supplies and attic stock.

7.3.2. Room shall be minimum 400-square feet.

~~7.3.3. For UI Housing:~~

~~7.3.3.1. Room size determined with Owner input.~~

~~7.3.4.7.3.3.~~ Provide the following:

~~7.3.4.1.7.3.3.1.~~ 3-foot 6-inch door. Door shall open outwards.

~~7.3.4.2.7.3.3.2.~~ Door shall have closer and armor plate.

~~7.3.4.3.7.3.3.3.~~ Fire rated ceilings

~~7.3.4.4.7.3.3.4.~~ Lighting levels at 20-foot candles.

~~7.3.4.5.7.3.3.5.~~ Light fixture(s) shall have safety guards.

~~7.3.4.6.7.3.3.6.~~ Shelving:

~~7.3.4.6.1.7.3.3.6.1.~~ Fifty percent (50%) of the shelving in this room shall be enclosed with doors and locks.

~~7.3.4.6.2.7.3.3.6.2.~~ Three (3) 1-foot 6-inch wall shelves on adjustable brackets and standards at the back of the room.

~~7.3.4.6.3.7.3.3.6.3.~~ The bottom shelf shall be 2-feet 6-inches above finished floor.

~~7.3.4.6.4.7.3.3.6.4.~~ Shelves shall be spaced 1-foot 8-inches apart, running the full length of the longest wall.

~~7.3.4.7.7.3.3.7.~~ Two (2) duplex outlets on shelving wall. All receptacles shall be GFCI.

~~7.3.4.8.7.3.3.8.~~ HVAC is required with 60-degree F winter heat minimum.

~~7.3.4.9.7.3.3.9.~~ All receptacles shall have a dedicated neutral and a dedicated ground.

~~7.3.4.10.7.3.3.10.~~ HVAC is required with 60-degree F winter heat minimum.

~~7.3.3.11.~~ Provide smooth floor transition from hall to room.

For UI Athletics

7.4. For UI Housing

7.4.1. For the Building Maintenance shop, the door shall be 3-feet 6-inches.

7.4.2. For the Building Maintenance Material/Equipment Storage Room, room sizing shall be determined with Owner input through an Owners Project Requirement document.

7.5. For UI-Hospitals and Clinics:

~~7.3.4.11-7.5.1.~~ The "Maintenance Rooms" section does not apply to UI-Hospitals and Clinics. Maintenance Room requirements shall be captured through the Owners Project Requirement process.

8. Telecommunication Closet (TC): (within UIHC – Telecommunication Distribution Room or TDR) Rooms (TR): (within UI Hospitals and Clinics – TDR):

8.1. Telecommunication ClosetRoom Location, Size, Accessibility

8.1.1. Room shall be a minimum of 10-feet by 15-feet.

8.1.2. Size to be determined by quantity and type of horizontal cables served from the telecommunication room as well as future cable plant expansion expectations.

8.1.3. ITS Physical Infrastructure shall be involved in determining room sizes and locations.

8.1.4. TCs/TRs shall be aligned vertically and centrally in buildings and shall be located to meet current ANSI/EIA/TIA allowable cable lengths.

8.1.5. Room shall be dedicated to ITS use only. No other systems shall pass through room, including HVAC ducts, plumbing, conduits, etc.

8.1.6. The fire alarm control panel (FACP) shall not reside in telecommunications room.

8.1.7. Access to telecommunication rooms shall be coordinated with ITS Physical Infrastructure.

8.1.8. Room shall be open to structure above with no ceiling. TR shall not have a ceiling.

8.1.9. TR doors shall open outward, open fully, shall have a door closer, door sweep and equipped with card access.

8.1.9.1. Rooms shall not be placed directly under any water sources (i.e., bathroom, kitchen, any kind of drain).

8.1.9.2. Cabling shall not exceed 295 feet.

8.1.9.3. Access to the room shall be direct from corridors.

~~8.1.9-8.1.9.4.~~ Refer to EXAMPLE TELECOMMUNICATIONS ROOM in appendices for the sample layout of TC for ITS.

8.1.10. For UI-Hospitals and Clinics:

8.1.10.1. Locate TDR away from mechanical chases to avoid pathway congestion.

~~8.1.10.2. Rooms shall not be placed directly under any water sources (i.e., bathroom, kitchen).~~

~~8.1.10.3. Cabling shall not exceed 295 feet.~~

~~8.1.10.4. Access to the TDR shall be direct from corridors.~~

~~8.1.10.5.~~ 8.1.10.2. HCIS TDR shall be a minimum of 10-feet by 20-foot TDR square footage to be 1/100th the size of the total square footage of the area it is intended to serve.

~~8.1.10.5.1.~~ 8.1.10.2.1. TDR may be large to serve up to 25,000 square feet.

~~8.1.10.5.2.~~ 8.1.10.2.2. Consult HCIS on size of rooms serving areas larger than 25,000 square feet.

~~8.1.10.6.~~ 8.1.10.3. A Wall mounted phone shall be installed at 18-inches to 24-inches from the door frame entering the room.

~~8.1.10.7.~~ Refer to EXAMPLE TELECOMMUNICATIONS ROOM in appendices for sample layout of TDR in UIHC.

8.2. Telecommunication ~~Closet~~Room Construction and Finishes

8.2.1. Walls shall extend to structure.

8.2.2. Walls shall have ¾-inch A/C (A side out) rated plywood, mounted from 6-inches to 8-foot 6-inches above finished floor.

8.2.3. Walls and plywood shall be painted extra white, Sherwin Williams B24W02651, minimum two (2) coats.

8.2.4. Overhead structure to be painted Sherwin Williams B24W02651.

8.2.5. Floor finish shall be sealed concrete.

~~8.2.5.~~ 8.2.6. Plywood shall be continuous, into the corners, and mounted with appropriately rated hardware and not standard sheetrock screws.

~~8.2.6.~~ 8.2.7. **For UIHCospitals and Clinics:**

~~8.2.6.1.~~ 8.2.7.1. Room shall be open to structure above with no ceiling.

~~8.2.6.2.~~ 8.2.7.2. Floor shall have sheet vinyl or VCT, off white.

~~8.2.6.3.~~ 8.2.7.3. Walls shall have ¾-inch 4-foot by 8-foot fire-rated CDX plywood mounted 10-inches above finished floor.

~~8.2.6.4.~~ 8.2.7.4. Plywood, walls, and overhead structure shall be treated on all sides with at least two coats of extra white paint, leaving fire-rated stamp visible at the top and bottom of plywood sheets to meet JCAHO standards.

~~8.2.6.5.~~ Plywood shall be continuous, into the corners, and mounted with appropriately rated hardware and not standard sheetrock screws.

8.3. Fire Alarm and Fire Protection

8.3.1. Provide cages on all fire suppression sprinklers.

8.3.2. ~~For UI-H~~Cospitals and Clinics:

8.3.2.1. Wet sprinklers shall be provided in each telecom room. Provide a sprinkler zone valve in each room.

8.3.2.2. If a single interlock pre-action dry sprinkler system is necessary for IT equipment, it must be reviewed with HCIS prior to including in design.

8.3.2.3. Room shall be equipped with appropriate fire detection and alarm sensors.

8.4. Environmental Controls

8.4.1. ~~Telecom~~ Room shall have year-round cooling with continuous air flow to maintain:

8.4.1.1. 72-to-80 degrees F

8.4.1.2. Forty-five percent (45%) to fifty-five percent (55%) maximum relative humidity

8.4.1.3. Positive air pressure with a minimum of one (1) complete exchange per hour.

8.4.1.4. Provide drip pans, shields, and drains at cooling units and condensate pumps when installed in room.

~~8.4.1.3.~~8.4.1.5. Provide 1 (one) 4-inch sleeve for temporary portable unit exhaust.

8.4.2. ~~For UI-H~~Cospitals and Clinics:

8.4.2.1. Maintain continuous and dedicated environmental control 24 hours per day, 365 days per year.

8.4.2.2. Design shall calculate the heat load by using equipment manufacturer's specifications for each component and allow for 50 percent growth.

8.4.2.3. Locate thermostat within the TDR by the door and shall only control the TDR.

8.4.2.4. Temperature range: 64 to 75 degrees F.

8.4.2.5. Relative humidity range: thirty percent (30%) to fifty-five percent (55%)

8.4.2.6. Dissipate the heat generated by active devices.

8.4.2.7. Temperature shall not increase 10 degrees in 60 minutes.

~~8.4.2.8.~~ Provide drip pans, shields, and drains at cooling units and condensate pumps when installed within TDR.

~~8.4.2.9.~~8.4.2.8. Chilled water piping to accommodate 7.2 GPM.

~~8.4.2.10-8.4.2.9.~~ Units to be wall mounted, 10-inches above the just off of off the floor for leak containment and a rope leak sensor is required.

~~8.4.2.11-8.4.2.10.~~ Cooling Units to be Liebert Data Mates

~~8.4.2.11.1-8.4.2.10.1.~~ Design shall provide redundant units.

8.4.2.10.2. Units to be provided with Liebert Unity Card Control with rope leak sensor. If humidification cannot be provided by the building system, humidification can be provided with the Liebert Data Mates using unconditioned domestic cold water source.

~~8.4.2.11.2-8.4.2.11.~~ Chilled water isolation valve to be located within TDR.

8.4.2.12. Cooling units must be on emergency power.

8.4.2.13. 208V power connection required. 120V power receptacle for Unity Card Control on emergency power.

8.5. Power Requirements

8.5.1. Minimum two (2) 100 amp dedicated, one (1) off building power and one (1) TVSS protected power panel tied to building generator if possible. Panel size dependent on size of area and user density being served.

8.5.1.1. Panel shall be located within TR.

~~8.5.2. Minimum of two (2) dedicated 20-Amp outlets per panel.~~

~~8.5.3-8.5.2.~~ Minimum of two (2) L6-20R 20-amp (building) / 208-volt locking receptacles and minimum of two (2) L6-30R 30-amp (generator) / 208-volt locking receptacle. Location of outlets shall be coordinated with ITS.

~~8.5.4-8.5.3.~~ Minimum of one (1) 110-V convenience receptacle per wall.

~~8.5.5-8.5.4.~~ Include grounding and bonding for communication systems.

~~8.5.6-8.5.5.~~ Include equipment racks, ladder racking, and cable management.

~~8.5.7-8.5.6.~~ **For UI-Hospitals and Clinics:**

8.5.6.1. Each TCR shall be supplied with both Critical and Normal power.

~~8.5.7.1-8.5.6.2.~~ Transformers shall not be included in TDR.

~~8.5.7.2-8.5.6.3.~~ UPS Racks

~~8.5.7.2.1-8.5.6.3.1.~~ Provide one (1) dedicated 120VAC quad receptacle and one (1) dedicated 208VAC circuit on emergency power. The 208VAC circuit may require up to 70 amps, verify with scheduled UPS.

~~8.5.7.2.2-8.5.6.3.2.~~ Receptacles shall be mounted at the rear of the rack and attached rigidly to the cable tray above the vertical manager. The UPS circuit may require a hardwired circuit that can be provided at the base of the rack.

~~8.5.7.3.8.5.6.4.~~ Non-UPS Racks:

~~8.5.7.3.1.8.5.6.4.1.~~ Provide one (1) dedicated 120VAC quad receptacle and one (1) dedicated 208VAC circuit on normal power.

~~8.5.7.3.2.8.5.6.4.2.~~ Receptacles shall be mounted at the rear of the rack and attached rigidly to the cable tray above the vertical manager.

~~8.5.7.4.8.5.6.5.~~ Power distribution for rack mounted equipment shall be done through the use of a monitored horizontal PDU. Provide a single data connection to each individual horizontal PDU.

~~8.5.7.5.8.5.6.6.~~ Provide 120V-20A wall receptacles to serve the following:

~~8.5.7.5.1.8.5.6.6.1.~~ Access Control System – Emergency Power

~~8.5.7.5.2.8.5.6.6.2.~~ Sound Masking – Normal Power

~~8.5.7.5.3.8.5.6.6.3.~~ Distributed Antenna System – Emergency Power

~~8.5.7.5.4.8.5.6.6.4.~~ Primex Wireless Clock Transmitter – Normal Power

~~8.5.7.5.5.8.5.6.6.5.~~ Rauland Responder 5 Nurse Call – Emergency Power

~~8.5.7.5.5.1.1.8.5.6.6.5.1.1.~~ One (1) circuit, hardwired, per every two cabinets installed.

8.5.6.7. The following technology shall be hosted inside the TDR:

<u>System Description</u>	<u>Location</u>	<u>Power</u>	<u>UPS</u>	<u>Generator</u>
<u>Structured Cabling</u>	<u>Rack</u>	<u>No</u>	<u>No</u>	<u>No</u>
<u>Data/Voice Electronics</u>	<u>Rack</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Television Distribution</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>No</u>
<u>DAS</u>	<u>Rack</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Video Surveillance</u>	<u>Rack</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Access Control</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>
<u>Paging</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>No</u>
<u>Telemetry</u>	<u>Rack</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Patient Monitoring</u>	<u>Rack</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Wireless Clock</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>No</u>
<u>Sound Masking</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>No</u>
<u>Nurse Call</u>	<u>Wall/Rack*</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>
<u>Lighting Control</u>	<u>Wall</u>	<u>Yes</u>	<u>No</u>	<u>No</u>

~~8.5.7.6.~~

System Description	Location	Power	UPS	Generator
Structured Cabling	Rack	No	No	No
Data/Voice Electronics	Rack	Yes	Yes	Yes
Television Distribution	Wall	Yes	No	No
DAS	Rack	Yes	Yes	Yes
Video Surveillance	Rack	Yes	Yes	Yes
Access Control	Wall	Yes	No	Yes
Paging	Wall	Yes	No	No
Telemetry	Rack	Yes	Yes	Yes
Patient Monitoring	Rack	Yes	Yes	Yes
Wireless Clock	Wall	Yes	No	No
Sound Masking	Wall	Yes	No	No
Nurse Call	Wall/Rack*	Yes	Yes	Yes
Lighting Control	Wall	Yes	No	No

8.5.7.7.8.5.6.8. Uninterruptable Power Supplies (UPS)

8.5.7.7.1-8.5.6.8.1. A standalone owner provided UPS shall be installed in each TR to support the installed equipment. A centralized UPS may only be considered on a per project basis.

8.5.7.7.2-8.5.6.8.2. UPS options:

8.5.7.7.2.1.1-8.5.6.8.2.1.1. Small – APC 3000VA (120V)

8.5.7.7.2.1.2-8.5.6.8.2.1.2. Medium – APC 6000VA (208V-Hardwired) Single phase and step down.

8.5.7.7.2.1.3-8.5.6.8.2.1.3. Large – APC 10KVA (208V-Hardwired) Single phase and step down.

8.5.7.7.3-8.5.6.8.3. Coordinate amperage requirements of hardwired UPS with HCIS.

8.6. Lighting Requirements

8.6.1. Minimum lighting levels equivalent of 50 lumens measured at 3-feet above finished floor.

8.6.2. Provide manual wall switches only. Automatic lighting controls shall not be installed.

8.6.3. Connect a minimum of one (1) light Fixture to emergency power.

8.6.4. Bottom of fixtures shall be 8-feet 6-inches above finished floor.

8.6.5. Coordinate with ITS-Physical Infrastructure for ~~TR~~/Light Fixture Layout.

8.6.6. For UI-~~Hospitals and Clinics~~:

8.6.6.1. Provide a minimum of two (2) LED strip light fixtures on manual switch with minimum of one light on emergency power.

8.7. Pathways within Telecommunications ClosetsRoom

8.7.1.1. Locate sleeve systems in places where pulling and termination will be organized and accessible for future use.

8.7.1.2. Where vertical and horizontal offsets are required, consider bend radius requirement and service loops.

8.7.1.3. In stacked closet locations, install a minimum of four (4) 4" sleeves. Work with ITS-Physical Infrastructure to determine location and quantity.

8.7.1.4. A minimum of ten (10) trade size STI series 44 EZ-Path fire-rated sleeves shall be provided for horizontal/backbone cabling, in two groups of five. All sleeves shall terminate at the cable tray within the TC, location to be determined by ITS-Physical Infrastructure. All sleeves must be accessible from both sides.

8.7.1.5. An 18" ladder rack style cable tray shall be provided around the perimeter of the telecommunications closet to serve all horizontal data cabling as well as backbone cabling.

8.7.1.6. Provide waterfall cable management or "drop-in" kits to allow for all cabling to be managed appropriately and within the manufacturer's recommended minimum bend radius requirements.

8.7.1.8.7.2. For UI-Hospitals and Clinics

~~8.7.1.1. Locate sleeve systems in places where pulling and termination will be organized and accessible for future use.~~

~~8.7.1.2. Where vertical and horizontal offsets are required, consider bend radius requirement and service loops.~~

~~8.7.1.3. In stacked closet locations, install a minimum of three (3) trade size STI series 44 EZ-Path fire-rated sleeves in the floor to accommodate backbone pathways. Work with HCIS to determine location and quantity.~~

~~8.7.1.4. A minimum of ten (10) trade size STI series 44 EZ-Path fire-rated sleeves shall be provided for horizontal/backbone cabling, in two groups of five. All sleeves shall terminate at the cable tray within the TDR, location to be determined by HCIS. All sleeves must be accessible from both sides.~~

~~8.7.1.5.8.7.2.1. Install one (1) 1-inch EMT conduit and single gang outlet for a wall phone. Phone shall be located just within the entrance of the TDR.~~

~~8.7.1.6.8.7.2.2. All conduits in TDR shall be surface mounted.~~

~~8.7.1.7. Basket style cable tray shall be provided around the perimeter of the telecommunications room to serve all horizontal data cabling as well as backbone cabling. See chart in appendix for sizing guidelines.~~

~~8.7.1.8-8.7.2.3.~~ A separate 12-inch wide by 4-inch-deep cable tray shall be provided and installed above the horizontal data cabling tray to serve access control and special systems cabling.

~~8.7.1.9. Provide waterfall cable management or “drop in” kits to allow for all cabling to be managed appropriately and within the manufacturer’s recommended minimum bend radius requirements.~~

9. University Classrooms

9.1. General Approach to Classroom Design:

- 9.1.1. Develop rooms with good sight lines and efficient seating layout.
- 9.1.2. Design shall proceed from the “inside out” and all classroom design should have prior consultation and approval of Classroom Scheduling and ITS-LST Group.
 - 9.1.2.1. Determine projection screen quantity, size, and location.
 - 9.1.2.2. Determine seat size and orientation of the instructor area.
 - 9.1.2.3. Draw viewing angles from each screen and ensure that all seats fit within.
 - 9.1.2.4. Determine location and width of access aisles.
 - 9.1.2.5. After these steps, determine location of walls.
- 9.1.3. Classrooms shall be shaped and sized to maximize seating and occupant comfort and interaction.
- 9.1.4. Design corridors and alcoves to provide informal student spaces with flexible, comfortable furniture to encourage collaboration.

~~9.2-9.1.5.~~ Classroom design details may vary to accommodate the latest best practices for teaching.

~~9.3-9.2.~~ Classroom ~~Design Specifies~~Location:

~~9.3.1.—~~Classroom Location:

~~9.3.1.1-9.2.1.1.~~ Locate classrooms as close as possible to the main building entrances to limit student travel through the building. This is most important for large capacity classrooms.

~~9.3.1.2-9.2.1.2.~~ Group classrooms together on the common floor.

~~9.3.1.3-9.2.1.3.~~ Locate classrooms away from noise-generating equipment and activities, including mechanical systems, elevators, vending, food service, and restrooms.

~~9.3.1.4-9.2.1.4.~~ Where classrooms adjoin such spaces, provide acoustic separation.

~~9.3.1.5-9.2.1.5.~~ Locate restrooms near lecture halls. Avoid common walls between restrooms and classrooms.

9.3.1.6-9.2.1.6. Provide corridor seating outside lecture halls and along hallways outside classrooms.

9.3.2-9.3. Accessibility:

9.3.2.1-9.3.1.1. Specialized equipment shall be included as follows:

9.3.2.2-9.3.1.2. Remote Real Time Captioning - Place an electrical outlet in the front of the room for all auditoria seating one hundred (100) or more.

~~9.3.2.3. — Lighting for Interpreter—A separate light for a sign language interpreter in all auditoria seating one hundred (100) or more shall be placed in the front of the room.~~

~~9.3.2.3.1. — This light shall not spill onto the projection screen and shall illuminate the interpreter from the front.~~

~~9.3.2.3.2. — The light control may be located with other controls at the lectern.~~

9.3.2.4-9.3.1.3. Accessible seating in lecture halls shall be fixed table and moveable chairs and/or open space for wheelchairs with priority signage included.

9.3.1.4. Provide entrances to lecture halls that allow wheeled access to the teaching area and consider access to multiple seating levels of the classroom when under the ADA Standards for Accessible Design.

9.4. Classroom Types

9.4.1. Seminar

A classroom that is used primarily for small group instruction.

Seating is predominantly at tables, depending on location, where students face each other to engage in discussion.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Single fixed or multiple moveable tables and chairs</u>	<u>Up to 25</u>	<u>25 - 30sf</u>

9.4.2. Auditorium

Classrooms with a sloped floor or stadium seating.

Desks are usually fixed tablet arm theater chairs facing the teaching area, some featuring raised teaching platforms.

Fix seating shall be low maintenance and labeled with row and seat number.

All contain lecterns or lectern/desks with fully embedded technology.

Design to include lobby or gathering area adjacent to space for circulation and seating.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>

<u>Theatre seats</u>	<u>No limit</u>	<u>12 - 24sf</u>
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9.4.3. Classroom Computer

Classrooms that are equipped with either desktop or laptop computers for all students. These rooms are not tied to a specific subject or discipline by equipment in the room or the configuration of the space.

These classrooms may be set with the computers in rows or with the computers along the perimeter with rows of desks in the center.

All contain lecterns or lectern/desks with fully embedded technology.

<u>FURNITURE TYPE</u>	<u>EQUIPMENT TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Moveable tables and chairs</u>	<u>Desktop Computers</u>	<u>No limit</u>	<u>30 - 35sf</u>
<u>Moveable tables and chairs</u>	<u>Laptop Computers</u>	<u>No limit</u>	<u>25 - 30sf</u>

9.4.4. Lecture

A classroom that is used primarily for instruction and is not tied to a specific subject or discipline by equipment in the room or the configuration of the space.

Entrances may be located at the front of the room for disability access.

Large capacities are made up of tiered floors or furnished with active learning furnishings at varied heights to improve sight lines approved by Classroom Scheduling.

Desks are typically fixed tables and chairs that cannot be rearranged in different configurations.

All contain lecterns or lectern/desks with fully embedded technology.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Fixed tables and moveable chairs</u>	<u>15 - 70+</u>	<u>20 - 25sf</u>

9.4.5. Multipurpose

A classroom that is used primarily for instruction and is not tied to a specific subject or discipline by equipment in the room or the configuration of the space.

Desks are typically tablet armchairs or moveable tables and chairs that can be rearranged in different configurations to match an instructional pedagogy.

All contain lecterns or lectern/desks with fully embedded technology.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Moveable tables and chairs</u>	<u>15+</u>	<u>25 - 30sf</u>
<u>Tablet armchairs</u>	<u>15 -70</u>	<u>20 - 25sf</u>

9.4.6. TILE (Transform, Interact, Learn, Engage) Configuration Options

Spaces shall be designed creatively with a primary focus on student and instructor collaboration.

9.4.6.1. TILE

Active-learning classrooms with round tables that seat nine students with three computers at each table. These technology-rich rooms provide central switching stations that faculty members and students can use to project images from classroom laptops to LCD screens.

<u>FURNITURE TYPE</u>	<u>SF RANGE PER STUDENT</u>
<u>Fixed tables and moveable chairs</u>	<u>25 - 35sf</u>

9.4.6.2. TILE – Flex

Active-learning classrooms that seat students in groups of five to seven with furniture that provides a flexible switch between individual and group work.

Laptops are not provided in these rooms.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Moveable tables and chairs</u>	<u>Multiples of 6 (preferred)</u>	<u>30 - 40sf</u>

9.4.6.3. TILE – Flex – Plus

Active-learning classrooms that seat students in groups of six with furniture that provides a flexible switch between individual and group work.

Laptops are provided at either a 1:1 or 1:3 student ratio.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Moveable tables and chairs</u>	<u>Multiples of 6</u>	<u>30 - 40sf</u>

9.4.6.4. TILE – Lite

Active-learning classrooms that are technology light (no provided laptops, additional monitors, or extra technology).

Seating is at movable tablet armchairs that cluster around power pods to form groups of six, enabling different types of active-learning.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Tablet armchairs</u>	<u>Multiples of 6</u>	<u>25 - 30sf</u>

9.4.7. Study Space

A room used by individuals to study at their convenience and not restricted to a particular subject or discipline by contained equipment.

These spaces are defined as individual and collaborative. Individual study is available on an unscheduled basis.

Collaborative study space is centrally scheduled initially and thereafter on an unscheduled basis for the remaining hours.

Furnish with equipment and infrastructure to support individual and group work.

Provide pathway to telecommunication closet for room scheduler device at study space entrance door.

<u>FURNITURE TYPE</u>	<u>CAPACITY</u>	<u>SF RANGE PER STUDENT</u>
<u>Fixed or moveable tables and chairs</u>	<u>Up to 6</u>	<u>Varies</u>

9.3.2.5.

9.3.3.9.5. Acoustics:

9.3.3.1.9.5.1. All classrooms shall be designed with three (3) acoustic goals:

9.3.3.1.1.9.5.1.1. Prevent external and background noise from affecting the room.

9.3.3.1.2.9.5.1.2. Prevent sounds generated within the room from affecting adjacent spaces.

9.3.3.1.3.9.5.1.3. Foster effective sound transmission from the speaker and media to the audience and allow audience comments to be easily heard.

9.3.3.2.9.5.2. Classroom acoustics shall meet the standards recommended in the ANSI/ASA S12.60-2010 American National Standard Acoustical Performance Criteria, Design Requirements and Guidelines for Schools.

9.3.3.3.9.5.3. Extend walls to structure.

9.3.3.4.9.5.4. Use absorptive materials, in addition to upholstered seating, to control reverberation time.

9.3.3.5.9.5.5. Acoustical ceiling tile may be considered part of the acoustical treatment.

9.3.3.6.9.5.6. Acoustical Wall Panels, as needed with locations reviewed by Classroom Scheduling.

9.3.3.6.1-9.5.6.1. Shall be placed beyond arm's reach where possible.

9.3.3.6.2-9.5.6.2. Placed on the rear wall when one (1) wall in conventional classroom is to be treated.

9.3.3.6.3-9.5.6.3. Place rear wall panels on the upper half of the wall, with bottom of panels no lower than 4-feet 0-inches above finished floor.

9.3.3.6.4-9.5.6.4. Side wall treatment may be added if rear wall does not provide surface at the minimum listed below for the type of room.

9.3.3.6.5-9.5.6.5. Place side wall panels no lower than 6-feet 0-inches above finished floor.

9.3.3.6.6-9.5.6.6. Panel configuration does not have to be continuous; panels may be spaced rather than butted against each other.

9.3.3.6.7-9.5.6.7. Specific recommended quantities are shown in the following tables:

<u>ROOM SIZE IN SQUARE FEET</u>	<u>RECOMMENDED ACOUSTICAL TREATMENT</u>
SEMINAR ROOM	
Up to 500	100 sf
500+	200 sf
SMALL CLASSROOM	
Up to 500	200 sf
501-750	300 sf
750+	450 sf
LARGE CLASSROOM	
Up to 1,000	400 sf
1,000+	800 sf
AUDITORIA AND LECTURE ROOMS	

Up to 2,500	8-12 foot	100 sf
Up to 3,500+	12-18 foot	500 sf
3,501 - 4,000	15-20 foot	800 sf
Up to 5,000+	20-40 foot	1750 sf

9.3.4-9.5.7. Windows:

9.3.4.1-9.5.7.1. Windows shall not be located at the front or back of classroom.

9.3.4.2-9.5.7.2. Provide light control at each window for media projection.

9.3.4.2.1-9.5.7.2.1. Roller shades at three percent (3%) room darkening are preferred.

9.3.4.2.2-9.5.7.2.2. Some locations may require dual head with blackout roller shades.

9.3.4.2.3-9.5.7.2.3. Mount tightly against frame or wall to reduce light spill.

9.5.7.2.4. Shades shall not be connected to building's automated shade control system unless approved by Classroom Scheduling.

9.3.4.2.4-9.5.7.3. [Manual shades preferred in lieu of motorized where applicable within energy code.](#)

9.3.5-9.5.8. Doors:

9.3.5.1-9.5.8.1. Preferred door location is at the rear of the classroom.

9.3.5.2-9.5.8.2. In rooms with tiered or sloped floors, place doors to allow wheeled access to the teaching area and multiple seating areas.

9.3.5.3-9.5.8.3. Equip new doors with sidelights maximum width of 1-foot 0-inches.

9.3.5.4-9.5.8.4. In renovations where sidelights are not possible, provide clear glass panel in door, maximum 100-square inches; vision-panel base maximum 3-feet 6-inches above finished floor and top minimum 5-feet 2-inches above finished floor.

9.3.5.5-9.5.8.5. Doors shall operate quietly and provide acoustic separation.

9.3.5.6-9.5.8.6. Doors open outward and shall not block corridor traffic.

9.3.6-9.5.9. Ceiling:

9.3.6.1-9.5.9.1. Ceilings shall accommodate projection screen with bottom of screen at a minimum 3-feet 4-inches above finished floor, and screen height 1/5 the distance from front wall to last row of seats.

9.3.6.2-9.5.9.2. Ceiling height requirements may differ for seminar rooms, classrooms, and auditoria within the same building.

9.3.6.3-9.5.9.3. Provide maintenance access to equipment mounted at or above ceilings.

9.3.7-9.5.10. Wall Finishes:

9.3.7.1-9.5.10.1. Locate chair rail on back and side walls.

9.3.7.2-9.5.10.2. Apply a durable, easy-to-clean surface such as epoxy paint across the entire front wall below the writing surface.

9.3.8-9.5.11. Flooring:

9.3.8.1-9.5.11.1. Flooring type shall be determined by room function and reviewed and approved by Classroom Scheduling.

9.3.8.2-9.5.11.2. Hard surface flooring shall be durable, slip resistant, and require minimal maintenance.

9.3.8.3-9.5.11.3. Seating areas in sloped and tiered floors may be sealed concrete.

9.3.8.4-9.5.11.4. Flooring material shall be variegated in color, not solid, to conceal dirt and wear.

9.3.8.5-9.5.11.5. Stair nosing shall contrast with flooring to eliminate trip hazard.

9.3.9-9.5.12. Furnishings:

9.3.9.1-9.5.12.1. Furniture shall be selected for durability, ease of maintenance, comfort and moveable/flexible.

9.3.9.2-9.5.12.2. Classroom furniture shall have an appearance distinct from other furnishings in the building.

9.3.9.3-9.5.12.3. Tablet arms shall be flat and smooth.

9.3.9.3.1-9.5.12.3.1. Surface, at a minimum, shall be sized to hold both an 8 ½-inch by 11-inch pad and average sized laptop and adaptable to both left and right-handed students.

9.3.9.4-9.5.12.4. In renovations, color and finish of moveable furnishings shall be consistent with overall building materials.

9.3.9.5-9.5.12.5. Furniture items shall be comfortable for people ranging in size from the 5th percentile female (4-feet 11-inches tall, 113 pounds) to the 95th percentile male (6-feet 2-inches tall, 246 pounds).

9.3.9.6-9.5.12.6. Fixed Auditoria and Lecture Room seating width shall be 23-to-24-inches on center.

9.3.9.7-9.5.12.7. Riser mounted seating may be preferred for new riser construction – confirm with Owner.

9.3.9.8-9.5.12.8. Student tables shall be minimum depth of 18-inches.

9.3.9.9-9.5.12.9. Moveable tables shall be equipped with lockable casters.

9.3.9.10-9.5.12.10. Moveable seating shall be on appropriate casters for specified flooring except in tiered/sloped seating environments and shall not have arm rests.

9.3.9.11-9.5.12.11. Caster or chair-glide shall match room flooring type.

9.3.9.12-9.5.12.12. Ten percent (10%) of all seating shall be suited for left-handed users.

9.3.9.13-9.5.12.13. Lecture and Seminar Room seating shall be heavy-duty, stain repellent, upholstered fabrics.

9.3.9.14-9.5.12.14. Instructor table shall be 48-to-60-inches wide by 24-inches deep and include a modesty panel and attached lectern.

9.3.9.15-9.5.12.15. Adjustable height instructor chair shall be provided in all classroom types except in seminar classrooms.

9.3.9.16-9.5.12.16. Provide battery-operated GPS clock. Match existing campus clock system managed by the Office of the Provost.

9.3.9.17-9.5.12.17. Rooms shall have a height adjustable multimedia lectern. Refer to ITS-LST Group for specifications.

9.3.9.18-9.5.12.18. Rooms shall have a moveable tabletop or free-standing lectern in addition to the multimedia lectern.

9.3.9.19-9.5.12.19. Coat racks shall not be provided.

9.3.9.20-9.5.12.20. Pencil sharpeners shall not be provided.

9.3.9.21-9.5.12.21. Tack surfaces in classrooms shall not be provided.

9.3.10-9.5.13. Typical Classroom Front:

9.3.10.1-9.5.13.1. The distance from the front wall to the first row of seats shall be between one (1) to two (2) times the height of the projection screen.

9.3.10.2-9.5.13.2. Typical screen height in a flat floor classroom is 8-feet.

9.3.10.3-9.5.13.3. The multimedia lectern shall not obstruct students' view of the writing surface and projection screen.

9.3.10.4-9.5.13.4. Classroom seating layout:

9.3.10.4.1-9.5.13.4.1. Locate seats within the viewing angle.

9.3.10.4.1.1-9.5.13.4.1.1. The viewing angle is derived from Infocomm/AVIXA best practices.

~~9.3.10.4.2~~~~9.5.13.4.2.~~ Classrooms shall be narrow enough to permit all seats to be within the viewing angle from the front wall.

~~9.3.10.5~~~~9.5.13.5.~~ Projection screen shall be placed to allow at least a 6-foot-wide portion of the writing surface to remain visible when the screen is lowered.

~~9.3.10.6~~~~9.5.13.6.~~ Provide adequate space for instructor station, table, and chair.

~~9.3.11~~~~9.5.14.~~ Writing Surfaces:

~~9.3.11.1~~~~9.5.14.1.~~ In each classroom, provide maximum possible writing surface at the front instruction wall. Additional writing surface on the side or back walls may be provided.

~~9.3.11.2~~~~9.5.14.2.~~ All writing surface products shall be approved by Classroom Scheduling.

~~9.3.11.2.1~~~~9.5.14.2.1.~~ Desirable products include porcelain-covered steel, magnetic dry-erase board, glass, or acrylic materials.

~~9.3.11.2.2~~~~9.5.14.2.2.~~ Continuous full-length tray shall be included in design.

~~9.3.11.3~~~~9.5.14.3.~~ Avoid disruptions in writing surface with mechanical or power boxes or switches.

~~9.3.11.4~~~~9.5.14.4.~~ Minimum width shall be 12-feet.

~~9.3.11.5~~~~9.5.14.5.~~ Writing surface shall be a minimum 4-feet in height, mounted 86-inches above finished floor to top.

~~9.3.11.6~~~~9.5.14.6.~~ Bottom of the board shall not be less than 36-inches above finished floor.

~~9.3.12~~~~9.5.15.~~ Projection Booth:

~~9.3.12.1~~~~9.5.15.1.~~ An enclosed, lockable booth is preferred in Lecture Halls and Auditoria.

~~9.3.12.2~~~~9.5.15.2.~~ Booth shall include projector shelf and window with access for equipment maintenance.

~~9.3.12.3~~~~9.5.15.3.~~ Include additional mechanical cooling for large-venue projection equipment.

~~9.3.12.4~~~~9.5.15.4.~~ Provide cabling raceway from the lectern or A/V rack to the booth.

~~9.3.12.5~~~~9.5.15.5.~~ Where an enclosed booth is not possible, a securable cabinet may be used.

~~9.3.12.6~~~~9.5.15.6.~~ Acoustically isolate the booth.

~~9.3.13~~~~9.5.16.~~ Mechanical Systems:

~~9.3.13.1~~~~9.5.16.1.~~ HVAC equipment mounted in rooms adjacent to classrooms shall be isolated for vibration and noise control.

~~9.3.13.2~~~~9.5.16.2.~~ HVAC diffusers and intakes shall not be placed near or directed toward projection screens.

~~9.3.13.3-9.5.16.3.~~ The HVAC system shall provide for year-around service.

~~9.3.14-9.5.17.~~ Electrical Systems:

~~9.3.14.1-9.5.17.1.~~ The front teaching wall shall have minimum of one (1) duplex outlet.

~~9.3.14.2-9.5.17.2.~~ The number and location of the outlets shall be coordinated with Owner.

~~9.3.14.3-9.5.17.3.~~ Adequate electrical power to student tables shall be provided in coordination with Classroom Scheduling.

~~9.3.15-9.5.18.~~ Lighting:

~~9.3.15.1-9.5.18.1.~~ Provide back-lit toggle switches at each room entrance.

~~9.3.15.2-9.5.18.2.~~ Locate clearly labeled lighting controls on the instructor multimedia lectern and on wall nearest to the instructional area.

~~9.3.15.3-9.5.18.3.~~ Consult ITS ~~Physical Infrastructure~~ for any programmable/scene lighting configuration.

~~9.3.15.4-9.5.18.4.~~ Lighting controls shall be integrated into the multimedia control panel.

~~9.3.15.5-9.5.18.5.~~ Classrooms shall have a minimum of two (2) separately controlled occupied areas, seating area and instructional area, with the ability to dim both areas independently.

~~9.3.15.6-9.5.18.6.~~ General classroom lighting shall provide 45-to-65-foot candles on writing surfaces.

~~9.3.15.7-9.5.18.7.~~ Lighting in rooms with sloped or tiered floors shall take into account the slope to provide consistent foot candles across the entire seating area.

~~9.3.15.8-9.5.18.8.~~ Lighting shall be evenly distributed for reading and writing and allow occupants to see each other's faces.

~~9.3.15.9-9.5.18.9.~~ Seating area shall maintain lighting levels adequate for note taking while viewing projection screens.

~~9.3.15.10-9.5.18.10.~~ Note-taking lighting levels may be achieved with dimming or selected switching of lamps.

~~9.3.15.11-9.5.18.11.~~ Provide independent, adjustable lighting at projection screens.

~~9.3.15.12-9.5.18.12.~~ Provide independent, adjustable lighting at writing surface. Writing surface shall be evenly illuminated.

~~9.3.15.13-9.5.18.13.~~ Maintain lighting levels at the lectern adequate for reading.

~~9.3.15.14-9.5.18.14.~~ Avoid suspending fixtures from the ceiling to prevent conflict with ceiling-mounted projectors.

~~9.3.15.15-9.5.18.15.~~ Provide task lighting on the equipment rack or technology controls.

~~9.3.15.16-9.5.18.16.~~ Provide LED step lights at all level changes in a classroom or auditorium. Step lights shall not be part of the room control system.

~~9.3.15.17-9.5.18.17.~~ Mount luminaires so lamps are parallel to front wall.

~~9.3.16-9.5.19.~~ Technology:

~~9.3.16.1-9.5.19.1.~~ All buildings with classrooms shall have a small, dedicated closet with storeroom lock for classrooms management use, minimum 50-square feet-to-80-square feet based on quantity of classrooms within building.

~~9.3.16.2-9.5.19.2.~~ Closet shall be capable of storing an 8-foot ladder that is accessible by the public corridor.

~~9.3.16.3-9.5.19.3.~~ Classrooms shall have standard multimedia rack and controls specified by ITS-LST Group for specific standards, which may include projector (installed with shock absorbing mount) or TV display, Blu-ray player, visualizer, control system, audio system, computer, and wireless collaboration pod.

~~9.3.16.4-9.5.19.4.~~ Multimedia lecterns shall be adjustable to allow for a variety of positions and ADA access and shall have a dedicated 20-amp circuit and four (4) total data drops.

~~9.3.16.5-9.5.19.5.~~ Audio/visual signal pathways, conduit size, and termination points in the classrooms shall be approved or specified by ITS Learning Spaces Technologies.

~~9.3.16.6-9.5.19.6.~~ Voice amplification is required for rooms seating seventy (70) or more.

~~9.3.16.6.1-9.5.19.6.1.~~ Rooms with voice amplification shall have an external line level input / output and induction hearing loop.

~~9.3.16.6.2-9.5.19.6.2.~~ Induction hearing loop systems shall be the system installed for spaces requiring assistive listening systems.

~~9.3.16.7-9.5.19.7.~~ Provide full wireless coverage for all classroom spaces.

~~9.3.16.8-9.5.19.8.~~ All classrooms require four (4) active network drops at the instructor's station.

~~9.3.16.9-9.5.19.9.~~ Additional capacity to expand data service to every seat in a TILE classroom is preferred.

~~9.3.16.10-9.5.19.10.~~ Provide pathway to telecommunication closet for room scheduler device at classroom entrance door.

~~9.5.19.11.~~ Schedulers should be Power or Ethernet. Consult with ITS-LST Group for location.

9.5.20. Security

~~9.5.20.1.~~ Lockdown function, locate near instructor podium, include cover

~~9.3.16.11.~~

10. Offices:

10.1. Guidelines for office size:

10.1.1. Dean or Vice President: 200-to-300-square feet

10.1.2. Departmental Executive: 180-square feet

10.1.3. Faculty private office: 140-square feet

10.1.4. Staff private office: 120-square feet

10.2. For UI-Hospitals and Clinics:

~~10.1.4.~~10.2.1. The "Offices" section does not apply to UI-Hospitals and Clinics. Office requirements shall be captured through the Owners Project Requirement process.

11. Loading Dock Facilities:

11.1. Review loading dock facility requirements with Owner.

11.2. Potential requirements:

11.2.1. Landfill dumpster or compactor equipment with appropriate decking, railings, and access.

11.2.1.1. Costs associated to procure and account for dumpsters or compactors shall be part of the project.

11.2.1.2. Dumpsters shall be accessible by a front-loading truck with the following minimum dimensions:

11.2.1.2.1. Travel access height: 13-feet 2-inches

11.2.1.2.2. Arm operation height: 23-feet

11.2.1.2.3. Overall width: 9-feet 6-inches

11.2.1.2.4. Overall approach length: 30-feet 8-inches

11.2.1.2.5. Vehicle wheelbase: 16-feet 8-inches

11.2.1.2.6. Turning radii, inside: 43-feet

11.2.1.2.7. Turning radii, outside: 60-feet 8-inches

11.2.1.2.8. Loading Docks shall have a minimum slope of one percent (1.0%) and a maximum slope of five percent (5.0%).

11.2.1.3. Compactors and recycle roll-off containers shall be accessible by a rear hook and lift system truck.

11.2.1.3.1. Minimum arm operation height: 17-feet 6-inches

11.2.1.3.2. Overall approach length: 54-feet

- 11.2.1.3.3. Compactor length: 22-feet 6-inches
- 11.2.1.3.4. Compactor height: 8-feet 7-inches
- 11.2.1.3.5. Overall width: 9-feet 6-inches
- 11.2.1.3.6. Travel access height: 13-feet 2-inches
- 11.2.1.3.7. Provide with IDOT required bumper assembly.
- 11.2.1.4. Provide either hydraulic or manual lift and/or catwalks for servicing trash / recycle containers.
- 11.2.1.5. Refuse trucks shall not be expected to back up more than 50-feet to access or exit dock.
- 11.2.1.6. Dock levelers shall be sealed to prevent air infiltration.
- 11.2.2. Truck dock bays at grade and/or at loading height. Bays may include a recessed lift.
- 11.2.3. Minimum of two (2) spaces for service vehicle parking.
- 11.2.4. Dedicated receiving area.
- 11.2.5. Dedicated holding area (hazardous materials, chemicals, ~~spent lamp storage~~).
- 11.2.6. Keyed hose bibbs with easy access and an isolated shut-off valve.
- 11.2.7. Two (2) area drains, one (1) in open areas and one (1) near dumpster locations in enclosed areas.
- 11.2.8. Acceptable lift for servicing trash / recycle containers: Vestil TCD-M-60-DC DC Power Trash Can Dumpster

12. Animal Rooms:

- 12.1. All animal rooms shall comply with the current edition of AAALAC standards.
- 12.2. Additional standards that shall be considered by the Design Professional are Federal Regulations, Title 9, Subchapter A, Animal Welfare 43FR56217, the Public Health Service Regulations contained in DHEW Publications number (NIH) 78-23, Guide for Care and Use of Laboratory Animals and the Biosafety in Microbiological and Biomedical Laboratories (BMBL).

3) CONCRETE

1. General:

1.1. Accessories touching the exposed surface of the concrete or in contact with soil shall be coated with plastic or epoxy to prevent rust.

1.2. For UI-Hospitals and Clinics:

1.2.1. Any cored holes in concrete slabs shall be patched using non shrink grout and pins anchored into the slab in the existing opening to tie the new patch into the existing slab and a steel plate shall be used below the slab to support the new patch being installed.

2. Mix Design and Materials:

2.1. Concrete strengths shall be specified in accordance with actual requirements.

2.1.1. Concrete mix shall be specified with minimum cement content, as well as maximum water/cement ratio.

2.1.2. Lignite shall be limited to 0.07 percent, by weight of the fine aggregate in all exposed concrete. Lignite-free applications may be required by Owner.

2.1.3. Calcium chloride in concrete mixes shall not be permitted.

2.1.4. Substitution of up to 20% (by weight) of cement material with class C or F fly-ash complying with AASHTO M 295 is acceptable.

2.1.5. Mix design shall be reviewed with the Owner at exterior entrances and steps to address resistance and durability to sand and salt use.

2.2. Exposed Concrete:

2.2.1. Exposed concrete intended as a finish material shall be clearly identified in the drawings and specifications.

2.2.2. Exposed concrete intended as a finish material shall be placed using special formwork, form liners, surface repairs and surface treatments such as sandblast, rubbing, etc.

2.3. Precast Concrete:

2.3.1. Panels shall be designed with adequate structural integrity to permit handling, transportation, storage, and erection.

2.3.2. Fabricator shall submit design to the Design Professional for review.

2.3.3. Fabricator shall have a minimum of three (3) years of experience in the fabrication of similar precast units.

2.3.4. Erector shall have a minimum of two (2) years of experience erecting similar precast units.

2.3.5. Shop drawings shall be prepared by a Registered Professional Engineer licensed to practice in the State of Iowa.

2.3.6. Fabricator shall comply with the following codes and standards:

2.3.6.1. ACI-318 “Building Code Requirements for Reinforced Concrete”.

2.3.6.2. CRSI “Manual of Standard Practice”.

2.3.6.3. Pre-stressed Concrete Institute MNL117, “Manual for Quality Control for Plant and Production for Architectural Precast Concrete Products.”

2.3.7. For UIHC:

2.3.7.1. The mix design for the exterior pre-cast at UIHC (~~Hawkins Drive University Campus~~) facilities shall be per the following table. The Constructor shall provide a sample for Owner approval.

T1W-T3G-.40-5 percent				
POUNDS	ONE CUBIC YARD S. S. D.	CU. VOL		SP. GR.
1645#	½-inch FORT DODGE LIMESTONE	9.95		2.65
1330#	#8 PLATTE RIVER SAND	8.14		2.62
513#	LEHIGH T-1 WHITE	2.61		3.15
145#	ASH GROVE T-3 GRAY 22 percent	0.74		3.15
263#	WATER .40 W/C 31.6 GAL.	4.22		1
4 OZ	DARAVAIR PER YARD 5 percent	1.35		
20 OZ	WRDA-82 PER YARD 30Z/CWT.			
66 OZ	DARACEM-19 PER YARD 10 OZ./CWT			
2985 GRAMS	# 43 STRAW PER YARD [DCS] 1 percent DOSE			
	MEDIUM SANDBLAST			
	144.3 # @ 5 percent			

2.4. Placement:

2.4.1. Base course and under slab drainage system for slabs shall conform to geotechnical engineer recommendations.

2.4.2. Slabs shall be constructed on a minimum 4-inch base of ¾-inch-to-1-inch clean rock with a plastic vapor barrier. Refer to 7. Thermal and Moisture Protection for additional information.

2.4.3. Areas having floor drains shall have positive slope to the floor drain. Indicate direction of pitch on drawings.

2.4.4. Slab flatness and levelness shall be within 1/8-inch in 10-feet.

- 2.4.5. ASTM E1155 shall be used to specify flatness and levelness when a high level of accuracy is required.
- 2.5. Joints
- 2.5.1. Joint spacing and detail shall be shown on the drawings.
- 2.5.2. Contraction joints shall be tooled during finishing or sawed within eighteen (18) hours of concrete placement.
- 2.5.3. Contraction joints shall have a minimum depth of one-quarter of the pavement thickness and a minimum width of 1/8-inch.
- 2.5.4. Transverse contraction joints shall be provided at a maximum of two and a half (2½) times the pavement thickness for street pavements and two (2) times for all other pavements.
- 2.5.5. Longitudinal joints shall have a maximum separation of 12-feet for streets and 9-feet for sidewalks.
- 2.5.6. Construction joints shall be located at expansion joint locations wherever possible. Construction joints at other locations shall be keyed.
- 2.5.7. Concrete flatwork shall be isolated from columns, existing walls, etc., by non-extruding expansion joint material.
- 2.6. Testing: Design Professional shall specify allowable limits for each test required.
- 2.6.2. The Owner shall retain services of the testing firm. Constructor shall be responsible for scheduling tests.
- 2.6.3. Constructor shall notify the Owner a minimum of 48-hours prior to placement of concrete.
- 2.6.4. Testing Requirements:
- 2.6.4.1. Strength, air entrainment, temperature, and slump tests.
- 2.6.4.2. Strength tests shall require four (4) cylinders, three (3) broken and one (1) spare.
- 2.6.4.3. Testing rate shall be a minimum of one (1) test for the first 25 CY placed each day, and one (1) test for each additional 50 CY placed.
- 2.6.4.4. Concrete may be tested more often, at the Owner's discretion.
- 2.6.5. Test data from concrete cylinder breaks shall be evaluated using the current edition of American Concrete Institute 214.
- 2.6.6. Test results shall be sent directly to the Constructor, Design Professional, and the Owner.

4) MASONRY

1. General:
 - 1.1. Stone coping shall be used for modification to existing facilities with stone coping.
 - 1.2. Use of stone coping for design effect shall require approval from Owner.
 - 1.3. Masonry units shall not be used for foundation walls below grade.
 - 1.4. Waterproofing materials shall not be used on new masonry or stone surfaces.
 - 1.5. Design Professional shall indicate wall expansion joints on drawings.
 - 1.6. Mortar and Manufacture of Masonry Units shall conform to current ASTM Standards on Masonry. ASTM C91-89 (Standard Specification for Masonry Cement) and C270-89 (Standard Specification for Mortar for Unit Masonry) shall apply.
2. Brick and Block Masonry:
 - 2.1. Follow Brick Institute of America (BIA) and Masonry Advisory Council (MAC) for design requirements.
 - 2.2. Allowances may be specified for brick only if specific selections cannot be made.
 - 2.3. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.
 - 2.4. Testing:
 - 2.4.1. Brick, including that incorporated into the face of architectural precast panels, shall comply with ASTM C216, and have a rating of “no efflorescence” when tested according to ASTM C67.
 - 2.4.2. Lab certification of brick shall be based on samples taken from the project specific production run and shall be approved prior to delivery.
3. Stone Masonry:
 - 3.1. Limestone shall follow the current edition of the Indiana Limestone Handbook.
 - 3.2. Coping stones shall be secured with stainless steel anchors and pins.
 - 3.3. Coping stones shall have a continuous, lead-coated copper flashing beneath the stones that extends flush to, but not past, the surface of the wall.
 - 3.4. Head joints of coping stones shall be set with joint sealant in lieu of mortar or grout.
4. Accessories:
 - 4.1. Shelf angles and other metal objects incorporated into masonry walls shall be hot dipped galvanized. Fasteners shall be stainless steel.

4.2. Flashing:

4.2.1. Flashings shall extend $\frac{1}{4}$ inch beyond the face of wall.

4.2.2. In-wall flashings shall be composite copper asphaltic felt.

4.2.3. Through-wall flashings shall be stainless steel.

4.2.4. Weeps shall be installed above each flashing.

4.3. Wall ties shall be hot dipped galvanized steel, equal to Hohmann & Barnard, Inc., DW10 Box Wall Tie.

4.4. Mortar at load bearing joints of dissimilar material types (brick and stone, brick, and concrete, etc.) shall be raked to allow the installation of backer rod and sealant.

5) METALS

1. Structural Steel:

- 1.1. Construction Documents shall clearly assign the responsibility for the design of steel connections. The responsible party shall seal the connection designs.
- 1.2. Design Professional shall use twist-off bolts and load indicator washers for field structural connections where possible.
- 1.3. Pre-engineered metal building roof purlins shall be adequately braced on the compression flange to resist all design loads.
- 1.4. Purlin slide clips commonly used with standing seam systems shall not be considered an effective brace for the purlin.
- 1.5. Separate purlin bracing such as threaded rods or sag angles shall be provided in addition to the slide clips.
- 1.6. Certified (AWS D1.1) welders shall be required on structural work.

~~1.7. For UIHC: Interior Partitions: Non-Load Bearing Partition Framing, steel stud partitions, shall be minimum 20-gauge.~~

~~1.8.1.7.~~ Guardrails and Handrails:

~~1.8.1.7.1.~~ Exterior guardrails and handrails shall be fully welded, hot dipped, galvanized steel pipe.

~~1.8.2.1.7.2.~~ Painted surfaces shall be prepared per ASTM D6386 *Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products and Hardware Surfaces for Painting*.

~~1.8.2.1.7.2.1.~~ Railings shall be painted black - high gloss enamel paint.

~~1.8.2.2.1.7.2.2.~~ Paint shall be listed for use over galvanized steel.

~~1.8.3.1.7.3.~~ Infill panels shall be vertical balusters.

~~1.8.4.1.7.4.~~ Support posts shall be surface mounted. Review mounting detail with Owner.

~~1.9.1.8.~~ All exterior fasteners shall be stainless steel.

~~1.10.1.9.~~ Mockup panel is required for all welded railings, grilles, and similar architectural metal elements.

1.10. Exposed, exterior stainless-steel elements shall be type 316.

1.11. For UIHCospitals and Clinics:

1.11.1.1. Interior Partitions: Non-Load Bearing Partition Framing, steel stud partitions, shall be minimum 20-gauge.

4.11.1.12.

2. Testing:

- 2.1. Design Professional shall specify allowable limits for each test required.
- 2.2. The Owner shall retain services of the testing firm. Constructor shall be responsible for scheduling tests.
- 2.3. Constructor shall notify the Owner a minimum of 48 hours prior to erection.
- 2.4. Test results shall be sent directly to the Constructor, Design Professional, and the Owner.

6) WOODS, PLASTICS, AND COMPOSITES

1. Rough Carpentry:

- 1.1. Fire-retardant lumber shall be in accordance with American Wood Preservers Association standards.
- 1.2. Chromated Copper Arsenate (CCA) treated lumber shall not be used.

2. Architectural Millwork and Cabinetry:

- 2.1. Architectural millwork and cabinetry shall meet Architectural Woodwork Institute standards.
- 2.2. Millwork finish shall be free of lead bearing substances.
- 2.3. Durable solid surfacing materials, such as plastic laminate on solid wood or exterior grade plywood substrate, shall be used for windowsills. Standard particleboard shall not be used.

2.4. For UI-H Hospitals and Clinics:

- 2.4.1. Millwork shall be manufactured in an AWI QCP facility and shall conform to the latest edition of the AWS standards.
- 2.4.2. Faces of millwork cabinets shall not be produced with ridges.
- 2.4.3. Wood casework shall be used only with Owner approval. Plastic laminate casework shall be used in most areas.
- 2.4.4. Wood casework shall not contain knots.
- 2.4.5. Either pressure treated solid lumber or sold surface materials shall be used for casework bases instead of water wicking or permeable materials.
- 2.4.6. Casework panels shall adhere to AWI Architectural Woodwork Standards at a level no higher than Custom.
- 2.4.7. Panels at integrated glove dispensers shall be a thermofoil finish.
- 2.4.8. Plastic laminates used vertically on walls shall ~~not~~ be of a finish that does not show fingerprints and smudges.
- 2.4.9. Provide ¼ inch high nylon glides under the base of sink vanities to create a gap to prevent water wicking.
- 2.4.10. Any exposed surfaces under countertops shall be painted.
- 2.4.11. Stainless steel casework and storage cabinets shall be Continental Metal Products and all other metal casework shall be Hamilton Industries or Owner approved equal.
- 2.4.12. Casework hardware shall be:
 - 2.4.12.1. Folding Shelf Brackets shall be Stanley 794.

- 2.4.12.2. Plastic Grommets shall be Doug Mockett.
- 2.4.12.3. Fixed Panels shall be KEKU push in fittings.
- 2.4.12.4. Cabinet pulls shall Berenson BE 9398.
- 2.4.12.5. PPE Cabinet pulls shall be HAF ELE 9.2.01.250.
- 2.4.12.6. Hinges:
 - 2.4.12.6.1. Hafele 327.21.500, Blum B-071B3580, or approved EQUIV concealed hinge where doors are against walls, hinges to have 90° stops.
 - 2.4.12.6.2. PPE Cabinet Soft Close Hinges:
 - 2.4.12.6.2.1. Pull shall be HAF ELE 9.2.01.250.
 - 2.4.12.6.2.2. Soft close hinge shall be Hettich Intermat 9944, Fast-assembly hinge, Opening angle 125° with Hettich Soft Close.
- 2.4.12.7. Drawer Guides:
 - 2.4.12.7.1. Drawers with less than 1-cubic foot of volume – Hafele Accuride 50 pounds.
 - 2.4.12.7.2. Drawers larger than 1-cubic foot of volume – Hafele, Accuride 75 and 100 pounds.
 - 2.4.12.7.3. Shelf Standards and Brackets: K & V 255 and 256.
- 2.4.12.8. Cabinet Locks shall be:
 - 2.4.12.8.1. Doors: Olympus 700 SC, 7/8-inch or 1 3/8-inch or KABA Simplex 9600.
 - 2.4.12.8.2. Drawers: Olympus 800 SC, 7/8-inch or 1 3/8-inch or KABA Simplex 9600.
 - 2.4.12.8.3. Narcotics/Medicine Drawers: Olympus 725 RL with Hospital Standard Core.

2.5.3. Countertops:

- 2.5.1.3.1.** Seams shall be kept to a minimum.
- 2.5.2.3.2.** Plastic laminate countertops shall have a plywood substrate.
- 2.5.3.3.3.** Sprayed-on glue application for plastic laminate shall not be used.
- 2.5.4.3.4.** Countertops in wet areas shall not be constructed with substrate susceptible to moisture.
- 2.5.5.3.5. For UI Hospitals and Clinics:**
 - 2.5.5.1.3.5.1.** Solid Surface counters shall be used in wet areas.
 - 2.5.5.2.3.5.2.** Solid Surface countertops to have integral back splashes.

2.5.5.3.3.5.3. In patient care areas, solid surface back and side splashes shall extend to the underside of the cabinet.

2.5.5.4.3.5.4. Sinks in solid surface counters shall be integral solid surface construction, without overflows and with an offset drain.

2.5.5.5.3.5.5. Drip edges shall be used on all sides of patient room sinks.

2.5.5.6.3.5.6. Solid surface counters at workstations to have knife edge.

2.5.5.7.3.5.7. Solid surfaces shall be used in windowsills.

7) THERMAL AND MOISTURE PROTECTION

1. Fire Proofing shall be cementitious.
2. Fire Stopping:
 - 2.1. Provide installed firestop products that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations restoring the integrity of the fire rated construction to its original fire rating.
 - 2.2. Provide fire resistive systems listed for construction gaps per the specific combination of fire-rated construction type, configuration, gap dimensions, and fire rating.
 - 2.3. Provide systems manufactured by 3M, HILTI, [STI](#), or approved equivalent that are listed by Underwriters.
 - 2.4. Underwriter Laboratories Inc. (UL), in "Fire Resistance Directory".
 - 2.5. Must be red in color.
 - 2.6. Where firestop systems not listed by any listing agency are required due to project conditions, submit a substitution proposal with evidence specified, to be reviewed for owner approval.
 - 2.7. Do not conceal firestopping installations until the Owner's inspection agency or authorities having jurisdiction have examined each installation. Owner, Design Professional, and Installing Contractor will conduct and document a comprehensive inspection of all installed firestopping.
 - 2.8. Installer Qualifications: Firm shall be qualified by having experienced staff who are properly trained to install the specified products, by completing the manufacturer's certified product installation training. Contractor must provide certificate of qualification.
 - 2.9. Every location shall include a label identifying who installed it, when it was installed and the system that was used.
3. Fire and Smoke Wall Markings
 - 3.1. Provide permanent marking of all fire and smoke rated partitions.
 - 3.2. Markings shall be an 8-inch diameter fluorescent orange painted circle applied 6-12 inches above the finished ceiling with a 4-inch black numeral or letters stenciled over the orange circle.
 - 3.3. Markings shall be on both sides of all fire and smoke rated partitions and in every adjacent room.
 - 3.4. The spacing of permanent markings shall not be more than 8 feet on center.

4. Interior Wall Insulation

3.5.4.1. For UI-Hospitals and Clinics:

3.5.1.4.1.1. Batt insulation shall be installed in all interior walls for increased sound absorption. Insulation to be unfaced, fiberglass batt, formaldehyde free.

3.5.2.4.1.2. Spray Foam Insulation

~~3.5.2.1.4.1.2.1.~~ Review with Owner when recommended use.

~~3.5.2.2.4.1.2.2.~~ Product shall meet Flame Spread and Smoke Developed Rating: ASTM E 84, class A and shall be a closed-cell spray foam providing a minimum R-value of 6.5 per inch.

~~4.5.~~ Exterior Wall Insulation:

~~4.1.5.1.~~ Semi rigid, blanket batt type, mineral wool, unfaced, complying with ASTM C665 and NFPA 285.

~~4.2.5.2.~~ Shall have ASTM E84 values of flame spread less than 25.

~~4.3.5.3.~~ Smoke development and fuel contributed less than 50.

~~4.4.5.4.~~ Use closed cell extruded polystyrene insulation below grade on exterior walls.

~~5.6.~~ Foundation Waterproofing:

~~5.1.6.1.~~ All foundation walls with accessible or occupied space on one (1) side and soil on the other shall have waterproofing systems installed below grade. Components of the waterproofing system shall be by the same manufacturer.

~~5.2.6.2.~~ Drain tiles shall be installed at footings and tied to storm sewer system as allowed by local municipalities.

~~5.2.1.6.2.1.~~ Perforated pipe for subgrade drains shall be SDR-35, Schedule 40 PVC, or HDPE conforming to ASTM F2688 or F2306.

~~5.2.2.6.2.2.~~ Pipe shall be installed in a geotextile envelope with clean rock.

~~5.2.3.6.2.3.~~ Perforated pipe in a 'sock' shall not be allowed.

~~5.3.6.3.~~ Down spouts shall be tied into storm sewers (in lieu of foundation drain tiles) and shall not discharge on grade.

~~5.4.6.4.~~ Other areas that require below grade waterproofing shall have complete systems with all components of the system provided by the same manufacturer.

~~6.7.~~ Roofing:

~~6.1.7.1.~~ General:

~~6.1.1.7.1.1.~~ Roofing systems shall comply with the following:

~~6.1.1.1.7.1.1.1.~~ Underwriters Laboratory (UL) labels are required for each membrane, with top side fire rating meeting ASTM E108 Class A.

~~6.1.1.2.7.1.1.2.~~ National Roofing Contractors Association (NRCA), Roofing and Waterproofing Manual.

~~6.1.1.3.7.1.1.3.~~ Sheet Metal and Air Conditioning Contractors Association International (SMACNA), Architectural Sheet Metal Manual.

~~6.1.1.4~~~~7.1.1.4~~. American Society for Testing and Materials (ASTM) standards for polymer-modified bitumen D5147, D6162, D6163, and D6164.

~~6.1.1.5~~~~7.1.1.5~~. FM Global RoofNav:

~~6.1.1.5.1~~~~7.1.1.5.1~~. Minimum 1-60 SH (severe hail) approved rating.

~~6.1.1.5.2~~~~7.1.1.5.2~~. All components shall be approved for both individual and use in a listed assembly.

~~6.1.1.6~~~~7.1.1.6~~. A Sheet Metal Constructor shall fabricate and install all roof related sheet metal flashings and trim. No roofing personnel shall be allowed to fabricate or install roof related sheet metal.

~~6.1.1.7~~~~7.1.1.7~~. Sealants used in conjunction with roof related sheet metal shall receive a sealant primer and the sealant color shall match that of the adjacent sheet metal.

~~6.1.1.8~~~~7.1.1.8~~. Abandoned or unused equipment and materials shall be removed on re-roofing projects.

~~6.1.2~~~~7.1.2~~. Approved Roofing Manufacturers:

~~6.1.2.1~~~~7.1.2.1~~. EPDM – Black Membrane:

~~6.1.2.1.1~~~~7.1.2.1.1~~. Carlisle Corporation

~~6.1.2.1.2~~~~7.1.2.1.2~~. Holcim Building Envelope - Elevate

~~6.1.2.1.3~~~~7.1.2.1.3~~. Versico Roofing Systems

~~6.1.2.2~~~~7.1.2.2~~. PVC – White Membrane:

~~6.1.2.2.1~~~~7.1.2.2.1~~. Sarnafil Corporation

~~6.1.2.2.2~~~~7.1.2.2.2~~. **For UIHC:** GAF or Carlisle Syntec

~~6.1.2.3~~~~7.1.2.3~~. KEE – White Membrane:

~~6.1.2.3.1~~~~7.1.2.3.1~~. Seaman Corporation

~~6.1.2.4~~~~7.1.2.4~~. Metal Roofing Systems:

~~6.1.2.4.1~~~~7.1.2.4.1~~. ATAS Aluminum Corporation - Monarch

~~6.1.2.4.2~~~~7.1.2.4.2~~. Butler Manufacturing Company - VSR

~~6.1.2.4.3~~~~7.1.2.4.3~~. Centria - SRS

~~6.1.2.4.4~~~~7.1.2.4.4~~. MBCI – LokSeam

~~6.1.2.4.5~~~~7.1.2.4.5~~. Steelox Systems, Inc. - CF/SD

~~6.1.2.4.6~~~~7.1.2.4.6~~. Vincent Metals - System 1

~~6.1.3.7.1.3.~~ The Design Professional shall consider the following design parameters when selecting a roof system:

~~6.1.3.1.7.1.3.1.~~ Life expectancy of building

~~6.1.3.2.7.1.3.2.~~ Life of the roof system

~~6.1.3.3.7.1.3.3.~~ Present and future use of building, including specific uses in the building that could affect the roof system.

~~6.1.3.4.7.1.3.4.~~ Aesthetics

~~6.1.3.5.7.1.3.5.~~ Initial cost of the roof system and additional building costs required for recommended roof system.

~~6.1.3.6.7.1.3.6.~~ Maintenance costs and requirements

~~6.1.3.7.7.1.3.7.~~ Energy costs associated with recommended roof system.

~~6.1.3.8.7.1.3.8.~~ Building height, roof slope, wind resistance requirements

~~6.1.3.9.7.1.3.9.~~ Local environmental issues, contaminants, and pollutants

~~6.1.3.10.7.1.3.10.~~ Structural properties of roof superstructure

~~6.1.3.11.7.1.3.11.~~ Type of roof deck

~~6.1.3.12.7.1.3.12.~~ Vapor retarder requirements

~~6.1.3.13.7.1.3.13.~~ Roof traffic, access, and penetrations

~~6.1.3.14.7.1.3.14.~~ Code and insurance requirements and restrictions

~~6.1.3.15.7.1.3.15.~~ HVAC internal pressures

~~6.1.3.16.7.1.3.16.~~ Application issues, such as staging.

~~6.1.4.7.1.4.~~ The Design Professional shall follow these roofing guidelines when designing the roofing system:

~~6.1.4.1.7.1.4.1.~~ Single-ply ballasted roofs and spray foam roofing system shall not be used.

~~6.1.4.2.7.1.4.2.~~ Overflows are required and shall not be piped into the primary roof drain system. Highly visible systems such as scuppers and open site drains are preferred.

~~6.1.4.3.7.1.4.3.~~ Roof elevations greater than two floors high: Overflows shall be piped through the building and discharged near grade.

~~6.2.7.2.~~ Roofing Systems:

~~6.2.1.7.2.1.~~ Metal Roofing-Structural Standing Seam (SSR)

~~6.2.1.1.7.2.1.1.~~ Structural metal roofing shall meet UL 90 uplift rating.

~~6.2.1.2.7.2.1.2.~~ Minimum design slope 1 inch per foot.

6.2.2.7.2.2. Metal Roofing-Structural Standing Seam (SSR)

6.2.2.1.7.2.2.1. Roofing shall be pre-engineered metal running perpendicular to purlins supports. Provide glass batt insulation directly beneath the roofing and over the purlins.

6.2.2.2.7.2.2.2. Sheets shall have a steel or aluminum core, minimum 22-gauge, and corrosion protection provided by a Kynar-coated finish.

6.2.2.3.7.2.2.3. Ice guards are required on eaves over sidewalks.

6.2.3.7.2.3. Slate

6.2.3.1.7.2.3.1. Slate material shall be ASTM C406, Type-S1, with ninety (90) to one hundred (110) year performance-life.

6.2.3.2.7.2.3.2. Use of artificial slate requires Owner approval.

6.2.3.3.7.2.3.3. Minimum design slope 5 inches per foot. Slopes down to 3 inches per foot are acceptable with adhered polyethylene reinforced bitumen sheet underlayment.

6.2.3.4.7.2.3.4. Use copper nails and ridge caps.

6.2.3.5.7.2.3.5. Ice guards are required on eaves over sidewalks.

6.2.4.7.2.4. Asphalt Shingles

6.2.4.1.7.2.4.1. Asphalt shingles shall be fiberglass seal-tab type with minimum twenty-five (25) year manufacturer's warranty.

6.2.4.2.7.2.4.2. Minimum roof slope shall be 4 inches per foot with one (1) layer of 30-pound asphalt saturated felt underlayment. Slopes down to 3 inches per foot are acceptable with two (2) layers of underlayment.

6.2.4.3.7.2.4.3. 35-40 mil self-adhered rubberized asphalt or butyl membrane shall be used in all valleys and at edges.

6.2.4.4.7.2.4.4. Provide a pre-finished metal sheet steel drip edge at eaves and gable rakes.

6.2.4.5.7.2.4.5. Shingles shall be nailed, not stapled.

6.3.7.3. Roofing Components:

6.3.1.7.3.1. Membrane and Insulation Assemblies:

6.3.1.1.7.3.1.1. SBS Type Modified Bitumen Sheet System:

6.3.1.1.1.7.3.1.1.1. Membranes to consist of a base sheet, interply sheet and cap sheet of SBS type sheets bonded with cold-process adhesive.

6.3.1.1.2.7.3.1.1.2. Fire-rated sheet may be necessary to meet Class A requirements.

6.3.1.1.3.7.3.1.1.3. Polyester or fiberglass reinforcement is allowable, per manufacturer's roof systems.

~~6.3.1.1.4-7.3.1.1.4.~~ Standard test methods for sampling and testing Modified Bitumen material shall comply with ASTM D-5147, D-6162, D-6163, and D-6164.

~~6.3.1.1.5-7.3.1.1.5.~~ Insulation shall be selected per current ASHRAE 90.1 guidelines, rigid Polyisocyanurate or extruded polystyrene, as part of roof manufacturer's approved system and included in the total system warranty. **(For UIHC:** Insulation shall be Polyisocyanurate (20 psi minimum).

~~6.3.1.1.6-7.3.1.1.6.~~ The specified Insulation shall be compatible with the system and shall be included in the total system warranty.

~~6.3.1.1.7-7.3.1.1.7.~~ It is required that insulation be installed in more than one (1) layer with staggered joints. Use of a cover board is not considered a layer.

~~6.3.1.1.8-7.3.1.1.8.~~ Surfacing shall be white, ceramic granule surfaced cap sheet.

~~6.3.1.1.9-7.3.1.1.9.~~ Membrane shall be anchored with non-ferrous termination bars and stainless-steel fasteners at wall and deck transition.

~~6.3.1.1.9.1-7.3.1.1.9.1.~~ Termination bars shall be covered with a reglet and counterflashing.

~~6.3.1.1.10-7.3.1.1.10.~~ Granular color shall be selected by the Owner.

~~6.3.1.1.11-7.3.1.1.11.~~ Substrate Board:

~~6.3.1.1.11.1-7.3.1.1.11.1.~~ ½-inch thick siliconized gypsum factory-primed on one (1) side for exterior fire rating Class A, as part of roof manufacturer's approved system.

~~6.3.1.1.11.2-7.3.1.1.11.2.~~ Substrate board shall be installed with staggered joints.

~~6.3.1.1.12-7.3.1.1.12.~~ Cover Board:

~~6.3.1.1.12.1-7.3.1.1.12.1.~~ **For UIHC:** Cover board shall be required for all single-ply roofing membranes and shall be ½-inch minimum high-density gypsum.

~~6.3.1.1.13-7.3.1.1.13.~~ Base Flashings:

~~6.3.1.1.13.1-7.3.1.1.13.1.~~ SBS-type with polyester reinforcement only.

~~6.3.1.1.13.2-7.3.1.1.13.2.~~ APP-type at non-nailable substrates shall not be used.

~~6.3.1.1.13.3-7.3.1.1.13.3.~~ SBS-type with granule surfacing and polyester reinforcement as walkways.

~~6.3.1.1.14-7.3.1.1.14.~~ **For UIHC:**

~~6.3.1.1.14.1-7.3.1.1.14.1.~~ No open flame torch application methods shall be allowed.

~~6.3.1.2.7.3.1.2.~~ EPDM - Fully Adhered:

~~6.3.1.2.1-7.3.1.2.1.~~ Membrane:

~~6.3.1.2.1.1-7.3.1.2.1.1.~~ Minimum 60 mil thick EPDM non-reinforced sheet.

~~6.3.1.2.1.2-7.3.1.2.1.2.~~ Seam products shall be pre-manufactured as supplied and approved by manufacturer. Minimum field seam width shall be 5 ½ inches.

~~6.3.1.2.2-7.3.1.2.2.~~ Insulation shall be selected per current ASHRAE 90.1 guidelines and included in the total system warranty. (**For UIHC:** Insulation shall be Polyisocyanurate (20 psi minimum).

~~6.3.1.2.3-7.3.1.2.3.~~ Polyisocyanurate shall have facers designed for EPDM adhesion and shall be approved or manufactured by primary membrane manufacturer.

~~6.3.1.2.4-7.3.1.2.4.~~ Mechanical insulation fasteners, with locking caps, shall be used metal and wood decks.

~~6.3.1.2.5-7.3.1.2.5.~~ Adhere with polyurethane adhesive over concrete substrate and vapor barriers.

~~6.3.1.2.6-7.3.1.2.6.~~ Insulation shall be compatible with the application method required and the other materials of the roofing system and shall be included in the total system warranty.

~~6.3.1.2.7-7.3.1.2.7.~~ Install insulation in more than one (1) layer with staggered joints. Use of a cover board is not considered a layer.

~~6.3.1.2.8-7.3.1.2.8.~~ Surfacing shall not be required. Use fire rated Class-A system for exterior fire resistance.

~~6.3.1.2.9-7.3.1.2.9.~~ Base Flashings shall be 60 mil EPDM.

~~6.3.1.2.9.1-7.3.1.2.9.1.~~ Continue field membrane up walls and curbs using non-penetrating attachment methods.

~~6.3.1.2.9.2-7.3.1.2.9.2.~~ Use details that minimize uncured rubber.

~~6.3.1.2.9.3-7.3.1.2.9.3.~~ Termination bars shall be covered with a reglet and counter flashing.

~~6.3.1.2.10-7.3.1.2.10.~~ Substrate Board shall be ½-inch thick siliconized gypsum core panel.

~~6.3.1.2.11-7.3.1.2.11.~~ Cover Board:

~~6.3.1.2.11.1-7.3.1.2.11.1.~~ **For UIHC:** Cover board shall be required for all single-ply roofing membranes and shall be ½-inch minimum high-density gypsum.

~~6.3.1.3-7.3.1.3.~~ PVC (reinforced) - Fully Adhered:

~~6.3.1.3.1-7.3.1.3.1.~~ Membrane shall be minimum 60 mil thick fabric reinforced sheet with heat weld seaming.

~~6.3.1.3.1.1-7.3.1.3.1.1.~~ **For UIHC:** Membrane shall be minimum 80 mil thick fabric.

~~6.3.1.3.2-7.3.1.3.2.~~ Insulation shall be selected per current ASHRAE 90.1 guidelines and included in the total system warranty.

~~6.3.1.3.2.1-7.3.1.3.2.1.~~ **For UIHC:** Insulation shall be Polyisocyanurate (20 psi minimum).

~~6.3.1.3.3-7.3.1.3.3.~~ The insulation specified shall be compatible with the application method required as well as with the other materials of the roofing system and shall be included in the total system warranty.

~~6.3.1.3.4-7.3.1.3.4.~~ Install insulation in more than one (1) layer with staggered joints. Use of a cover board is not considered a layer.

~~6.3.1.3.5-7.3.1.3.5.~~ **For UIHC:**

~~6.3.1.3.5.1-7.3.1.3.5.1.~~ Cover board shall be required and shall be ½ inch minimum high-density gypsum. Review requirement for Cover board on all other projects.

~~6.3.1.3.6-7.3.1.3.6.~~ Substrate Board when required shall be ½ inch thick siliconized gypsum core panel.

~~6.3.1.3.7-7.3.1.3.7.~~ Surfacing not required.

~~6.3.1.3.8-7.3.1.3.8.~~ Base Flashings shall be membrane coated metal or reinforced sheet and accessories provided by primary manufacturer.

~~6.3.1.3.9-7.3.1.3.9.~~ Anchor membrane with non-ferrous termination bars and stainless-steel fasteners at wall and deck transition. Termination bars shall be covered with a reglet and counterflashing.

~~6.3.1.4-7.3.1.4.~~ Adhered KEE Thermoplastic Membrane Roofing:

~~6.3.1.4.1-7.3.1.4.1.~~ **For UIHC:**

~~6.3.1.4.1.1-7.3.1.4.1.1.~~ FiberTite 50-mil XT or 90-mil Xtreme membrane to be used when approved.

~~6.3.2-7.3.2.~~ Roof Deck:

~~6.3.2.1-7.3.2.1.~~ Systems shall be designed by a registered Structural Engineer.

~~6.3.2.2.7.3.2.2.~~ Existing roof decks shall be checked by a Registered Structural Engineer, as directed by Owner.

~~6.3.2.3.7.3.2.3.~~ Design Professional shall determine expected wind uplift conditions and determine suitability of the recommended system.

~~6.3.2.4.7.3.2.4.~~ Roof deck securement shall be per FM Global Property Loss Prevention Data Sheet 1-29.

~~6.3.2.5.7.3.2.5.~~ Slope deck to drains whenever possible. For new construction, positive slope for drainage shall not be tapered insulation except at crickets and around equipment pads.

~~6.3.2.6.7.3.2.6.~~ Gypsum, wood, or wood fiber cement decks shall not be used.

~~6.3.2.7.7.3.2.7.~~ Roof deck material shall be a minimum 20-gauge metal deck or a cast in place concrete deck.

~~6.3.2.8.7.3.2.8.~~ Lightweight concrete shall not be used.

~~6.3.2.9.7.3.2.9.~~ All wood curbs, blocking, subfascias, etc. shall be preservative-treated material.

~~6.3.3.7.3.3.~~ Vapor Retarders

~~6.3.3.1.7.3.3.1.~~ Design Professional shall determine the need for a vapor retarder. Provide calculations to Owner for record.

~~6.3.3.2.7.3.3.2.~~ Vapor retarder shall be by the same manufacturer as the roof membrane.

~~6.4.7.4.~~ Roofing Accessories

~~6.4.1.7.4.1.~~ Coping shall be constructed with metal selected from one (1) of the following materials.

~~6.4.1.1.7.4.1.1.~~ Sheet metal, 22-or 24-gauge, galvanized, factory finished with Kynar 500. **For UIHC:** use 22 gauge.

~~6.4.1.2.7.4.1.2.~~ Copper, ASTM B370, 16 to 20 ounces.

~~6.4.1.3.7.4.1.3.~~ Aluminum, .032-inch or .040-inch, factory finished with Kynar 500.

~~6.4.1.4.7.4.1.4.~~ Stainless steel, .018 soft buff.

~~6.4.2.7.4.2.~~ Gravel stop and fascia shall be 22-or 24-gauge, galvanized, factory finished with Kynar 500.

~~6.4.3.7.4.3.~~ Installation shall be in accordance with SMACNA minimum standards. End laps and side laps shall provide for thermal expansion. Joints shall have cover and backup plates.

~~6.4.4.7.4.4.~~ Sheet metal roof accessories shall be constructed with metal selected from one (1) of the following materials:

6.4.4.1.7.4.4.1. Sheet metal, 20-gauge, galvanized, factory finished with Kynar 500.

6.4.4.2.7.4.4.2. **For UIHC:**

6.4.4.2.1.7.4.4.2.1. Minimum gauge thicknesses for roof related sheet metal accessories:

6.4.4.2.1.1.7.4.4.2.1.1. Edge Metal: 24 gauge

6.4.4.2.1.2.7.4.4.2.1.2. Counterflashing: 24 gauge

6.4.4.2.1.3.7.4.4.2.1.3. Expansion/Control Joint Cover: 22 gauge

6.4.4.2.1.4.7.4.4.2.1.4. Supper: 24 gauge

6.4.4.2.1.5.7.4.4.2.1.5. Conductor Heads: 22 gauge

6.4.4.2.1.6.7.4.4.2.1.6. Gutter: 22 gauge

6.4.4.2.1.7.7.4.4.2.1.7. Downspout: 22 gauge

6.4.5.7.4.5. Copper, ASTM B370, 16 to 20-ounce.

6.4.5.1.7.4.5.1. Aluminum, ASTM B209, alloy 3003, AA-C22A41 clear anodized finish, minimum 20-gauge.

6.4.5.2.7.4.5.2. Solder, 50/50 ASTM B32.

6.4.6.7.4.6. Supports when required for equipment and/or conduits set on top of the roof shall be placed over roof membrane manufacturer's recommended walkway material. (Includes **UIHC**)

6.4.7.7.4.7. Supports for rooftop-mounted equipment shall be a minimum 14-inch height above finished roof.

6.4.7.1.7.4.7.1. Use prefabricated equipment supports where possible.

6.4.7.2.7.4.7.2. Equipment support frames or stands shall provide following working clearances:

<u>EQUIPMENT WIDTH</u>	<u>HEIGHT ABOVE FINISHED ROOF</u>
Up to 25 inches	14 inches
25-37 inches	18 inches
37-49 inches	24 inches
49-61 inches	30 inches
Over 61 inches	48 inches

6.4.8.7.4.8. Minimize use of pitch pans or sealant pockets.

6.4.8.1.7.4.8.1. For UIHC: Penetration flashing details shall be accomplished without the use of pitch pans.

~~6.4.9.7.4.9.~~ Maintain minimum 12-inch flashing height above finished roof.

~~6.4.10.7.4.10.~~ Minimize roof penetrations. If structural penetrations are unavoidable, use round structural steel shapes to facilitate flashing.

~~6.4.11.7.4.11.~~ Account for thermal break(s).

~~6.4.12.7.4.12.~~ In new construction, roof shall have a minimum design slope of ¼-inch per foot.

~~6.4.13.7.4.13.~~ In reroofing, the roof shall have a minimum slope of 1/8-inch per foot. Tapered insulation may be necessary to achieve required slope.

~~6.4.14.7.4.14.~~ Use crickets, saddles, and edge strips, tapered at two (2) times slope, to direct water from penetrations and parapet walls.

~~6.4.15.7.4.15.~~ Parapet Wall

~~6.4.15.1.7.4.15.1.~~ For UIHC:

~~6.4.15.1.1.7.4.15.1.1.~~ Treated plywood shall be used for base flashings substrates at perimeter walls in lieu of gypsum sheathing when allowed by code.

~~6.4.16.7.4.16.~~ Roof Hatch

~~6.4.16.1.7.4.16.1.~~ For UIHC:

~~6.4.16.1.1.7.4.16.1.1.~~ Roof access hatches shall be as manufactured by The Bilco Company, with mill finish aluminum construction.

~~6.5.7.5.~~ Roof Access and Safety:

~~6.5.1.7.5.1.~~ OSHA-approved fall protection systems shall be included on all roof systems.

6.5.2. Stairs shall be provided for roof access.

6.5.3. Ladders and ships ladders are not acceptable.

6.5.4. For UIHC:

6.5.4.1. ~~An alternating tread stair-ship ladder may shall be used for replacement of existing ladders~~ Replacement of existing ladders (when approved) shall be fully supported off adjacent walls and shall be aluminum or painted galvanized steel. ~~If vertical ladders are used a security card reader will be used at any required access point.~~

6.5.4.2. Ladders shall not penetrate roof membrane or flashing.

6.5.4.3. Window Washing Tie-off Anchors:

~~6.5.4.4.16.5.14.3.1.~~ Tie-off anchors shall be designed and installed on all new roofs per ANSI/IWCA I-14.1.

~~6.5.4.5.~~26.5.14.3.1. A minimum of 10 percent of the tie-off anchors shall be tested on site using load cell apparatus in accordance with manufacturer's recommendations. Tests shall be conducted by an independent agency, and test reports shall be sent to the Owner.

36.5.14.3.1. All anchors relying upon chemical adhesive fasteners are to be 100 percent tested on site using load

~~6.5.4.6.~~46.5.14.3.1. cell apparatus in accordance with manufacturer's recommendations. Tests shall be conducted by an independent agency, and test reports shall be sent to the Owner.

6.5.5. For UI Housing:

6.5.5.1. When public access is provided onto a rooftop courtyard of a UI Housing facility, the roof perimeter shall have a six (6) feet high barrier that is non-climbable.

6.5.5.2. Provide fall protection connection devices (tiebacks and lifeline anchor systems) on or about the roof / roof edges in compliance with codes, ANSI / IWCA I-14 and OSHA requirements.

6.5.5.3. Provide connection tiebacks and lifeline anchors along roof perimeter edges designed for connection of window drops and window washing platforms drops. Anchor systems shall provide independent fall arrest anchorages in addition to working line anchors for each descent location as required by OSHA and ANSI.

6.5.6. Verify wind velocity requirements with the Owner.

6.5.7. Roof drains shall be located at projected low points.

6.5.8. Provide roof walkways to and around rooftop equipment, and other areas, as directed by the Owner.

6.5.8.1. Roof mats shall be a non-slip material.

6.5.9. Rooftop equipment /systems shall have an OSHA-approved guardrail or parapet. Roof tie-offs are not allowed.

6.5.10. Existing roof access shall be evaluated, and roof access hatches, ladders, and other components shall be installed as needed and approved by the Owner.

6.5.11. Equipment located on the roof shall be a minimum of 10-feet from the roof edge (all sides) or provide a 42-inch-high roof parapet or railing. Tie-offs are not allowed.

~~6.6.7.6.~~ Roof Installation:

6.6.1. Roofing Constructor shall have the following qualifications:

6.6.1.1. A minimum of five (5) years of experience in installation of the specified roofing system.

6.6.1.2. Roof Manufacturer Certification as installer for specified roofing systems.

6.6.1.3. Roof Foreman and 50 percent of installing crew are trained and certified in the installation of specified roofing system.

6.6.1.4. Foreman shall be full-time, at project site, through roof completion.

~~6.7.7.7.~~ Roof Warranties and Certification:

6.7.1. Roof Manufacturer and roof installer shall provide the following items:

6.7.1.1. Roofing Manufacturer guarantee for all materials furnished and work performed under the roofing system contract against defective workmanship for a period of twenty-four (24) months after Substantial Completion.

6.7.1.2. The system may include the following components:

6.7.1.2.1. Roofing membrane (built-up felts or single ply), slate, shingles, or metal roofs

6.7.1.2.2. Flashing and counterflashing

6.7.1.2.2. Insulation

6.7.1.2.2. Vapor barrier

6.7.1.2.2. Fasteners and adhesives

6.7.1.2.2. Sealants and caulking

6.7.1.2.2. Ballast and ballast stops

6.7.1.2.2. Walkway mats and pavers

6.7.1.2.2. Roof hatches, pitch pans and equipment curbs

6.7.1.2.2. Gutters, downspouts, and fascia panels

6.7.1.2.2. Roofing accessories, as required, making a complete roofing system

6.7.1.2.2. Coping

6.7.1.3. Warranted roof system components shall be identified in the Construction Documents.

6.7.1.3.1. Roof materials and accessories shall be part of the approved system.

6.7.2. Roofing manufacturer shall provide a total system warranty against leaks, defective materials, and workmanship, for a minimum period of fifteen (15) years after Substantial Completion.

6.7.3. Warranty shall run concurrently with the roofing installer warranty.

6.7.4. Warranty shall cover labor and materials for the complete roofing system.

- 6.7.5. Manufacturer shall be liable for full replacement cost of the roof system; warranty shall have no-dollar limit.
- 6.7.6. Constructor shall provide the Owner with Roof Warranty.
- 6.7.7. Warranty shall not exclude coverage resulting from winds less than the velocity coordinated with the Owner.

8) OPENINGS

1. Doors and Frames:

1.1. Design Professional shall review condition of existing doors and hardware and shall advise the Owner of necessary or recommended replacements or upgrades.

~~1.2. Only door and frame type and manufactures listed in this section shall be used.~~

~~1.3-1.2.~~ Minimum door size shall be 3-feet 0-inches in width and 7-feet 0-inches in height.

~~1.4-1.3.~~ Door heights shall not exceed 8-feet 0-inches.

~~1.5-1.4.~~ Doors shall have an intermediate rail at the centerline of exit device.

~~1.6-1.5.~~ Glass doors shall have stiles and rails.

~~1.7-1.6.~~ Door frames installed in existing structures shall match the color of existing door frames.

~~1.8-1.7.~~ Restroom door interior shall have waterproof finish.

~~1.9-1.8.~~ Pairs of exterior doors requiring exit devices shall have a Von Duprin keyed removable center mullion.

~~1.10-1.9.~~ All doors and frames to be mortised and prepped for all hardware, including electrical hardware furnished by the hardware supplier or the access control supplier.

1.10. All exterior doors shall have an exterior door handle.

1.11. Materials and installation shall comply with Steel Door Institute standards ANSI/SDI-100 A250.8-2003.

1.12. Doors shall be factory prime painted per current ANSI/SDI A250.10-1998.

~~1.11.~~

1.12-1.13. **For UI-Hospitals and Clinics:**

~~1.12-1-1.13.1.~~ Doors greater than 3-feet 0-inches in width or over 84-inches in height shall have four (4) hinges.

~~1.12-2-1.13.2.~~ All door frames shall be template reinforced for hardware 7-gauge on hinges and 12-gauge everywhere else. ~~Frames shall be grouted full.~~

~~1.12-3-1.13.3.~~ Vision Panels shall be 18-gauge cold rolled steel, mitered, welded corners with countersunk mounting holes.

1.13.3.1. Acceptable manufacturers: Anemostat Door Products BFL 123 or approved equal.

~~1.12-3-1-1.13.4.~~ For sliding doors models approved are: The AD Door system and the Special-Lite SpecSlide sliding doors.

~~1.13-1.14.~~ Doors and hardware shall be installed by the supplier furnishing the doors and frames.

~~1.13-1-1.14.1.~~ Supplier shall have been in business at least five (5) years specializing in sales and installation of Contract Grade doors and hardware.

~~1.13.2.1.14.2.~~ On-site supervising installer shall have at least five (5) years of experience installing doors and hardware.

~~1.13.3.1.14.3.~~ One (1) additional member of the supplier's installation crew shall have at least two (2) years of door and hardware installation experience.

~~1.13.4.1.14.4.~~ Installer to follow Manufacturer instructions for templating and installation.

~~1.14.1.15.~~ Hollow-Metal Frames:

~~1.14.1.1.15.1.~~ All wood and hollow-metal doors shall be installed in hollow-metal frames.

~~1.14.2.1.15.2.~~ All Hollow-metal frames in new construction shall be welded, ground, and finished smooth.

~~1.14.3.1.15.3.~~ Frames shall be reinforced with 12-gauge steel for all surface mounted hardware.

~~1.14.4.1.15.4.~~ Grouted and Exterior door frames shall be A60 galvanized and primed. Frames shall be factory-prime painted per ANSI/SDI A250.10-1998 (R2011).

~~1.14.5.1.15.5.~~ Frames and anchors in interior, wash-down spaces shall be 316, #4 finish stainless steel or A60 galvanized.

~~1.14.6.1.15.6.~~ Frames in masonry walls shall be grouted as the masonry units are laid. Use mortar, maximum 4-inch slump, hand trowel method. This should be flagged as a construction note in drawings.

~~1.15.6.1.~~ Frames set in existing masonry or concrete walls shall be punched and dimpled four (4) times in the height at each jamb and have pipe spacer reinforcing brackets welded into the frame at each punched hole.

~~1.15.6.2.~~ Install polystyrene rigid insulation fillers, cut to profile, to keep grout out of bottom 6-inches of frame.

~~1.15.6.3.~~ Frames shall be braced at bottom and mid-point prior to grouting or installation of wall board.

~~1.14.6.1.1.15.6.4.~~

~~1.14.6.2.~~ Anchor frame to existing wall with Dynabolts, using shims as required, and brace frames with spreader bars at bottom and midpoint of frame.

~~1.14.7.~~ Grouted frames shall be A60 galvanized.

~~1.14.8.~~ Install polystyrene rigid insulation fillers, cut to profile, to keep grout out of bottom 6-inches of frame.

~~1.14.9.~~ Frames shall be braced at bottom and mid-point prior to grouting or installation of wall board.

~~1.14.10.1.15.7.~~ Frames in stud walls shall be filled with fiberglass insulation.

~~1.14.11.~~ Materials and installation shall comply with Steel Door Institute standards ANSI/SDI 100 A250.8-2003.

~~1.14.12-1.15.8.~~ Exterior frames shall be 12-gauge.

~~1.14.13-1.15.9.~~ Interior high-frequency frames shall be 14-gauge.

~~1.14.14-1.15.10.~~ Interior, low-frequency frames shall be 16-gauge.

~~1.14.15-1.15.11.~~ Prior approval from Owner is required to designate low-frequency frames.

~~1.14.16.~~ Shop or field applied prime and/or paint to match color of factory applied prime and/or paint.

~~1.14.17.~~ Minimum door size shall be 3 feet 0 inches in width and 7 feet 0 inches in height.

~~1.14.18.~~ Door heights shall not exceed 8 feet 0 inches.

~~1.14.19.~~ Doors shall have an intermediate rail at the centerline of exit device.

~~**1.14.20. For UIHC:**~~

~~1.14.20.1.~~ Frames shall be 14-gauge on exterior doors and interior doors over 4-foot wide and shall be 16-gauge on all other interior doors (less than 4-foot wide).

~~1.14.20.2.~~ Corner joints shall be mitered, interlocked, welded, and ground smooth.

~~1.14.20.3.~~ Acceptable manufacturers: Ceco, Curries, Steelcraft, or Owner approved equal.

~~1.15-1.16.~~ Hollow-Metal Doors:

~~1.15.1-1.16.1.~~ All doors shall be 1 ¾-inch thick.

~~1.15.2-1.16.2.~~ Hollow-metal doors shall have steel stiffened cores.

~~1.15.2.1-1.16.2.1.~~ Steel ribs shall be 22-gauge, welded at both ends.

~~1.15.3-1.16.3.~~ Exterior doors and doors in high moisture interior spaces shall be A60 galvanized.

~~1.15.4-1.16.4.~~ Doors in interior wash down spaces shall be A60 galvanized or stainless steel.

~~1.15.5-1.16.5.~~ The top edge of exterior doors and doors in interior, high moisture or wash down spaces shall have inverted steel channel closures, installed flush, tack welded in place, filled, and finished smooth.

~~1.15.6-1.16.6.~~ Doors with lite cutouts larger than 100 square inches, including half glass, full glass, and large narrow cut outs, are to have steel channels welded between the door skins, around the entire perimeter of the lite cut out.

~~1.15.7-1.16.7.~~ Exterior door faces shall be 14-gauge steel and meet Level 4/Model 2 standards.

~~1.15.8-1.16.8.~~ Interior door faces shall be 16-gauge steel and meet Level 3/Model 2 standards.

~~1.15.9-1.16.9.~~ Doors shall be reinforced with 14-gauge steel for surface-mounted hardware.

~~1.15.10.1.16.10.~~ All door edge seams shall be continuously welded or have 1-inch welds, every 6-inches on center, ground, and be finished smooth. Door edges shall be fabricated utilizing beveled edges on hinge and lock edges.

~~1.15.11. Materials, storage, and installation shall comply with current Steel Door Institute standards ANSI/SDI 100 A250.8-2003.~~

~~1.15.12. Doors shall be factory prime painted per current ANSI/SDI A250.10-1998.~~

~~1.15.13. Doors shall be Curries 747T or Steelcraft BW.~~

~~1.15.14. Shop or field applied prime and/or paint to match color of factory applied prime and/or paint.~~

~~1.15.15.1.16.11.~~ **For UIHC:**

~~1.15.15.1.~~ All hollow metal doors shall be fire rated at 90 minutes or higher, UL fire rated and shall meet NFPA 80 standard.

~~1.15.15.2.1.16.11.1.~~ Painted hollow metal doors shall be used in cross-corridor, ~~and~~ double-egress situations, ~~and areas where infection control is a concern.~~

~~1.15.15.3.1.16.11.2.~~ Hollow metal door exterior side shall be SDI-100 Grade III, 16-gauge, galvanized faces, seamless edges, R-10, polyurethane core.

~~1.15.15.4.1.16.11.3.~~ Door interior side shall be SDI-100 Grade II, 18-gauge faces, seamless edges with 20-gauge stiffeners, and sound insulation core.

~~1.15.15.5.1.16.11.4.~~ Doors shall be template reinforced for hardware 7-gauge on hinges, 12-gauge everywhere else.

~~1.15.15.6.~~ Acceptable manufacturers: ~~Ceco, Curries, Steelcraft, or Owner approved equal.~~

~~1.16.1.17.~~ Fire Rated Hollow-Metal Access Doors:

~~1.16.1.1.17.1.~~ **For UIHC:**

~~1.16.1.1.1.17.1.1.~~ Frames shall be 16-gauge with 20-gauge galvanized, bonderized steel door panels, UL fire rated, meet NFPA 80 standard and must be self-closing and positive latching.

~~1.16.1.2.1.17.1.2.~~ Frame to be trimless, with flush door.

~~1.16.1.3.1.17.1.3.~~ Acceptable manufacturers: Cesco, JL Industries, Milcor, or Owner approved equal.

~~1.17.1.18.~~ Wood Doors:

~~1.17.1.1.18.1.~~ Exterior wood doors are not allowed.

~~1.17.2.1.18.2.~~ Wood doors shall be 5-ply solid-core and comply with WDMA IS 1A-11 Window and Door Manufacturers Association standards.

~~1.17.3.1.18.3.~~ Performance standard to meet WDMA IS 1A-11, Extra Heavy Duty.

~~1.17.4.1.18.4.~~ Aesthetic grade to meet WDMA IS 1A-11, Custom Grade.

~~1.17.5.1.18.5.~~ Face veneers shall be A-grade, plane sliced, book and running matched.

~~1.17.5.1.1.18.5.1.~~ Allowable veneer species are red oak, select white birch, select white maple and cherry, ~~or match to existing doors.~~

~~1.17.6.1.18.6.~~ Doors shall be factory prefinished, System TR-6, per WDMA IS.1A-11.

~~1.17.6.1.1.18.6.1.~~ Finish shall be factory standard colors.

~~1.17.7.1.18.7.~~ All doors shall be factory pre-machined for all mortise hardware, including face holes and race ways, as required for specified hardware.

~~1.17.8.1.18.8.~~ Crossbands shall be wood-based composites, minimum thickness of 1/16-inch and extend the full width of the door.

~~1.17.9.1.18.9.~~ Crossbands and face veneers shall be laminated to the core with Type 2 interior-use glue using the Hot Press process.

~~1.17.10.1.18.10.~~ Non-Fire-Rated Wood Doors:

~~1.17.10.1.1.18.10.1.~~ Non-fire-rated wood doors shall be Custom Grade and constructed using WDMA 5-ply hot press method for laminating door materials.

~~1.17.10.2.1.18.10.2.~~ Core-type shall be Structural Composite Lumber Core (SCLC-5).

~~1.17.10.3.1.18.10.3.~~ Stiles and rails shall be securely bonded to the core and then abrasively planed prior to veneering.

~~1.17.10.4.1.18.10.4.~~ Stiles shall be hardwood, one (1) piece, laminated or veneered.

~~1.17.10.5.1.18.10.5.~~ Rails shall be solid wood, structural composite lumber meeting the minimum requirements of WDMA, or medium density fiberboard meeting requirements of ANSI 208.2 (Medium Density Fiberboard for Interior Use).

~~1.17.10.6.1.18.10.6.~~ Constructions with laminated edges may use structural composite lumber, as an inner stile component.

~~1.17.11.1.18.11.~~ Fire-Rated Wood Doors:

~~1.17.11.1.1.18.11.1.~~ Fire-rated wood doors shall be WDMA 5-ply construction, using Hot Press method for laminating door materials.

~~1.17.11.2.1.18.11.2.~~ 20-minute and 45-minute rated doors shall be Structural Composite Lumber Core (SCLC-5).

~~1.17.11.3.1.18.11.3.~~ 60-minute to 90-minute rated doors shall be Mineral Core.

~~1.17.11.4.1.18.11.4.~~ Stiles shall consist of manufacturer's standard laminated edge construction with improved screw-holding capability and split resistance.

1.17.11.4.1. Inner and outer stiles shall not contain salt treating.

1.17.11.4.2. Rails shall be solid wood or other material contained in manufacturer's fire door approvals.

~~1.17.11.5.1.18.11.5.~~ For mineral core doors, top rails shall be a minimum 5-inch, bottom rails shall be minimum 5 ½-inch bottom. Minimum lock block size shall be 4 ½-inches by 10-inches.

~~1.17.11.6~~1.18.11.6. Doors with exit devices shall also have hinge-edge blocking and top and bottom latch blocking to match specified exit devices.

~~1.17.11.7~~1.18.11.7. Fire ratings shall comply with positive pressure requirements UL 10C/UBC7-2-97, with concealed intumescent.

1.18.11.8. Acceptable manufacturers: Masonite Architectural, Aspiro Series and VT Industries, Heritage Collection or Owner approved equal.

~~1.17.11.8~~1.18.11.9. Doors in areas with IC and/or high abuse concerns shall be hollow metal.

1.17.121.18.12. For UIHC:

~~1.17.12.1.~~ All doors not required to be rated, or fire rated to less than 90 minutes shall be flush wood door.

~~1.17.12.2~~1.18.12.1. In high cart traffic areas, doors shall have stainless steel kickplates.

~~1.17.12.3~~1.18.12.2. Doors shall be PLAM doors, solid core particle board, premium grade, plain sliced, red oak (or approved finish material), book-matched, 5-ply, AWI 1300.

~~1.17.12.4.~~ Optional use of eiDOORS Vinyl Clad Interior doors by Eggers, VT Industries, Algoma, or approved MFR is permissible and shall be approved by Owner.

~~1.17.12.5~~1.18.12.3. Finished doors shall not contain knots.

~~1.17.12.6~~1.18.12.4. Lead lined doors shall be 7-ply, solid particle core with hardwood cross bands and lead glued to the core.

~~1.17.12.7.~~ Lead lined door size and lead thickness is dependent on the level of radiation protection required.

~~1.17.12.8.~~ Lead lined frames and doors shall be installed according to manufacturer's specifications.

~~1.17.12.9~~1.18.12.5. Doors shall be machined for hardware and fitted to net size.

1.18.12.6. Mineral core doors are not acceptable.

~~1.17.12.10.~~

1.18.1.19. Aluminum and Glass Storefront Doors and Framing:

~~1.18.1.1.19.1.~~ Exterior aluminum storefront door and frame system shall be Kawneer 500T Thermal Broke system as the basis of design.

~~1.18.2.1.19.2.~~ Interior aluminum storefront door and frame system shall use Kawneer 500 Heavy Wall system as the Basis of Design.

~~1.18.3~~1.19.3. Bottom rail shall be minimum 10-inches high, top rail shall be minimum 5-inches high, intermediate rail shall be 5-inches and stiles shall be minimum 5-inches wide.

~~1.18.4~~1.19.4. Interior, aluminum doors and frames shall be 500 Heavy Wall System and have extrusions wall thickness to be 3/16-inch. Exterior aluminum door and frame shall be 500T Insulpour Thermal Broke system and have an extrusion wall thickness of 1/8-inch.

~~1.18.5~~1.19.5. Top and bottom of rails shall be welded to stiles. All welds shall be concealed.

~~1.18.6~~1.19.6. Exterior doors shall have a sealed, flush top cap, and weather-stripping.

~~1.18.7~~1.19.7. Exterior doors, including aluminum storefront framing, shall have thermal break construction.

~~1.18.8~~1.19.8. Perimeter weatherstrip to be furnished and installed in jamb and head by aluminum storefront manufacturer.

~~1.18.9~~1.19.9. Thresholds and sweeps shall be furnished by Door hardware supplier and installed by aluminum storefront contractor.

~~1.18.10~~1.19.10. ~~Exterior aluminum storefront framing shall have thermal break construction.~~

~~1.18.11~~1.19.11. Storefronts shall comply with American Architectural Metal Association (AAMA) standards.

~~1.18.12~~1.19.12. **For UIHC:**

~~1.18.12.1~~1.19.12.1. ICU Manual Sliding Doors shall not have a floor track.

~~1.19.1~~1.20. Rolling Fire Doors and Fire Shutters:

~~1.19.1.1~~1.20.1. Rolling fire doors and fire shutters activated by fusible link, local smoke/fire detector or central smoke/fire alarm system.

~~1.19.2~~1.20.2. Rolling fire doors shall only be permitted to avoid atriums.

~~1.19.3~~1.20.3. Doors shall automatically release only when activated by an alarm signal.

~~1.19.4~~1.20.4. Doors shall maintain an average closing speed not to exceed 9-inches (229 mm) per second during closing.

~~1.19.5~~1.20.5. Manual push buttons shall be inoperable when automatic closure is activated.

~~1.19.6~~1.20.6. Doors shall be connected to emergency power.

~~1.19.7~~1.20.7. Doors shall have motor operated reset.

~~1.19.8~~1.20.8. **For UIHC:**

~~1.19.8.1.1.20.8.1.~~ Rolling fire doors shall be 22-gauge stainless steel or galvanized steel, interlocking slats, prime painted with automatic closing activated by smoke detection system, UL fire rated and must meet NFPA 80 and local fire codes.

~~1.19.8.2.1.20.8.2.~~ Acceptable manufacturers: Cookson FD-5 or Owner approved equal. Tube motors are preferred.

~~1.20.1.21.~~ Fire Rated Folding Partitions:

~~1.20.1.1.21.1.~~ Fire Rated Folding Partition shall be a horizontal Sliding partition, 1-hour fire rated, STC 50. Won Door Fireguard Model 20.

~~1.20.1.1.1.21.1.1.~~ Closing systems shall be automatic composed of a microprocessor control box, key switch module, motor drive unit and leading-edge obstruction detector.

~~1.20.1.1.1.1.21.1.1.1.~~ The microprocessor control box and key switch module shall be accessible whether the door is open or closed.

~~1.21.1.22.~~ Operable Partitions:

~~1.21.1.1.22.1.~~ Operable Partitions shall be manual or electric, accordion, STC 39, Modernfold Soundmaster 8 or Skyfold (Preferred).

2. Hardware:

[2.1. Door hardware for UIHC is included in 2.21 below.](#)

~~2.1.2.2.~~ General:

2.1.1. The Design Professional shall use Openings Studio™ software tools and processes to produce Door Hardware specifications to support project reviews and quality assurance during all phases of design, construction, and facility management. Door and hardware schedules, and associated Building Information Modeling product data and parameters shall be integrated and updated with Openings Studio™. Design Professionals shall contact UI Security Engineering Services to obtain access to Openings Studio™. Note that this does *not* apply to UIHC projects.

2.1.2. Refer to *LOCKSET TYPES BY BUILDING DETAILS* in Appendices

2.1.3. All door hardware shall be heavy-duty, institutional grade.

2.1.4. University Classrooms shall have electronic access control.

2.1.4.1. If Electronic access control is not possible, Classrooms shall have entry function locks, with thumb turns on the inside face of the door, non-fire rated exit devices with thumb turn cylinder dogging, or fire rated exit devices with thumb turn on inside of door for locking lever trim, to allow locking of door without having to open it.

2.1.4.2. Doors shall be self-closing.

2.1.5. Office Suite Perimeter doors shall have entry function locks, with thumb turns on the inside face of the door to allow locking of door without having to open it. Doors shall be self-closing.

- 2.1.6. Office doors shall have entry function locks with thumb turns on the inside face of the door for locking, without having to open the door.
- 2.1.7. ITS telecommunication rooms shall have electronic locks, door closers, and access control.
- 2.1.8. Hardware specifications shall be provided by a Door & Hardware Institute Certified Architectural Hardware Consultant that is not an employee of the door and hardware supplier for the project.
- 2.1.9. All hardware specifications shall be reviewed with University Key and Access Services and/or UIHC Engineering Services.
- 2.1.10. Electrified hardware integrating with the Owner's AMAG access control system shall be 24-volt. Refer to the Electronic Access Control and Security (AMAG) section for more information.
- 2.1.11. Exit only doors shall have hardware on the egress side only.
- 2.1.12. Panic devices on doors with access controls shall utilize electronic trim.
- 2.1.13. Doors with power operators shall have electronic latch retraction and electrified trim.
- 2.1.14. Exterior trim shall be fail-secure.
- 2.1.15. Electronic strikes shall not be used.
- 2.1.16. Hardware finish shall be either US32D (BHMA 630) or US26D (BHMA 626 or 652).
- 2.1.17. Doors and hardware shall be installed by the supplier furnishing the doors and frames.

~~2.1.17.1~~2.2.17.1. Supplier shall have been in business at least five (5) years specializing in sales and installation of Contract Grade doors and hardware.

~~2.1.17.2~~2.2.17.2. On-site supervising installer shall have at least five (5) years of experience installing doors and hardware.

~~2.1.17.3~~2.2.17.3. One (1) additional member of the supplier's installation crew shall have at least two (2) years of door and hardware installation experience.

~~2.1.17.4~~2.2.17.4. Installer to follow Manufacturer instructions for templating and installation.

~~2.1.17.5~~2.2.17.5. Installer, supplier, Constructor, Design Professional and Owner shall convene for a pre-installation meeting prior to installation of doors and hardware.

~~2.2.2.3.~~ 2.2.2.3. Submittals and Shop Drawings:

- 2.2.1. Hardware schedule submittals shall be in vertical format.
- 2.2.2. All openings with electrified hardware shall include a function narrative.
- 2.2.3. As-Installed final door hardware schedule shall be submitted with O&M Manual in electronic PDF format.

2.2.4. Design Professional shall add specification requirement for door hardware supplier to provide .txt file of final door hardware schedule with O&Ms to be provided to the Owner.

~~2.3.2.4.~~ Hinges:

2.3.1. Hinges shall be of full mortise-type with concealed bearings. Exterior hinges shall be stainless steel.

2.3.2. Use non-removable pins on all out-swing doors which are to be secure.

2.3.3. Manufacturers shall be Stanley or McKinney.

~~2.3.4. All hinges shall be concealed ball bearing.~~

~~2.3.5.~~2.3.4. Exterior door hinges shall be heavy-weight, 5-inches x 4 ½-inches x 0.190-inches.

~~2.3.6.~~2.3.5. Interior door hinges shall be 4 ½-inches x 4 ½-inches.

~~2.3.7.~~2.3.6. Medium and high frequency interior doors shall be heavy weight, .180 metal thickness.

~~2.3.8.~~2.3.7. Low frequency doors to have standard weight, .134 metal thickness.

~~2.3.9.~~2.3.8. All exterior doors, all interior corridor doors, and all mineral core fire doors that are 6-foot 8-inches tall or taller shall be hung with four (4) hinges.

~~2.3.10.~~2.3.9. All doors 3-foot 6-inches wide or wider shall be hung with four (4) hinges.

~~2.3.11.~~2.3.10. Hinges in stainless steel frames shall be stainless steel.

~~2.3.12.~~2.3.11. All exterior door hinges shall be stainless steel.

~~2.3.13.~~2.3.12. All hinges in moist and corrosive environment areas to be stainless steel.

~~2.3.14.~~2.3.13. All exit only or lockable out-swinging doors shall have non-removable pins.

~~2.3.15. For UIHC:~~

~~2.3.15.1. Doors greater than 3 feet 0 inches in width or over 84 inches in height shall have four (4) hinges.~~

~~2.4.2.5.~~ Door Closers:

2.4.1. Floor and concealed top jamb-mounted closers are not acceptable.

2.4.2. Cushion stops shall not be used.

2.4.3. Door closers shall be installed on all custodial, maintenance, and telecommunication rooms.

2.4.4. Door closers shall be LCN 4040XP.

- 2.4.5. Classrooms or auditoriums with occupancy of fifty (50) or more shall require LCN 4410HSA, electric, motion sensor hold open closers.
- 2.4.6. Closer covers shall be plastic.
- 2.4.7. Protection Plates shall be used on all doors with door closers.
- 2.4.8. All labeled doors with LCN 4410HSA closers shall be connected to the building fire alarm system.
- 2.4.9. Closers in moist and corrosive environment areas to have SRI primer.
- 2.4.10. Interior non-fire rated doors and gates with closers shall meet the following standards:
 - 2.4.10.1. Latch shall release with no more than 15 pounds of force on the door handle or exit devices.
 - 2.4.10.2. Closing speed from 90-degrees to 12-degrees shall be a minimum of 5 seconds.
 - 2.4.10.3. Closing speed for delayed action closers shall be not more than 10 seconds, unless required otherwise.
 - 2.4.10.4. Opening force after door has had the latch released and is started in motion is to be 5 pounds as tested with ADA Accessibility Force spring gauge placed immediately above latching hardware and 2 ½-inch for latch edge of door.
 - 2.4.10.5. Back check shall be adjusted so door does not slam into any obstructions and starts to check opening of door 15-degrees before door is to stop.
- 2.4.11. Exterior door and fire-rated doors are required to positively latch and shall be adjusted as near to 5 pounds of opening force as possible.
- 2.4.12. Closing device types include:
 - 2.4.12.1. Standard Closer
 - 2.4.12.2. Automatic Operator
 - 2.4.12.3. Electric Motion Sensor Hold Open Closer
 - 2.4.12.4. Spring Hinges shall only be used with Owner's approval.
- 2.4.13. Installation:
 - 2.4.13.1. Door Hardware Installer shall prepare a schedule, including all doors with closing devices, and record the associated test results for each.
 - 2.4.13.1.1. Schedule shall include the following information:
 - 2.4.13.1.1.1. Door Number
 - 2.4.13.1.1.2. Door Location

- 2.4.13.1.1.3. Door Width
- 2.4.13.1.1.4. Closing Device Type
- 2.4.13.1.1.5. Opening Force
- 2.4.13.1.1.6. Closing Time
- 2.4.13.1.1.7. Latch Release Force
- 2.4.13.1.1.8. Notes (as applicable)

2.4.13.1.2. Door Hardware Installer shall document adjustments for each door on the Door Schedule.

2.4.13.1.3. Prior to submission of Final Door Schedule by Door Hardware Installer, Owner's Representative shall witness Door Hardware Installer testing of up to ten percent (10 %) of installed doors with closing devices.

2.4.13.1.3.1. Doors shall be randomly selected by Owner's Representative

2.4.13.1.3.2. If doors do not comply with the previously recorded test results, additional doors shall be tested.

2.4.13.1.3.3. Owner's Representative shall witness Door Hardware Installer retesting of failed doors after required adjustments are completed.

2.4.13.1.4. Final Door Schedule shall be submitted as a closeout item after all deficiencies have been corrected.

2.4.13.2. All door closers shall be through-bolted to door.

2.4.13.3. Closer shall be mounted on side of door for least visibility, unless required for maximum door swing or to protect closer from the environment, moisture, or carts.

2.4.13.4. All closers shall be field adjusted to comply with all applicable codes and standards.

2.4.13.4.1. Adjust spring power, closing (main) speed, latch speed, back check, and delayed action adjustment, if included, to comply with Department of Justice ADA Standards for Accessible Design and applicable building codes.

2.4.13.5. For projects that require mechanical system adjustments after hardware installation, closers shall be retested and readjusted to ensure compliance following testing and balancing procedures.

2.4.13.6. Supplier shall furnish all drop plates and mounting brackets as required for proper installation.

~~2.4.14. For UHC:~~

~~2.4.14.1. 4 inch Hospital Stops shall be used on inpatient, treatment, procedure, and any other area where integral cove bases are required.~~

~~2.4.15.2.4.14.~~ For UI Housing:

~~2.4.15.1.2.4.14.1.~~ Doors with access control devices shall all have door closers.

2.4.15.2.~~2.4.14.2.~~ Delayed action door closers shall be installed on all UI Housing custodial, maintenance, supply, equipment, trash, storage, and telecommunications rooms.

~~2.4.16.2.4.15.~~ Delayed action door closers may be used in animal care facilities.

2.5. Power Operators:

- 2.5.1. Power operators shall be hard-wired, push plate operated only. Radio frequency types shall not be used.
- 2.5.2. Push-and-go function shall not be activated.
- 2.5.3. Power operators shall be Electrohydraulic Norton model #6061, with arm shoe through-bolted.
- 2.5.4. Actuators shall be Wikk Industries, Inc. Ingress'r I36-3, 36-inches in height, 304 Stainless Steel 630 finish, hardwired.
- 2.5.5. Actuator shall be installed with bottom of actuator 6-inches above finished floor.
- 2.5.6. Actuator to be located a minimum of 36 inches from the leading edge of the door, in the open position.
- 2.5.7. Automatic operators on exterior doors and their corresponding vestibule door shall be wired for sequential operation.
- 2.5.8. All on/off and hold-open switches shall be concealed.
- 2.5.9. All door operator arms shall be through bolted to door.
- 2.5.10. Adjust all operators at installation. After all mechanical systems are operating, field readjust as required. For manual operation, power operators shall comply with requirements listed in article 4.2.15 Door Closers.

2.5.11. Supplier shall furnish all drop plates and mounting brackets as required for proper installation.

2.5.12. Power operator required at University Classroom entrances.

~~2.5.11.~~

~~2.5.12.~~2.5.13. For UI Housing:

~~2.5.12.1.~~2.5.13.1. Power operated doors shall be integrated with the building's security system (AMAG).

2.5.13.2. Install occupancy indicators (occupied/vacant flag) as part of door lockset at the following locations: residence hall bathrooms, unisex restrooms, and lactation restrooms.

~~2.5.12.2.~~

2.6. Locksets and Latchsets:

- 2.6.1. Locksets and latchsets shall be mortise type.
- 2.6.2. Approved manufacturers for new buildings are Yale 8800 CRCN, Sargent 8200 LW1J, or Schlage L series 03N.

- 2.6.3. Refer to *LOCKSET TYPES BY BUILDING DETAILS* in Appendices for manufacturer and models to match existing buildings.
- 2.6.4. Electronic locksets shall have request to exit and latch bolt monitoring switches.
- 2.6.5. Electromagnetic locks are not allowed except in **UIHC** facilities.
- 2.7. Cylinders and Keying:
 - 2.7.1. Construction keying and cylinders shall be provided and installed by the Constructor and two (2) construction and control keys shall be provided to Key & Access Services.
 - 2.7.2. Key system for new buildings shall be Small Format Interchangeable Core.
 - 2.7.3. Key systems for existing buildings shall be verified with Owner.
 - 2.7.4. Lock cylinders used in ITS telecommunication rooms, Facilities Management electrical, mechanical, elevator, and custodial spaces, and doors receiving access control hardware shall accept Schlage small format interchangeable core.
 - 2.7.5. Electronic mortise locks and panic devices shall have a keyed cylinder and be fail-secure on all exterior doors.
 - 2.7.6. Hardware supplier to furnish cylinders and cores, as required, for key switches and specialty doors where remainder of hardware is furnished by specialty door manufacturer.
 - 2.7.7. Furnish and installation of all permanent cores and cylinders shall be by Owner.
 - 2.7.8. Completion of keying schedule, procurement of key blanks, and cutting of all final keys shall be by Owner.
 - 2.7.9. For UIHC:
~~2.7.8.~~2.7.9.1. Construction keying and cylinders shall be provided and installed by UIHC.
- 2.8. Exit Devices:
 - 2.8.1. Exit devices shall be Von Duprin 98 series.
 - 2.8.2. Von Duprin 94 Series Impact device shall be used on door that is fire-rated, cross-corridor, non-locking and held open at all times.
 - 2.8.3. In multiple-door entries, only one (1) doorway shall be keyed from the exterior.
 - 2.8.4. Non-rated exit devices that have unlockable lever handle trim shall be furnished less dogging (LD).
 - 2.8.5. On interior pairs of doors, surface mounted, vertical rod, top rod only exit devices may be used with Owner approval. Device shall be through-bolted.
 - 2.8.6. Electronic Non-Rated Exit Devices:

2.8.6.1. Non-rated exit devices, with electronic latch retraction or electronic unlocking trim, shall be furnished less dogging (LD)

2.8.6.2. Entrance doors requiring a power operator, exit device, and access control shall use Von Duprin LX-RX-LC-LD-QEL x XP98L-E996L-03 (FSE) exit device.

2.9. Pulls and Push Plates:

2.9.1. Pulls shall be straight with no offset, 1 ¼-inch diameter, 2 ½-inch clearance between back of pull and face of door, fastened with 3/8-inch diameter through bolts.

2.9.2. Rockwood RM301 shall be Basis of Design.

2.9.3. Provide pull backup plates at all push/pull doors, except stainless steel or aluminum.

2.9.4. Backup plate shall be minimum 4-inches by minimum 16-inches, 0.050 stainless steel.

2.9.5. Push plates shall be minimum 6-inches by minimum 24-inches, 0.050 stainless steel.

2.10. Flushbolts:

2.10.1. Flushbolts shall be Ives FB51T, constant latching, top bolt only.

2.10.2. Where required by code, provide Ives FB31T or FB32 automatic on metal doors or Rockwood 1960 on wood doors, less fire bolt on non-rated wood doors.

2.11. Coordinators:

2.11.1. Coordinators shall be Trimco 3092 or Rockwood 1700.

2.12. Protection Plates:

2.12.1. Bottom of protection plates shall be mounted ¼-inch from the bottom of the door.

2.12.2. Protection plate height shall be minimum 10-inches high by door width, less 1 ½-inch, centered horizontally on door, 0.050 stainless steel.

2.12.3. Custodial spaces and other rooms with cart traffic to have armor plates, minimum 34-inch high by door width, less 1 ½-inch, centered horizontally on door, 0.050 stainless steel.

2.12.4. Protection plates shall be fastened with countersunk, oval head, under cut screws.

2.12.5. All four (4) edges shall be beveled.

2.12.6. Where subject to cart damage, Provide Rockwood R115LPB protection bars for lever handles and Rockwood HD2230 protection bars for exit devices.

~~2.12.7. For UIHC:~~

~~2.12.7.1-2.12.6.1. Kickplates shall be screwed on, stainless steel, US 32D.~~

2.13. Door Stops and Holders:

2.13.1. Wall bumpers shall be Rockwood 400 or Ives WS402CVX, cast brass or bronze housing.

2.13.2. All wall bumpers in stud walls shall have backing.

2.13.3. Overhead doorstops shall only be used with prior approval from Owner.

2.13.4. Overhead doorstops shall be Glynn-Johnson 90 series, manual.

2.13.5. Overhead stops/holders shall be surface-mounted.

2.13.6. All exterior doors that have overhead stops shall also have floor stops.

2.13.7. Floor stops shall be Trimco 1214.

2.13.8. Floor stops shall not be used on interior doors.

~~2.13.8.~~

2.14. Weather-Strip:

2.14.1. Weather-strip shall be Reese 769C with TEK screws and polyurethane rubber.

2.14.2. Install a screw maximum 1-inch from ends of weather strip.

2.14.3. Weather strip piece at hinge jamb shall be installed on face of door to compress against stop.

2.15. Sweeps:

2.15.1. Typical sweeps shall be Reese 772C with TEK screws and polyurethane rubber.

2.15.2. Automatic door bottom shall be Zero 367, 368, or 369 with magnet to assist in spring-action.
Color shall be clear aluminum or dark bronze to match frame.

2.16. Gasketing:

2.16.1. Gasketing shall be Reese 797, white or black to match color of frame.

2.16.2. Acoustical gasketing shall be Pemko 350 SPK.

2.16.3. Color shall be clear aluminum or dark bronze to match frame.

2.17. Thresholds:

2.17.1. Unless prohibited by sill condition, thresholds shall be Reese S471A with thermal break.

2.17.2. Furnish threshold 4-inches longer than door opening and cope around frame face.

2.18. Power Transfers:

2.18.1. Power transfers shall be Securitron CEPT-10.

2.18.2. Electric hinges may only be used with existing frames or 1-inch face jambs.

2.18.3. Power transfers and electric hinges shall have two (2) 18-gauge wires and six (6) or eight (8) 22- or 28-gauge wires.

2.19. Electronic Hold Opens:

2.19.1. Magnetic hold opens shall be LCN 7800 series, 24-volt, wall-mounted.

2.19.2. Housings shall be metal.

2.19.3. Floor mounted magnetic closure shall only be used with prior approval from Owner.

2.19.4. Electronic hold open/closures shall be LCN 4040SE 24 volt, Sentronic.

~~2.19.5.~~ Electronic hold open/closures shall only be used when magnetic hold opens are not feasible.

2.20. Power Supplies:

2.20.1. Motor driven (QEL) electronic latch retraction feature of exit devices to be powered by integral, on-board power suppl, furnished with Norton 6061 automatic operator, and shall be furnished and installed by the door hardware supplier.

2.20.2. Power supplies for electric trim, electric locks, and electric strikes shall be provided by the Access Control Constructor.

2.21. For UIHC Hardware:

2.21.1. Refer to UIHC DOOR ACCESS CONTROL HARDWARE AND ROUGH-IN DRAWINGS BY SECURITY LEVEL in appendices.

2.21.2. Finish: United States Standard US 26D satin chrome for interior doors, stainless steel for exterior doors.

2.21.3. Hinges: Full mortised, square cornered, 5-knuckled, ball bearing, template, polished and plated- Hager, Mckinney, Stanley.

2.21.4. Pivots: Heavy Duty Rixon.

2.21.5. Swing Clear Hinges: McKinney.

2.21.6. Locks, latches, and deadbolts: Sargent 8200 mortise, LW1-L, L escutcheon, L lever, curved lip strike, 7 pin cylinder SFIC.

2.21.7. All doors shall be positive latching.

2.21.8. Hold Opens must have disconnecting means at door to replace door holders. Locksmith needs to be able to replace hold opens without an outage to other areas/doors.

~~2.21.7.~~2.21.9. Bathroom shall have status indicator

2.21.10. Roller latches are prohibited.

~~2.21.8.~~

~~2.21.9-2.21.11.~~ Strikes shall be stainless steel, dustproof, with curved lip.

~~2.21.10-2.21.12.~~ Edge guard: marker EG308 with “adjust-a-screw” for high-traffic patient transportation areas.

~~2.21.11-2.21.13.~~ Stainless steel piano hinges: Assa Abloy marker HG325 with “adjust-a-screw” For high-traffic patient transportation areas.

~~2.21.12-2.21.14.~~ Panic Devices: Von Duprin. All panic devices used on fire rated openings shall be UL fire rated.

~~2.21.13-2.21.15.~~ Single Doors: Von Duprin series 99L 9975 Mortise x 996 trim with standard O6 lever or 9475.

~~2.21.14-2.21.16.~~ Double Doors: Both leaves 9447 (Impact) concealed vertical rod only.

~~2.21.15-2.21.17.~~ High Traffic Public areas, such as main public corridors, shall be metal doors only: Von Duprin 94 series.

~~2.21.16-2.21.18.~~ Coordinator and Carry Bar for double doors: Trimco 3092 series; use open back strike when possible. Can eliminate by using concealed vertical rod.

~~2.21.17-2.21.19.~~ Door Closers: LCN Super Smoothee Series 4041XP, Aluminum.

~~2.21.18-2.21.20.~~ Magnetic locks: Locknetics Mag Lock 490P

~~2.21.19-2.21.21.~~ Life Safety Closures:

~~2.21.19.1-2.21.21.1.~~ Doors with swings less than 105 – LCN Sentronic Series 4040 SE, 120-volt, Aluminum or LCN Super Smoothee series 4041XP aluminum with wall mounted magnetic door hold open LCN 7800 series 120V. Wall mounted magnet is preferred.

~~2.21.19.2-2.21.21.2.~~ Doors with swings greater than 105 – LCN Sentronic Series 4410 ME push-side, 4310 ME on pull-side, 120-volt, Aluminum. Wall mounted magnet is preferred.

~~2.21.21.3.~~ Handicapped, barrier-free door controls – Horton 4100 Series.

~~2.21.19.3-2.21.21.4.~~ High traffic areas with door operators ~~need~~ shall be BEA Industries [LZR or flat scans](#).

~~2.21.20-2.21.22.~~ Keying: Final shall be Medeco X4, which is owner supplied.

~~2.21.21-2.21.23.~~ Magnetic Holders: LCN 7800 Series 120-volt flush mount. Reinforced backing is required behind Holder.

~~2.21.22-2.21.24.~~ In high traffic areas door edge guards shall be used.

~~2.21.23-2.21.25.~~ Overhead Stops:

~~2.21.23.1-2.21.25.1.~~ Surface mounted only: Glynn Johnson 90 series.

~~2.21.23.2-2.21.25.2.~~ Concealed stops shall not be used.

- ~~2.21.24-2.21.26.~~ Automatic Flush Bolt: Glynn Johnson. Prefer constant latch (self-latching).
- ~~2.21.25-2.21.27.~~ Automatic Door Bottoms: Zero 360, Reese 521.
- ~~2.21.26-2.21.28.~~ Smoke Seal Assemblies: Reese 797B, National Guard.
- ~~2.21.27-2.21.29.~~ Wall Bumper: Ives 401, 402, 403. Reinforced backing is required behind Bumper.
- ~~2.21.28-2.21.30.~~ Thresholds: Zero 564B.
- ~~2.21.29-2.21.31.~~ Astragals: Zero 183 DUR. Astragals shall be avoided, if possible.
- ~~2.21.30-2.21.32.~~ Door Silencers and Doorstop: Ives.
- ~~2.21.31-2.21.33.~~ Extension Flush Bolt: Ives 358.
- ~~2.21.32-2.21.34.~~ Self-latching Flush Bolts: Ives 356, 357.
- ~~2.21.33-2.21.35.~~ Electric Strikes: HES 1006 with Smart Pak and typically KM faceplate option. Confirm faceplate option. HES 9500 surface with Smart Pak.
- ~~2.21.34-2.21.36.~~ Power Supply for electric strike: Locknetics 505 or 510 – strikes; Von Duprin PS 914 – for EL99 or CX99.
- ~~2.21.35-2.21.37.~~ Power transfer: McKinney EL-EPT-SC.
- ~~2.21.36-2.21.38.~~ Electric Lockset: Sargent Mortise Lockset 8271 – Trim and Finish to match typical hardware (24VDC with RX switch).
- ~~2.21.37-2.21.39.~~ Electric Interlock for failsafe operation: Kam-Lock 3020.
- ~~2.21.38-2.21.40.~~ Combination Locks: Kaba E5000 series.
- ~~2.21.39-2.21.41.~~ Push/Pull Hospital Latch for Patient Rooms: Sargent 7800 series.
- ~~2.21.40-2.21.42.~~ Card reader Locksets for patient guest rooms (such as Rossi Guest House): ILCO series 700 (Hotel-Motel).
- ~~2.21.41-2.21.43.~~ On-call room doors: Sargent 82281 Lock Body with LW1L trim reader by access control.
- ~~2.21.42-2.21.44.~~ Access Control Hardware:
- ~~2.21.42.1-2.21.44.1.~~ Single Door: Von Duprin, delayed egress Chexit Controlled exit device, CX9975.
- ~~2.21.42.2-2.21.44.2.~~ Double Doors: Leaf #1 – Von Duprin, delayed egress Chexit Controlled exit device, CX9975; Leaf #2 – Von Duprin CX9947 concealed vertical rod.
- ~~2.21.42.3-2.21.44.3.~~ HES 1006 Series heavy duty electric strike and Smart Pak with appropriate faceplate option Power supply provided by Access Control Provider.
- ~~2.21.42.4-2.21.44.4.~~ Von Duprin, DC 2004 Desk Console (if required).

~~2.21.42.5-2.21.44.5.~~ CCTV Camera, Bosche or Sanyo 24 v, color camera (IP DOE style).

~~2.21.42.6-2.21.44.6.~~ Door position switch, magnet top jamb type: George Risk Industries (GRI) models 8080-TWG-B, 7623-TWG-G or 200-26, depending on application.

~~2.21.42.7-2.21.44.7.~~ Power transfer-McKinney EL-EPT-SC.

~~2.21.44.8.~~ Von Duprin power supply PS-914.

~~2.21.45.~~ Kickplates shall be screwed on, stainless steel, US 32D.

~~2.21.46.~~ 4-inch Hospital Stops shall be used on inpatient, treatment, procedure, and any other area where integral cove bases are required.

~~2.21.47.~~ Doors greater than 3 feet 0 inches in width or over 84 inches in height shall have four (4) hinges.

~~2.21.42.8-2.21.48.~~

3. Windows:

1.1. Replacement windows shall be aluminum. In restoration projects, wood windows may be allowed as approved by the Owner.

1.1.1. Aluminum windows shall have thermal break construction and shall comply with American Architectural Metal Association (AAMA) standards.

1.2. Framing shall be thermally broken from any interior construction.

1.3. No unwarrantable glazing units.

1.4. Windows installed in climate-controlled buildings shall be non-operable to maintain a specific air balance and provide security.

1.5. Operable windows shall be capable of being cleaned from the interior of the building and be supplied with a positive locking device. Screens shall not be supplied with the windows.

1.6. Window frames installed in existing structures shall match the color of existing window frames.

1.7. Window systems requiring replaceable desiccant cartridges shall not be used.

1.8. All operating mechanisms shall be heavy-duty and institutional grade.

1.9. Window units shall comply with ASTM E283, E331, and E547.

~~1.10. Owner shall retain a Testing Firm to perform tests on randomly chosen installed window units. Constructor shall be responsible for retesting units that fail.~~

~~1.11.1.10.~~ For UIHC:

~~1.11.1.1.10.1.~~ Interior windows shall be aluminum and shall match existing.

~~1.11.2.1.10.2.~~ No exterior windows shall use integral blinds.

~~1.11.3.1.10.3.~~ Pivot-type windows shall not be used.

~~1.11.4.1.10.4.~~ Interior window acceptable manufacturers: Wausau, EFCO, Moduline or Owner approved equal.

~~1.11.5.1.10.5.~~ Interior window integral blinds shall be UniceL or Owner approved equal.

~~1.12.1.11.~~ Exterior aluminum windows:

~~1.12.1.1.11.1.~~ Extruded aluminum shall be prime billet 6063 alloy T5 temper.

~~1.12.2.1.11.2.~~ Anodic finish shall be Architectural Class I, electrolytically deposited minimum thickness 0.7 mil.

~~1.12.3.1.11.3.~~ Color shall match existing.

~~1.12.4.1.11.4.~~ Windows, thermal barrier, and related materials shall carry a minimum of a ten (10) year manufacturer's warranty.

~~1.12.5.1.11.5.~~ Thermal break shall be Insulbar, nylon impregnated fiberglass. Polyurethane thermal breaks are prohibited.

~~1.12.6.1.11.6.~~ Acceptable manufacturers: Wausau4250iV Insulbar, EFCO, Visuline Series, or Owner approved equal.

~~1.13.1.12.~~ Testing

~~1.13.1.1.12.1.~~ All new exterior aluminum windows shall pass the following field tests:

~~1.13.1.1.1.12.1.1.~~ ASTM E 783-02, Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

~~1.13.1.2.1.12.1.2.~~ ASTM E 1105-00, Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform of Cyclic Static Air Pressure Difference.

~~1.13.1.3.1.12.1.3.~~ AAMA 501.2-03, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing.

~~1.14.1.13.~~ For UI Housing:

~~1.14.1.1.13.1.~~ Sleeping rooms and apartments which are to have operable windows with the widest opening of 4-inches and shall include screens.

~~1.14.2.1.13.2.~~ Latching for these operable windows shall be operable without going through the screen.

4. Glass and Glazing:

2.1. All new construction and major renovations shall use low-E glazing.

2.2. Glazing on window replacement projects shall be evaluated on a life-cycle cost basis to determine viability of the low-E glazing. Evaluation shall include minimum glass performance values.

2.3. Exterior glass systems shall be a minimum of insulated, double-pane glass with aluminum thermal break frame construction.

2.3.1. Polyamide thermal break is preferred over polyurethane poured and debridged type thermal breaks.

2.3.2. Steel framing shall not be exposed to the exterior except where required by code.

2.4. Maintenance and replacement of broken glazing shall be considered during Design.

2.4.1. Replacement from the interior of the building is preferred.

2.4.2. Other replacement methods require Owner approval.

2.5. Exterior windows and exterior glazed doors shall have ¼-inch double glazing, certified by the Insulating Glass Certification Council (IGCC).

2.6. Glazing in new windows, doors, storefronts, etc. shall carry a ten (10) year manufacturer's warranty.

2.7. For UIHC:

~~2.7.1. Glazing shall be clear tempered ¼ inch thick float glass.~~

~~2.7.1. Exterior Glass: ¼" Solarbronze Heat Strengthened R100#2. window glazing shall be bronze tint tempered ¼ inch thick float glass.~~

2.7.2. Insulating glass units shall match adjacent glass. Note: Some projects have used ¼ Silver 20 HS (Surface #2), 12.7 TFBK, and ¼ SN 68 HT HS (surface #3)

~~2.21.43. Insulating glass shall match adjacent glass. Note, some projects have used ¼ Silver 20 HS (Surface #2), 12.7 TFBK, and ¼ SN 68 HT HS (surface #3).~~

2.7.3. Spaces: ½" Argon, Black Spacer, 5/8 inch clear laminated heat strengthened float glass.

2.7.4. Interior Glass Ply: ¼" Clear Heat Strengthened float glass. Acceptable manufacturers: Guardian (SNR Silver) and Vitro Solarband R100

2.7.4.2.7.5. Silicone color: shall be Black

2.7.5.2.7.6. Wireglass shall only be used with an approved deviation request. Acceptable wireglass manufacturers: Central Glass, Ashai Glass, HJ Martin & Son.

2.7.6.2.7.7. Acceptable fire rated glass: TGP "Firelite."

2.7.7.2.7.8. If windows need to be opaque, a dark film shall be installed on the interior.

5. Joint Sealants:

3.1. Exterior sealants require the use of a sealant primer.

3.2. Neutral Cure Silicone or Polyether sealant shall be used in the following:

3.2.1. Exterior and interior joints in horizontal concrete surfaces.

3.2.2. Between metal and concrete, mortar, stone, or masonry.

3.3. One-Part mildew-resistant silicone shall be used at interior joints in vertical surfaces of toilet room, shower, and kitchen ceramic tile.

3.4. Acrylic-emulsion sealant shall be used at interior joints in field-painted vertical and overhead surfaces of elevator door frames and hollow metal door frames, gypsum drywall, plaster, concrete or concrete masonry, and other interior joints not subject to movement.

9) FINISHES

1. Wall Systems:

- 1.1. The USG gypsum board construction manual guidelines shall be followed.
- 1.2. Use 5/8 -inch, Type X fire code drywall construction.
- 1.3. Mold resistant drywall shall be used in intermittently wet areas (restrooms, washrooms, custodial spaces, etc.)
- 1.4. 20-gauge (0.0329 inch) minimum studs shall be used. Specify both gauge and thickness. Wood studs shall not be used.
- 1.5. Control joints shall be installed every 30 feet and at both corners of door frames.
- 1.6. ~~Four (4) coats~~ (Level IV) finish of drywall finishing material, ~~one (1) embed, two (2) fill, and one (1) finish,~~ shall be used in exposed applications. Finish coat and sanding may be omitted in concealed applications.
- 1.7. Demountable panel systems require Owner approval.

2. Wall Finishes:

- ~~2.1. Finish selection shall be based on ease of cleaning and serviceability except where the value of aesthetics and guest impressions supersede the value of ease of cleaning and serviceability.~~
- ~~2.2.2.1.~~ 2.2.1. Wet or wash down areas (cage and cart wash areas, kitchens, etc.) shall use concrete masonry units with an FM Global approved plastic interior finish. Wall protection in lieu of CMUs.
- ~~2.3.2.2.~~ 2.3.2.2. Public stairways and corridors shall have durable wall finishes.
- ~~2.4.2.3.~~ 2.4.2.3. Mechanical rooms shall have masonry or concrete walls.
- ~~2.5.2.4.~~ 2.5.2.4. Wallpaper is not allowed except if approved in writing by owner.
- ~~2.6.2.5.~~ 2.6.2.5. Chair rails shall be provided in conference rooms, classrooms, or similar multi-use spaces except for UI Housing facilities.
- ~~2.7.2.6.~~ 2.7.2.6. Chair rail height shall be determined by chair selection (when required).
- ~~2.8.2.7.~~ 2.8.2.7. Corner protectors shall be installed on drywall corners in public circulation areas. Minimum height shall be 48-inches.
- 2.8. For UI Housing:
 - 2.8.1. Impact-Resistant Wall Board: Residential Floors, Corridor Side of all gypsum wall assemblies, including elevator lobbies.
 - 2.8.2. Abusive-Resistant Wall Board:
 - 2.8.2.1. Levels other than Residential Floors: all gypsum board wall assemblies.
 - 2.8.2.2. Residential Floors: all gypsum board wall assemblies, except for:

2.8.2.2.1. Corridor side of the corridor wall assemblies.

2.8.2.2.2. Student room side of the corridor wall assemblies.

2.8.2.2.3. One (1) side of each party wall between adjacent student rooms.

2.8.3. Acoustically enhanced Wall Board:

2.8.3.1. Walls between apartments and other spaces.

2.8.3.2. Residential floors:

2.8.3.2.1. Student room side of corridor wall assemblies.

2.8.3.2.2. One (1) side of each party wall between adjacent student rooms.

2.8.3.2.3. Both sides of party walls between residence advisor rooms and lounges / study rooms.

2.8.4. Glass-fiber reinforced plastic (GFRP) wall paneling and trim accessories at custodial area around mop sinks sufficiently extended vertically and horizontally to protect wall from moisture and splashes.

2.8.5. Vertical application of acoustical ceiling panel tiles not allowed.

2.9. For UI Hospitals and HClinics:

2.9.1. Wet or wash down areas (cage and cart wash areas, kitchens, etc.) shall use wall protection.

2.9.2. Wallpaper is permitted with written approval from the Owner.

2.9.1-2.9.3. To avoid moisture wicking, undercut outer layer of gypsum wallboard by ¼-inch at base and caulk with moisture resistant caulk that meets fire rating for wall.

2.9.2-2.9.4. All gypsum wall board to go to deck or structure above.

2.9.3-2.9.5. In wet areas and areas near sinks and ice machines, non-moisture wicking wallboard shall be specified.

2.9.4-2.9.6. High abuse areas (corridors, elevator lobbies, service areas etc.) shall receive Abuse Resistant gypsum board.

2.9.5-2.9.7. Corner guards shall be InPro, 2-inch 304 stainless-steel.

2.9.5.1-2.9.7.1. The corner guards shall sit at top of resilient base.

2.9.5.2-2.9.7.2. The top of the corner guard should be ¼-inch below suspended grid ceiling.

2.9.7.3. 2-inch leg u-shaped wall endcaps shall be installed at wall -ends of 8" or less. At less than 8-inches a continuous "U" shall be provided. Review locations with Owner.

2.9.5.3-2.9.7.4. The corner guards shall be affixed with adhesive. Corner guards that are mechanically fastened are not permitted.

~~2.9.6.2.9.8.~~ Operating rooms shall have minimum ¼-inch solid surface material by Corian on all walls to a minimum of 72-inches above finished floor with stainless steel edge protection.

~~2.9.6.1.2.9.8.1.~~ Solid surface material shall conform to ANSI/ICPA SS-1 for workmanship and finish, structural integrity, and material characteristics.

~~2.9.6.2.2.9.8.2.~~ Solid surface material shall not support fungal or bacterial growth as tested in accordance with ASTM G-21_ & G-22

~~2.9.6.3.2.9.8.3.~~ Panels shall be full height with welded seams, chamfered top edge and sealed corners.

~~2.10. For UI Housing:~~

~~2.10.1. Impact Resistant Wall Board: Residential Floors, Corridor Side of all gypsum wall assemblies, including elevator lobbies.~~

~~2.10.2. Abusive Resistant Wall Board:~~

~~2.10.2.1. Levels other than Residential Floors: all gypsum board wall assemblies.~~

~~2.10.2.2. Residential Floors: all gypsum board wall assemblies, except for:~~

~~2.10.2.2.1. Corridor side of the corridor wall assemblies.~~

~~2.10.2.2.2. Student room side of the corridor wall assemblies.~~

~~2.10.2.2.3. One (1) side of each party wall between adjacent student rooms.~~

~~2.10.3. Acoustically enhanced Wall Board:~~

~~2.10.3.1. Walls between apartments and other spaces.~~

~~2.10.3.2. Residential floors:~~

~~2.10.3.2.1. Student room side of corridor wall assemblies.~~

~~2.10.3.2.2. One (1) side of each party wall between adjacent student rooms.~~

~~2.10.3.2.3. Both sides of party walls between residence advisor rooms and lounges / study rooms.~~

~~2.10.4. Glass fiber reinforced plastic (GFRP) wall paneling and trim accessories at custodial area around mop sinks sufficiently extended vertically and horizontally to protect wall from moisture and splashes.~~

~~2.10.5. Vertical application of acoustical ceiling panel tiles not allowed.~~

3. Ceiling Systems:

3.1. Design Professional shall list appearance as criteria requirement when including “approved equal” to allow for coordination with maintenance stock.

3.1.1. Specialty ceiling tiles/systems require Owner approval.

3.1.1.1. Ceiling tiles/systems shall be removable without requiring the use of specialty tools.

3.1.2. Sound attenuation shall be used at partitions and above ceilings. Review criteria for acoustical separation with Owner.

3.1.3. Ceiling systems shall use noncombustible materials.

3.1.4. Gypsum Board Ceilings:

3.1.4.1. Gypsum board ceilings shall be limited to special public areas, soffits, and consistently wet areas (cage and cart wash areas, kitchens, bio-safety Level 3, or larger facilities).

3.1.4.2. Textured finishes shall not be used on gypsum board ceilings.

3.1.5. Acoustical Tile Ceilings:

3.1.5.1. Ceiling grid shall be an intermediate duty exposed system conforming to ASTM C635 (1-inch-wide grid). Basis of Design shall be Chicago Metallic 200 Snap Grid.

3.1.5.2. Suspend ceiling grid directly from the building structure.

3.1.5.3. Ceiling tile basis of design shall be Armstrong Ultima, 2-foot by 4-foot and/or 2-foot by 2-foot.

3.1.5.4. Reveal edge tiles require Owner approval.

3.1.6. Concealed spline or tongue and groove ceiling systems shall not be used.

3.1.7. Means of access shall be maintained to the plenum space and above ceiling devices.

3.1.8.3.2. For UI-Hospitals and Clinics:

3.2.1. Sounds attenuation is not required as wall gypsum board and bat insulation goes to deck.

3.2.2. Gypsum board ceilings are permitted in in-patient restrooms.

3.1.8.1.3.2.3. Standard tiles shall be 24-inch by 24-inch Rockfon Medical Standard, Square Lay-In with 15/16-inch regular grid or Owner approved equivalent.

4. Paint Finishes:

4.1. Paint shall be manufacturer's premium product. Specify the most sustainable paints and coatings available for the particular application.

~~4.2. Semi-gloss paint shall be used in all painted public areas on veneer plaster or concrete masonry units. Ceiling finish shall be two (2) coats, plus primer, of latex flat paint.~~

4.2. Attic stock shall not be provided for paint. A paint schedule or labels from the can shall be provided as a part of closeout documentation.

4.3. Painted door, window, and miscellaneous trim finish shall be two (2) coats, plus primer, of latex or alkyd enamel semi-gloss paint.

4.4. Stained door, window, and miscellaneous wood trim finish shall be high sheen / gloss, oil based with a urethane topcoat.

4.5. Epoxy paints shall be 2-part systems.

~~4.6. Attic stock shall not be provided for paint. A paint schedule or labels from the can shall be provided as a part of closeout documentation.~~

4.6. For UIHC:

4.6.1. Minimum 5 gal of attic stock per color and finish shall be provided for paint. A paint schedule or labels from the can shall be provided as a part of the closeout documentation.

4.7. Wall:

4.7.1. Semi-gloss paint shall be used in all painted public areas on veneer plaster or concrete masonry units.

4.7.2. Ceiling finish shall be two (2) coats, plus primer, of latex flat paint.

~~4.7.1.~~4.7.3. Wall finish shall be washable, durable, and consist of two (2) coats, plus primer, of latex eggshell or satin paint.

~~4.7.2.~~4.7.4. Flat paint shall not be used.

~~4.7.3.~~4.8. For UIHCospitals and Clinics:

4.8.1. Attic stock shall be provided. Coordinate with the Owner to determine quantities required.

4.8.2. Wall:

~~4.7.3.1.~~4.8.2.1. Standard walls shall be painted using Sherwin Williams Pro Mar 200 Egg Shell or Owner approved equal.

~~4.7.3.2.~~4.8.2.2. Scrubbable walls (in ~~operating and~~ procedure rooms, clean rooms, and as required in the Owners Project Requirements) shall be painted using Sherwin Williams "Pro Industrial – Zero VOC Waterborne Catalyzed Epoxy - #B73-360 Series Eg-Shel."

~~4.7.3.3.~~4.8.2.3. Note: Paint other than white at hand sanitizer locations shall be Sherwin Williams Pre-Catalyzed Water Based Epoxy.

~~4.8.~~4.8.3. Metal Doors and Frames

~~4.8.1.~~ For UIHC:

~~4.8.1.1.~~4.8.3.1.1. 1 Coat S-W Pro Industrial Pro-Cryl, B66-310 Series.

~~4.8.1.2.~~4.8.3.1.2. Alternate: Interior and Exterior; Ferrous and Non-Ferrous Metals (very smooth and/or Kynar like surfaces).

~~4.8.1.3.~~4.8.3.1.3. Bonding Primer: 1 Coat S-W DTM Bonding Primer, B66A50. Finish: 1-2 Coats S-W Pro Industrial Acrylic, B66-600 Series available in Gloss, Semi-Gloss, and Eggshell.

~~4.8.1.4.4.8.3.1.4.~~ Doors and frames shall be painted the same color on both sides.

~~4.9.4.8.4.~~ Wood Doors:

~~4.9.1. For UHC:~~

~~4.9.1.1.4.8.4.1.1.~~ New wood doors shall be prepped and stained or painted offsite.

~~4.9.1.2.4.8.4.1.2.~~ When painting over existing wood lacquered doors, doors shall be removed and prepared offsite.

~~4.9.1.3.4.8.4.1.3.~~ Prior to painting, doors shall be power sanded smooth to remove the existing stain.

~~4.9.1.4.4.8.4.1.4.~~ Primer shall be one (1) coat of XIM Advanced Technology UMA brand Bonder.

~~4.9.1.5.4.8.4.1.5.~~ Finish shall be one (1) to two (2) coats Sherwin-Williams Pro Industrial Acrylic, B66-600 Series available in Gloss, Semi-Gloss, and Eggshell.

5. Floor Finishes:

5.1. Entry Mats:

5.1.1. Entry mats are required at all main entrances.

5.1.2. Entries shall have removable; roll-up entrap matting installed into a mat well.

5.1.3. Mat wells shall not have drains.

5.1.4. Laydown mats shall be minimum 12-feet long to handle foot traffic but shall not exceed manufacturer maximum size recommendation for ease of removal and cleaning.

5.1.5. Basis of Design shall be linked tread, 3M Nomad floor mats.

5.2. Slip Resistant Tile:

5.2.1. Slip resistant tile shall be used on slopes and inclines.

5.2.2. Hard, durable, slip resistant surfaces requiring minimum maintenance shall be used in the following areas:

5.2.2.1. Entry level corridors

5.2.2.2. Food preparation and service spaces

5.2.2.3. Laboratories

5.2.2.4. Lactation rooms

5.2.2.5. Lobbies and public spaces

5.2.2.6. Restrooms

5.2.2.7. Stairwells

5.2.2.8. Storage rooms

5.3. Carpet and Base:

5.3.1. Submit carpet seaming diagram for Owner approval prior to ordering material.

5.3.2. Carpet shall be:

5.3.2.1. Fiber: nylon type 6 or 6.6.

5.3.2.2. Construction: Tufted loop pile.

5.3.2.3. Color: Multi-color yarn system.

5.3.2.4. Carpet tile face weight: minimum 16 ounces.

5.3.2.5. Broadloom face weight: minimum 22 ounces.

5.3.3. For UIHC:

5.3.3.1. Rolled Carpet shall be used over carpet tiles in high use areas.

5.3.3.2. Carpet to be 100-percent (100%) solution dyed nylon.

5.3.3.3. Rolled carpet shall be 6-foot wide Tandus Powerbond or approved equivalent.

~~5.3.3.3.~~ 5.3.3.4. Floor transitions shall be flush. Transition strips are not allowed.

5.3.4. Resilient base shall be:

5.3.4.1. 1/8-inch-thick vinyl or rubber.

5.3.4.2. Base joints shall be at inside corners and no closer than 24 inches to an external corner.

5.3.4.3. Continuous, rolled base shall be used.

5.3.4.4. Wood Base shall be hardwood species only.

5.4. Carpet Tiles:

5.4.1. Carpet tiles may be used in the following areas:

5.4.1.1. Auxiliary corridors

5.4.1.2. Classrooms, Auditoriums, and Lecture Halls

5.4.1.3. Computer labs

5.4.1.4. Conference rooms

5.4.1.5. Offices

5.4.2. For UIHC:

~~5.4.2.1. Carpet tiles may be considered in offices.~~

5.4.3.5.4.2. For UI Housing:

~~5.4.3.1.5.4.2.1.~~ Carpet tiles shall be used in UI Housing sleeping room corridors, offices, conference rooms, seminar rooms, study rooms, and dining seating areas, excluding major circulation routes.

5.5. Sealed Concrete:

5.5.1. Sealed concrete shall be used in the following areas:

5.5.1.1. Custodial Spaces

5.5.1.2. Mechanical rooms

5.5.2. For UIHC:

5.5.2.1. The finished flooring in electrical closets shall be sealed concrete.

~~5.5.2.1.~~5.5.2.2. Mechanical rooms located above another space shall have epoxy coating with all corners, edges, cracks, etc. caulked to prevent leakage to spaces.

5.6. Ceramic Tile:

5.6.1. Ceramic Tile Grout:

5.6.1.1. shall be pigmented or natural gray.

5.6.1.2. White or near white grout shall not be used.

5.6.1.3. Joints shall be sealed with a silicone-based product.

5.6.2. Ceramic tile in showers and restrooms shall be:

5.6.2.1. Waterproofed with impregnator sealant.

5.6.2.2. Epoxy grouted.

5.6.3. Select larger size tile to minimize grout lines.

5.6.4. Ceramic tile base/cove shall be curved rather than a 90-degree angle.

5.6.5. Ceramic tile may be used in the following rooms:

5.6.5.1. Lactation rooms

5.6.5.2. Restrooms

5.7. Vinyl Composition Tile:

5.7.1. VCT shall be a minimum 1/8-inch thick.

5.7.2. VCT shall not be used in classrooms.

5.8. Hard Surface Flooring:

5.8.1. Hard surface flooring, such as vinyl tile (premium quality products only), sheet vinyl, rubber flooring, or linoleum may be used in the following rooms:

5.8.1.1. Classrooms

5.8.1.2. Lactation rooms

5.8.1.3. Telecommunication Rooms

5.9. Non-slip Quarry Tile:

5.9.1. Non-slip quarry tile may be used in the following rooms:

5.9.1.1. Food preparation and service areas

5.9.1.2. Restrooms

5.9.2. For UI Housing:

5.9.2.1. Non-slip quarry tile shall be used in food preparation and service areas.

5.10. Terrazzo Flooring:

5.10.1. For UIHC:

5.10.1.1. Terrazzo floors shall be installed in the public areas on first floor levels of UIHC main facilities.

~~5.10.1.1.~~ 5.10.2. UIHC can use Vinyl Composition Tile in telecom rooms; VCT shall be a minimum 1/8-inch thick.

5.11. Epoxy Resin Floor:

5.11.1. Epoxy resin floor color shall be integral to flooring material.

5.11.1.1. Surface coloring shall not be used.

5.11.2. Epoxy coating may be used in the following rooms:

5.11.2.1. Food preparation and service areas (Epoxy coating shall not be used in UI Housing facilities.)

5.11.2.2. Laboratories

5.11.2.3. Mechanical rooms located above another space shall have epoxy coating with all corners, edges, cracks, etc. caulked to prevent leakage to spaces.

5.11.3. Stairwells shall have applied nosing one (1) piece full width of tread.

5.12. Epoxy Quartz Flooring:

5.12.1. For UIHC:

5.12.1.1. Use epoxy quartz flooring in restrooms with showers.

5.12.1.2. Flooring and Base shall be aggregate of coated quartz, embedded in clear epoxy and applied to a total thickness of 1/16-inch to 1/8-inch, as recommended by the manufacturer.

5.12.1.3. Apply two (2) coats of manufacturer's sealer topcoat to reduce texture.

5.12.1.4. Verify texture with users after initial topcoat application.

5.12.1.5. Clear floor sealers are not allowed.

5.13. Resilient Flooring:

5.13.1. For UIHC:

5.13.1.1. Resilient flooring to be Nora or approved equal.

5.13.1.2. Nora Plan Envirocare in patient care areas.

5.13.1.3. Inpatient rooms, procedure areas, cleanrooms and other places where required to have a 6-inch integral cove terminated with a cold weld against at the wall.

5.13.1.4. Provide one (1) #1 Nora Pad for every 10,000 square feet of Envirocare installed.

5.13.1.5. Nora Norament Grano tiles to be used in main public corridors. This excludes First Floor, which require Terrazzo.

5.13.1.6. Any patterns must be water jet cut.

5.13.1.7. All seams shall be hot welded.

5.13.1.8. Acrylic adhesive to be used as a standard. For Operating Rooms (OR) and areas with heavy rolling loads, Dryfix is recommended.

5.13.1.9. All cove filler strips to be FlashCove 1.25 inch. to be Johnsonite CFS-00-A 1.25 inch.

5.14. Luxury Vinyl Tile:

5.14.1. Luxury vinyl tile (premium quality products only) may be used in the following:

5.14.1.1. For UI Housing:

5.14.1.1.1. Residential Hall Apartment Kitchen, bathroom, entry, and laundry.

5.14.1.1.2. Major circulation routes / paths within dining seating areas (including food ~~server~~server circulation area.)

5.14.1.1.3. Telecommunication rooms (white color only).

5.14.1.1.4. Student sleeping rooms.

5.15. Flooring materials other than listed above require written approval from Owner.

10) SPECIALTIES

1. Signage

1.1. General:

1.1.1. Signage shall adhere to current ADA Standards for Accessible Design.

1.1.1.1. Copy shall provide appropriate contrast with background as identified by the ADA guidelines.

1.1.1.2. Braille room number shall be located directly below the tactile room number.

1.1.1.3. Braille text shall be located directly below the tactile room ~~text number.~~

1.1.1.4. Mounting locations shall be as identified by the ADA guidelines.

1.1.1.5. Digital displays outside rooms shall include an ADA compliant component.

1.1.1.6. Provide direction to accessible seating within auditoriums and tiered classrooms.

1.1.1.7. Rooms or spaces with an induction loop assistive listening system shall be identified with the universal symbol for hearing assistance accompanied by explanatory text and a "T," signifying an available telcoil-compatible system.

1.1.1.8. Based on agreements with the Fire Protection Authorities, red copy shall only be used as identified below.

1.1.1.9. Rooms that have a fire pump, main sprinkler valve, or fire command center shall identified as "Fire Equipment." Copy shall be red.

~~1.1.1.8-1.1.1.10.~~

1.1.2. Signage shall follow the International Fire Code (IFC).

~~1.1.3. Rooms with one (1) or more breaker panels shall be identified as "Electrical Room."~~

~~1.1.4-1.1.3.~~ Access door to building generator shall be identified as "Generator."

~~1.1.5-1.1.4.~~ Door openings onto a roof shall have a sign reading "Roof Access," including within penthouses.

~~1.1.6. Rooms that have a fire pump, main sprinkler valve, or fire command center shall identified as "Fire Equipment." Copy shall be red.~~

~~1.1.7-1.1.5.~~ Elevator machine rooms shall be identified as "Elevator Equipment."

~~1.1.8-1.1.6.~~ Mechanical rooms shall be identified as "Mechanical."

~~1.1.9-1.1.7.~~ Custodial spaces shall be identified as "Custodial."

~~1.1.10-1.1.8.~~ Per variances from Iowa City Fire Department, dated February 24, 1993, and Coralville Fire Department, dated March 31, 2009, NFPA 704 diamond signs need not be displayed. For municipalities other than Iowa City and Coralville, verify requirements with Owner.

~~1.1.11-1.1.9.~~ NFPA 101 inside stairwell signs shall be located in stairwells of three (3) or more landings. Exit level signage shall indicate the level or floor number and "exit this level." This copy shall be red.

~~1.1.12-1.1.10.~~ "In Case of Fire Use Stairs, Do Not Use Elevator" signs shall be located at elevators without message applied to call button panel when the call button panel does not have this message.

~~1.1.13-1.1.11.~~ Signage design, material, finish, size, and font are building specific and require Owner approval.

~~1.1.14-1.1.12.~~ Signage detail drawings shall be submitted for review no later than Fifty percent (50%) Construction Documents.

~~1.1.15-1.1.13.~~ Signs shall be designed to be updateable while maintaining vandal and tamper resistance.

~~1.1.16.~~ Every room shall be identified.

~~1.1.16.1.~~

The minimum signage required shall be a sign type room number.

~~1.1.17-1.1.14.~~ Interior decorative or super graphic displays shall not be visible from the exterior of the building.

~~1.1.18-1.1.15.~~ Departmental policies may require additional signage.

~~1.1.19-1.1.16.~~ Design Professional shall provide a sign schedule and location plan.

~~1.1.20-1.1.17.~~ Specifications for printed insert sign types shall include the printed inserts, the electronic template for updating the inserts, and the insert material.

~~1.1.21-1.1.18.~~ Modular inserts shall be adhered with tamper-proof fastener system.

~~1.1.22-1.1.19.~~ Signs referencing public venues include the following rooms:

~~1.1.22.1-1.1.19.1.~~ Restrooms, including accessible, single user, family, and other restrooms.

~~1.1.22.2-1.1.19.2.~~ Lactation rooms

~~1.1.22.3-1.1.19.3.~~ Classrooms

~~1.1.22.4-1.1.19.4.~~ Vending rooms

~~1.1.22.5-1.1.19.5.~~ Cafeterias

~~1.1.22.6-1.1.19.6.~~ Dining Facilities

~~1.1.22.7.1.1.19.7.~~ Game Rooms / Exercise Rooms

~~1.1.23.1.1.20.~~ For UIHC:

~~1.1.23.1.1.20.1.~~ All new signage to be Latitude ASI–Venus Series or Hospital Architect Approved equivalent.

~~1.1.24.1.1.21.~~ UI Housing:

~~1.1.24.1.1.21.1.~~ Signs with inserts shall not be used.

1.2. Interior Signage:

1.2.1. Refer to Interior Signage Details in Appendices for examples of sign types.

1.2.2. Building Directory (Not applicable to UI Housing facilities [or Iowa Healthcare facilities.](#))

1.2.2.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

1.2.2.2. Directory to be immediately viewable upon entering the building from the primary entrance and in major circulation areas.

1.2.2.3. Directory shall permanently identify level number and may include building name. Copy shall be permanently printed.

1.2.2.4. Directory shall be used to display destination addresses.

1.2.2.5. Content shall include public venue, department names and locations within the building. Directory may include administrative offices.

1.2.2.6. Destinations shall be listed alphabetically.

1.2.2.7. Provide minimum capacity of Ten percent (10%) greater than the current list of destinations.

1.2.2.8. Locations shall be keyed to floor levels, room numbers or map artwork.

1.2.2.9. Map artwork shall be plan view or stacked perspective.

1.2.2.9.1. Artwork shall schematically replicate the footprint of each level.

1.2.2.9.2. Features to be shown shall be stairs, elevators, restrooms, accessible restrooms, single user restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances, and department identification.

1.2.2.9.3. Room number ranges shall be identified.

1.2.2.9.4. A uniquely shaped and/or colored "YOU ARE HERE" symbol shall be placed in the plan location of the viewer.

1.2.2.9.5. Map artwork shall be oriented so that top of map is the direction the viewer is facing.

1.2.2.9.6. Map shall be sized to convey information clearly.

1.2.3. Elevator Directory (Not applicable to UI Housing facilities.)

- 1.2.3.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
- 1.2.3.2. Directory shall permanently identify level number.
- 1.2.3.3. Building name may be included as directed by the Owner.
- 1.2.3.4. Directory shall be used as display of destination addresses accessible by the elevator.
- 1.2.3.5. Content shall include building name, public venue, department names, administrative offices, and floor level locations.
- 1.2.3.6. Destinations shall be listed alphabetically.
- 1.2.3.7. Provide capacity of Ten percent (10%) greater than the current list of destinations.
- 1.2.3.8. Sign shall be located adjacent to the entrance into an elevator cab.
- 1.2.3.9. One (1) directory can serve two (2) adjacent elevator cabs.

1.2.4. Elevator Cab Directory (Not applicable to UI Housing facilities and UIHC.)

- 1.2.4.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
- 1.2.4.2. Elevator Cab Directory shall be used in addition to Elevator Directory.
- 1.2.4.3. Directory shall be used as display of destination addresses accessible by the elevator.
- 1.2.4.4. Provide capacity of Ten percent (10%) greater than the current list of destinations.

1.2.5. Overhead Directional (Not applicable to UI Housing facilities.)

- 1.2.5.1. Use of overhead directional signs shall be limited.
- 1.2.5.2. Overhead directional signs shall be used to direct to primary destinations or range of room numbers.
- 1.2.5.3. Copy on overhead directional signs shall be at a minimum of 2-inch height and comply with ADA requirements for visual character height.

1.2.5.4. Copy shall be self-adhesive vinyl, silkscreened or applied cut-out lettering.

1.2.5.5. Sign shall be used in conjunction with wall-mounted department identification.

~~1.2.5.4.~~

1.2.6. Wall-mount Directional

- 1.2.6.1. Wall-mount directional shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
- 1.2.6.2. Wall-mount directional shall permanently identify level number.
- 1.2.6.3. Building name may be included as directed by the Owner.
- 1.2.6.4. Copy shall be listed according to direction with left destinations listed first, upper destinations second and right destinations third.
- 1.2.6.5. Destinations in like direction shall be alphabetized.
- 1.2.6.6. Signs shall be located at decision points.
- 1.2.6.7. Wall-mount directional may include map artwork.

1.2.6.7.1. Map artwork:

- 1.2.6.7.1.1. Artwork shall be plan view or stacked perspective.
- 1.2.6.7.1.2. Artwork shall schematically replicate the footprint of each level.
- 1.2.6.7.1.3. Features shall include stairs, elevators, restrooms, accessible restrooms, single user restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances.
- 1.2.6.7.1.4. Room number ranges shall be identified.
- 1.2.6.7.1.5. A uniquely shaped and/or colored symbol labeled "You Are Here" shall be placed in the plan location of the viewer.
- 1.2.6.7.1.6. Map art shall be oriented with top of map the direction the viewer is facing.

1.2.6.8. UI Housing:

- 1.2.6.8.1. Only applicable for public restroom from primary entrance or dining facility.

~~1.2.7. Overhead Identification:~~

- ~~1.2.7.1. Use of overhead identification signs shall be limited.~~
- ~~1.2.7.2. Overhead identification signs shall be used to identify primary destinations.~~
- ~~1.2.7.3. Copy shall comply with ADA requirements for visual character height.~~
- ~~1.2.7.4. Copy shall be self-adhesive vinyl, silkscreened, or applied cut-out lettering.~~
- ~~1.2.7.5. Sign shall be used in conjunction with wall-mounted department identification.~~

~~1.2.8.1.2.7. Projecting Flag Identification (Not applicable to UI Housing facilities.)~~

- ~~1.2.8.1.1.2.7.1. Projecting flag identification shall be used for public areas visually hidden from direct view.~~
- ~~1.2.8.2.1.2.7.2. Flag shall be an acrylic blade fastened to an aluminum armature.~~
- ~~1.2.8.3.1.2.7.3. Copy shall comply with ADA requirements for visual character height.~~

~~1.2.8.4~~~~1.2.7.4.~~ Graphics shall be limited to symbol glyphs for public venues.

~~1.2.8.5~~~~1.2.7.5.~~ Glyphs shall be silkscreened or self-adhesive vinyl.

~~1.2.9~~~~1.2.8.~~ Department Directory (Not applicable to UI Housing facilities.)

~~1.2.9.1~~~~1.2.8.1.~~ Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

~~1.2.9.1.1~~~~1.2.8.1.1.~~ Changeable inserts shall be 8 ½-inches by 11-inches, 8 ½-inches by 14-inches, 11-inches by 17-inches, or as approved by Owner.

~~1.2.9.2~~~~1.2.8.2.~~ Directory shall be used as display of destination addresses within the department.

~~1.2.9.3~~~~1.2.8.3.~~ Content may include program names, faculty / staff identification and room numbers.

~~1.2.9.4~~~~1.2.8.4.~~ Destinations shall be listed alphabetically.

~~1.2.9.5~~~~1.2.8.5.~~ Provide capacity of Ten percent (10%) greater than the current list of destinations.

~~1.2.10~~~~1.2.9.~~ Department Identification Plaque (Not applicable to UI Housing facilities.)

~~1.2.10.1~~~~1.2.9.1.~~ Department identification plaque shall be wall mounted.

~~1.2.10.2~~~~1.2.9.2.~~ Plaque shall be scaled larger than room identification signage to provide more significance.

~~1.2.10.3~~~~1.2.9.3.~~ Plaque shall use uppercase sans-serif ADA spec tactile copy and Grade II Braille for the permanent identification component of the message.

~~1.2.10.4~~~~1.2.9.4.~~ Permanent message shall be department name and/or room number.

~~1.2.10.5~~~~1.2.9.5.~~ Supporting copy shall be silk-screened.

~~1.2.10.6~~~~1.2.9.6.~~ Sign face shall be matte.

~~1.2.10.7~~~~1.2.9.7.~~ Sign location shall not be viewable from the exterior of the building.

~~1.2.11~~~~1.2.10.~~ Department Identification Vinyl Lettering (Not applicable to UI Housing facilities.)

~~1.2.11.1~~~~1.2.10.1.~~ Vinyl lettering shall be scaled larger than room identification signage to provide more significance.

~~1.2.11.2~~~~1.2.10.2.~~ Vinyl lettering identifying a permanent space shall include ADA compliant identification.

~~1.2.11.3~~~~1.2.10.3.~~ Vinyl lettering shall not be viewable from the exterior of the building.

~~1.2.12~~~~1.2.11.~~ Room Number:

~~1.2.12.1~~1.2.11.1. Room number shall be wall mounted.

~~1.2.12.2~~1.2.11.2. Rooms identified by number only include general storage rooms and rooms whose purposes are to be discreet.

~~1.2.12.3~~1.2.11.3. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille.

~~1.2.12.4~~1.2.11.4. Sign face shall be matte.

~~1.2.13~~1.2.12. Room Identification:

~~1.2.13.1~~1.2.12.1. Room Identification shall be wall mounted.

~~1.2.13.2~~1.2.12.2. Rooms whose purpose or room information is not likely to change frequently shall be identified by room text and room number.

~~1.2.13.3~~1.2.12.3. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the permanent component of the message.

~~1.2.13.4~~1.2.12.4. Permanent message shall be room text and room number.

~~1.2.13.5~~1.2.12.5. Sign face shall be matte.

~~1.2.14~~1.2.13. Lactation Room Identification:

~~1.2.14.1~~1.2.13.1. Lactation room sign shall:

~~1.2.14.1.1~~1.2.13.1.1. Identify the room by the room number.

~~1.2.14.1.2~~1.2.13.1.2. List the room name.

~~1.2.14.1.3~~1.2.13.1.3. Include an in-house updatable insert.

~~1.2.15~~1.2.14. Conference Room Identification:

~~1.2.15.1~~1.2.14.1. Conference Room identification shall be wall mounted.

~~1.2.15.2~~1.2.14.2. Sign shall include "Conference" and room number.

~~1.2.15.3~~1.2.14.3. Signs shall incorporate gripper bar paper holder.

~~1.2.15.3.1~~1.2.14.3.1. Gripper bars shall be constructed of extruded aluminum.

~~1.2.15.4~~1.2.14.4. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the permanent component of the message.

~~1.2.15.5~~1.2.14.5. Permanent message shall be room text and room number.

~~1.2.15.6~~1.2.14.6. Sign face shall be matte.

~~1.2.16~~1.2.15. Office and Multi-purpose Room Identification:

~~1.2.16.1~~~~1.2.15.1.~~ Office and multi-purpose room Identification shall be wall mounted.

~~1.2.16.2~~~~1.2.15.2.~~ Sign shall identify rooms by room number and in-house, updatable insert.

~~1.2.16.3~~~~1.2.15.3.~~ Typical rooms include offices and rooms whose purpose or room information may change frequently.

~~1.2.16.4~~~~1.2.15.4.~~ Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the room number.

~~1.2.16.5~~~~1.2.15.5.~~ In-house, updateable insert shall be inserted into a slot between a clear window on the face and a backer panel.

~~1.2.16.5.1~~~~1.2.15.5.1.~~ Face shall have thumb notch or similar means to enable updating.

~~1.2.16.6~~~~1.2.15.6.~~ Signs shall incorporate gripper bar paper holder. Gripper bars shall be constructed of extruded aluminum.

~~1.2.16.7~~~~1.2.15.7.~~ Sign face shall be matte.

~~1.2.17~~~~1.2.16.~~ Electronic Meeting Signs:

~~1.2.17.1~~~~1.2.16.1.~~ Electronic meeting signs shall be used at UI Housing seminar and multi-purpose rooms and all other UI Housing reservable spaces.

~~1.2.18~~~~1.2.17.~~ Open Office Workstation Identification (Not applicable to UI Housing facilities.)

~~1.2.18.1~~~~1.2.17.1.~~ Each open office workstation shall receive an identification sign.

~~1.2.18.2~~~~1.2.17.2.~~ Open office workstation signage shall not include room number.

~~1.2.18.3~~~~1.2.17.3.~~ Sign shall identify occupant or use by in-house, updateable insert.

~~1.2.18.4~~~~1.2.17.4.~~ Confirm mounting detail with Owner.

~~1.2.18.5~~~~1.2.17.5.~~ In-house, updateable insert shall be placed into a slot between a clear window on the face and a backer panel.

~~1.2.18.5.1~~~~1.2.17.5.1.~~ Face shall have thumb notch or similar means for enabling updating.

~~1.2.18.6~~~~1.2.17.6.~~ Sign face shall be matte.

~~1.2.19~~~~1.2.18.~~ Symbol Identification:

~~1.2.19.1~~~~1.2.18.1.~~ Symbol identification shall be wall mounted.

~~1.2.19.2~~~~1.2.18.2.~~ Information shall be organized with room number on top, symbol glyph on 6-inch area in the middle and supporting text on bottom.

~~1.2.19.3~~~~1.2.18.3.~~ Typical rooms include single user, men's, and women's restrooms, and stairwells.

~~1.2.19.4~~~~1.2.18.4~~ Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.

~~1.2.19.5~~~~1.2.18.5~~ Sign face shall be matte.

~~1.2.20~~~~1.2.19~~ Large Symbol Identification:

~~1.2.20.1~~~~1.2.19.1~~ Large symbol identification shall be wall mounted.

~~1.2.20.2~~~~1.2.19.2~~ Information shall be organized with room number on top, symbol glyph on 6-inch area in the middle and multiple lines of supporting text on bottom.

~~1.2.20.3~~~~1.2.19.3~~ Typical rooms include family restrooms and locker rooms.

~~1.2.20.4~~~~1.2.19.4~~ Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.

~~1.2.20.5~~~~1.2.19.5~~ Sign face shall be matte.

~~1.2.21~~~~1.2.20~~ Entrance Number Plaque:

~~1.2.21.1~~~~1.2.20.1~~ An entrance number plaque shall be placed at each exterior door, including entrances from rooftop and balconies.

~~1.2.21.2~~~~1.2.20.2~~ Plaque shall be an exterior grade 1/8-inch 2-ply material with contrasting color layers, Rowmark Ultra-Matte material or approved equal.

~~1.2.21.3~~~~1.2.20.3~~ Numbers shall be assigned by Owner.

~~1.2.21.4~~~~1.2.20.4~~ "ENT" shall precede all numbers.

~~1.2.21.5~~~~1.2.20.5~~ Sign shall use uppercase sans-serif.

~~1.2.21.6~~~~1.2.20.6~~ Plaques shall be sized to fit on doorframe, centered over door on outside of facility.

~~1.2.21.7~~~~1.2.20.7~~ Typical size plaque is 1-1/2-inches by 6-inches with 1-inch copy.

~~1.2.22~~~~1.2.21~~ Loading Dock Entrance Number Plaque:

~~1.2.22.1~~~~1.2.21.1~~ Loading Dock entrance number plaque shall be placed at each exterior dock.

~~1.2.22.2~~~~1.2.21.2~~ Plaque shall be a 1/8-inch painted aluminum panel with highly contrasting, self-adhesive, vinyl copy.

~~1.2.22.3~~~~1.2.21.3~~ Numbers shall be assigned by Owner.

~~1.2.22.4~~~~1.2.21.4~~ "ENT" shall precede all numbers. Sign shall use uppercase sans-serif.

~~1.2.22.5~~~~1.2.21.5~~ Typical plaque size is 12-inches by 12-inches with 4-inch copy or sized in accordance with specific building criteria.

~~1.2.22.6~~~~1.2.21.6~~ Sign shall be placed adjacent to door and viewable from street.

~~1.2.23.1.2.22.~~ Code Specified Information:

~~1.2.23.1.1.2.22.1.~~ Code Specified Information shall be wall mounted.

~~1.2.23.2.1.2.22.2.~~ Refer to applicable code for text, symbols, size, and sign layout.

~~1.2.23.3.1.2.22.3.~~ Tobacco-free signage shall be placed at all building entrances.

~~1.2.23.4.1.2.22.4.~~ Sign face shall be matte.

~~1.2.24.1.2.23.~~ Architectural Lettering:

~~1.2.24.1.1.2.23.1.~~ Architectural lettering may be used to identify the following:

~~1.2.24.1.1.1.2.23.1.1.~~ Building

~~1.2.24.1.2.1.2.23.1.2.~~ Department

~~1.2.24.1.3.1.2.23.1.3.~~ Special venues

~~1.2.24.1.4.1.2.23.1.4.~~ Points of sale

~~1.2.24.2.1.2.23.2.~~ Letters shall be individually cut out characters from acrylic sheet, solid surface material, metal or cast from metal.

~~1.2.24.3.1.2.23.3.~~ Architectural Lettering identifying a permanent space shall also include ADA compliant identification.

~~1.2.25.1.2.24.~~ Donor Signage:

~~1.2.25.1.1.2.24.1.~~ Donor recognition signage shall be designed as part of the interior signage.

~~1.2.25.2.1.2.24.2.~~ Finished product shall complement and coordinate with building design.

~~1.2.25.3.1.2.24.3.~~ Coordinate with The University of Iowa Foundation to design the signage types for the various donation levels.

~~1.2.25.4.1.2.24.4.~~ Donor Signage types:

~~1.2.25.4.1.1.2.24.4.1.~~ Donor Wall

~~1.2.25.4.2.1.2.24.4.2.~~ Room

~~1.2.25.4.3.1.2.24.4.3.~~ Departments

~~1.2.25.4.4.1.2.24.4.4.~~ Building

~~1.2.25.5.1.2.24.5.~~ Signs shall be designed to allow for the addition of future donors.

~~1.2.25.6.1.2.24.6.~~ Signs shall be designed to be updated with little or no modification to the existing signage.

~~1.2.26.1.2.25.~~ Custom Signage:

~~1.2.26.1.2.25.1.~~ Custom signage identifying a permanent space shall also include ADA compliant identification.

~~1.2.26.2.1.2.25.2.~~ Custom Signage may be illuminated.

~~1.2.26.2.1.2.25.2.1.~~ Illuminated signs shall be UL listed.

~~1.2.26.2.2.1.2.25.2.2.~~ Lamp types shall be reviewed by Owner.

~~1.2.26.2.3.1.2.25.2.3.~~ Signs shall be designed to prevent excessive heat build-up.

~~1.2.26.2.4.~~ Electrical service shall be concealed.

~~1.2.27.1.2.26.~~ UI Housing Residential Bathroom / Shower Rooms:

~~1.2.27.1.2.26.1.~~ Provide wall mount sign with insert to post custodial cleaning times.

1.3. Exterior Signage:

- 1.3.1. Refer to Exterior Signage Details in Appendices for examples of sign types.
- 1.3.2. New buildings shall have at least one (1) major building identification sign located within 5-to-20 feet of the building's main entrance.
- 1.3.3. Secondary building entrances may be signed with a smaller building identification sign if the entrance is open to general public access and has public exposure.
- 1.3.4. Signs shall be perpendicular to building face.
- 1.3.5. Tallest point of sign be nearest to the building face.
- 1.3.6. Final locations shall be reviewed and approved by the Owner.
- 1.3.7. Signs or lettering shall not be applied to an exterior building surface.
- 1.3.8. Design Professional shall identify signage locations on site drawings.

1.4. Signage Installation:

- 1.4.1. Verify with Owner prior to specifying mounting systems which will permanently impact architectural finishes.
- 1.4.2. Wall Mounted Signage:
 - 1.4.2.1. Typical wall-mounted sign installation shall be double-sided foam tape and silicone adhesive.
 - 1.4.2.2. Signs exceeding the adhesive strength of double-sided foam tape shall have additional threaded studs attached to wall surface.
 - 1.4.2.3. Projecting flag identification shall be mechanically fastened to wall.
- 1.4.3. Signs mounted to glass shall have a backer panel of matching size on the second surface of the glass.
- 1.4.4. Stone Mounted Signage:
 - 1.4.4.1. Architectural lettering shall be securely mounted with vandal and tamper resistant method appropriate to wall surface.
 - 1.4.4.2. Threaded studs, set in non-shrinking grout, shall be used wherever possible.
 - 1.4.4.3. Signs and lettering mounted to limestone or similar natural stone surfaces shall not use silicone adhesive or double-sided tape.

1.4.5. Ceiling Mounted Signage:

1.4.5.1. Signs hanging from ceiling or projecting from wall shall be mounted away from sprinklers and shall not obscure site lines to fire exit signage.

1.4.5.2. Bottom of sign shall be above door swing.

1.4.5.3. Sign shall be attached to structure, fastened to drywall, plaster, or suspended by cable. Cable shall be stainless steel and aircraft quality or equal.

1.4.5.4. Signs shall not be attached to suspended ceiling grid systems.

1.4.5.4.1. If structure is inaccessible, review alternatives with Owner.

1.4.5.4.2. Hole where cable passes through ceiling tile shall match dimension of suspension system.

2. Visual Display and Bulletin Boards:

2.1. Bulletin boards in public areas shall be enclosed for all non-UI Housing facilities.

2.2. For UI Housing:

2.2.1. Bulletin boards in public areas shall not be enclosed.

2.2.2. Provide a tack surface at reception desk, using same cork as tack boards.

2.2.3. Provide one (1) 18-inch by 24-inch tack board per student room.

2.2.4. Provide one (1) 4-foot by 6-foot tack board in bathroom / shower POD alcove / vestibule.

2.2.5. Provide one (1) 4-feet by 8-feet tack board in corridors, per house, on sleeping floors.

2.2.6. Provide a glass marker board in seminar room, study rooms, and the student government office.

3. Restroom Accessories:

3.1. General:

3.1.1. For UIHC:

3.1.1.1. Approved Manufacturers: Bobrick, Bradley or American Specialties.

3.1.1.2. Units listed below are based on Bobrick.

3.1.1.3. Other manufacturer's models must be equal to the listed Bobrick models.

3.2. Toilet Partitions

3.2.1. Partitions shall be compact laminate material, of light color tone.

3.2.2. Fire rating must meet code requirements.

3.2.3. Partitions shall be wall or ceiling mounted to allow for Owner cleaning methods.

3.2.3.1. Overhead braces shall have anti-grip design.

3.2.3.2. Ceiling-supported partitions shall have a flip-over latch for closure.

3.2.3.3. Wall Hung Urinal Screens shall have integral wall-mounting flange or continuous wall-mounting bracket specified as a "Government Screen."

3.2.3.4. Blocking shall be installed for all wall-mounted partitions.

3.2.4. Partitions shall have one (1) through-bolted coat hook inside of each stall door. Coat hook shall be Strybuc 829C Chrome.

3.2.5. For Athletics:

3.2.5.1. Toilet partitions shall be floor mounted phenolic panels.

3.2.6. For UIHC:

3.2.6.1. Toilet Partition compartments shall be stainless steel or solid surface and ceiling hung.

3.2.6.2. Hardware for toilet compartments shall have a safety release latch that allows the door to be opened from the outside in the case of an emergency.

3.3. Hand Dryers:

3.3.1. ~~Constructor to provide~~ Provide one (1) hand dryer per two (2) lavatories, and a minimum of two (2) dryers for three (3) or more lavatories.

3.3.1.1. Acceptable hand dryers: World Dryer model Q-974A2, or Dyson Airblade V

3.3.2. Single unit installation height shall be 38-inches above finished floor to operable part of unit.

3.3.3. For two (2) units, one (1) shall be at 34-inches above finished floor and the second shall be at 41-inches above finished floor.

3.3.4. Install a 30-inch by 38-inch sheet of solid surface material under hand dryers.

3.3.4.1. When installing the Dyson Airblade V, specify the Dyson Airblade V hand dryer stainless steel back panel.

3.3.5. Color shall be reviewed with Owner.

3.3.6. UIHC

~~3.3.5.3.3.6.1.~~ Hand towels are required. Not hand dryers.

3.4. Sharps Containers:

3.4.1. Owner shall provide one (1) Sharps container for each restroom.

3.4.2. Manufacturer shall be Bemis 5-quart translucent beige, number 175 020 with wall-safe bracket and key.

3.4.3. Constructor shall mount in an unobstructed area, at 48-inches above finished floor to container inlet opening.

3.5. Paper towel dispensers:

3.5.1. For UIHC:

3.5.1.1. High use public [restroom](#) areas shall use Silhouette Wave'n Dry Electronic Touch-Free, Model #80000, color: Black.

3.5.1.1.1. When space does not allow for the option above, with Owner's approval, the following dispenser can be used: Full size stainless steel multi-fold paper towel dispenser – Bobrick B-2620 Keyless Surface Mounted.

3.5.1.2. [Single-Use](#) Public and Staff Restrooms, Exam Rooms, and Patient Rooms shall use the stainless-steel multi-fold towel dispensers.

3.5.1.2.1. Full size stainless steel multi-fold paper towel dispenser – Bobrick B-2620 Keyless surface Mounted.

3.5.1.2.2. Half size stainless steel multi-fold paper towel dispenser- Bobrick B-2621 Keyless Surface Mounted.

3.5.1.2.3. Verify full or half size at each location with Owner.

3.5.2. For UI Housing:

3.5.2.1. Paper towel dispensers shall only be installed in UI Housing staff break rooms and in commercial kitchens, where required by health department.

3.5.3. For Athletics:

3.5.3.1. Dispensers will be Owner furnished - Contractor installed.

3.5.3.2. Coordinate paper towel dispenser type with Owner.

3.6. Toilet Tissue Dispensers:

3.6.1. Owner shall provide one (1) triple-roll Renown toilet tissue dispenser per water closet.

3.6.2. Constructor to mount dispenser above the ADA handrail (if present) on the wall adjacent to the latch side of the stall door (if present).

3.6.3. Toilet tissue dispenser locking mechanism shall not be blocked by ADA handrails.

3.6.4. For UIHC:

[3.6.4.1. For high use public restrooms, owner to provide multi-role dispenser.](#)

~~3.6.4.1~~3.6.4.2. Bath Tissue Dispensers shall be two (2) roll stainless steel, satin, ASI 74022-H (Semi recessed where possible or surface mounted on masonry walls) or equivalent.
Mounted below handrail.

3.6.5. For Athletics:

3.6.5.1. Coordinate toilet tissue dispenser type with owner

Soap Dispensers:

3.6.6. Owner shall provide Renown foam soap dispensers.

3.6.7. Constructor to wall mount soap dispenser above each lavatory.

3.6.8. Allow enough space to open and fill dispenser.

3.6.9. For UIHC:

3.6.9.1. Renown FX (Provided by EVS)

3.7. Infant Changing Stations:

3.7.1. Stations shall be vertical, surface mounted, plastic. Koala Bear Care or Owner approved equal.

3.7.2. For UIHC:

3.7.2.1. Stations shall be horizontal, stainless steel, surface mounted. Koala Bear Care KB310-SSWM or Owner approved equal.

3.7.3. For UI Housing:

3.7.3.1. For new construction and remodel:

3.7.3.1.1. Stations shall be horizontal, stainless steel, recessed mounted. Koala Bear Care KB310-SSRE or Owner approved equal.

3.7.3.2. For installations in existing spaces:

3.7.3.2.1. Stations shall be horizontal, stainless steel, surface mounted. Koala Bear Care KB310-SSWM or Owner Approved Equal

3.8. Toilet and Bath Accessories

3.8.1. For UIHC:

[3.8.1.1.](#) Grab bars – B6806 Series; 1 ½-inch diameter which conform with ADA regulations.

~~3.8.1.1.~~ [3.8.1.1.1.](#) [UIHC restrooms require vertical grab bars at all locations with horizontal grab bars](#)

3.8.1.2. Towel bar – B674.

3.8.1.3. Mirror – B290 Series.

3.8.1.4. Towel hook – B6717.

3.8.1.5. Robe hooks – B671.

3.8.1.6. Shower seat ~~– HEWI hinged seat model 900-51821590~~ [Bobrick folding seat models B-918116 \(1K lbs capacity for patient showers\) & B-5181 \(360 lbs capacity for staff only showers\).](#)

3.8.1.7. 4-inch stainless-steel Bobrick shelf

3.8.1.8. Foot operated surgical soap dispenser – B119.

3.8.1.9. Toilet Seat Cover Dispenser - Silhouette Toilet Seat Cover Dispenser, Model #19510, color: Black Translucent – 16 1/8- inch wide by 11 7/8-inch height by 3 1/8-inch, 1-pound.

3.8.1.10. Sanitary Napkin Receptacle – Bobrick B-270. Used only in multi stall restrooms.

3.9. Mop Holders:

3.9.1. For UIHC:

3.9.1.1. Mop holders – B233.

3.9.2. For UI Housing:

3.9.2.1. Utility Rooms provide utility shelf/mop and broom holder with, drying rod, hooks, and mop/broom holders.

3.10. Integral Wall Trashcans:

3.10.1. For UI Housing:

3.10.1.1. Integral wall hung trashcans shall not be used.

4. Fire Extinguishers:

4.1. All extinguishers shall be manufactured by Amerex, Ansul, or Owner approved equal.

4.2. The Constructor shall provide and install all fire extinguishers.

4.3. Fire extinguishers shall be as follows and shall include UI Housing:

4.3.1. Public areas and laboratories shall be Amarex B402 – 5-pound multi-purpose (ABC) dry chemical fire extinguisher.

4.3.2. Laboratories shall be Amarex 322 – 5-pound carbon dioxide (CO2) fire extinguisher.

4.3.3. Electrical rooms (where required) shall be Amarex 330 - 10-pound carbon dioxide (CO2) fire extinguisher.

4.3.4. Mechanical rooms and high hazard rooms shall be Amarex B456 – 10-pound multi-purpose (ABC) dry chemical fire extinguisher.

4.4. For UIHC:

4.4.1. Where interior fire extinguisher cabinets are installed, furnish with one (1) 5-pound ABC extinguisher. ~~carbon dioxide fire extinguisher (Amerex 322) and one (1) 2 ½ gallon water extinguisher (Amerex 240 or approved equal).~~

4.4.2. Mechanical rooms shall be 10-pound 4A 80BC rated ABC dry chemical fire extinguisher with maximum spacing of 50 feet per NFPA 10 for a high hazard area. Amerex B-456 or Owner approved equal.

4.4.3. Electrical rooms shall have a 10-pound carbon dioxide fire extinguisher minimum, for larger rooms a 15-pound carbon dioxide fire extinguisher shall be used with a maximum spacing of 30 feet per NFPA 10 for extra high hazard. Amerex 330 (10-pound) or 331 (15-pound) or Owner approved equal.

4.4.4. Generator locations shall have minimum 10-pound, Purple K, dry chemical fire extinguisher. Amerex B-460 (10-pound) or B-415 (20-pound) or Owner approved equal.

5. Fire Extinguisher Cabinets:

5.1. Extinguishers shall be installed in a cabinet for all new construction.

5.2. Cabinets shall be used in all public areas, i.e., corridors, lounges, lobbies, gathering spaces.

5.2.1. Cabinet shall be Larson 2409-R2 with full acrylic view. 24-inches high x 9-inches wide x 6-inches deep to hold a 5 or 10-pound ABC extinguisher or ~~105~~-pound CO2 extinguisher.

5.2.2. Cabinet shall have friction-type device to keep the door closed, not a keyed-lock.

5.2.3. Extinguishers may be wall-hung if renovation project in laboratories, electrical rooms, and mechanical rooms do not allow enough space for cabinet installation.

5.3. For UIHC:

5.3.1. Interior Fire Extinguisher Cabinets shall be Stainless Steel, Clear Tempered Glass, Vertical Duo Style, vertical Red Lettering, with Flat Fully Recessed trim. Larsen 2720-R or Owner approved equal.

5.3.2. Exterior Fire Extinguisher Cabinets shall be chemical resistant fiberglass construction, red in color, with acrylic window, stainless steel hinges and rivets, stainless steel quick-opening latches and door sealing gasket. Brooks Model FGC26 or Owner approved equal.

5.3.3. All cabinets shall be mounted so the handle of the tallest fire extinguisher in the cabinet is 42-inches above finished floor.

6. Automatic Electronic Defibrillator and Bleeding Control Kit Stations:

6.1. Automatic Electronic Defibrillators:

6.1.1. AED are required. Review requirements with Owner.

6.1.2. UI Department of Public Safety shall be notified when an AED will be included in a project.

6.1.3. AED shall be Philips HeartStart Onsite model HS-1 with Onsite Semi-Rigid Standard Carry Case and Philips Fast Response Kit.

6.2. Bleeding Control Kits:

6.2.1. Bleeding Control Kits shall be North American Rescue Basic PABC 8-Pack – Nylon, item 80-0460.

6.3. AED and Bleeding Control Kit Cabinets:

6.3.1. AED cabinet shall be sized to allow for storage of AED and a Bleeding Control kit.

- 6.3.2. Cabinet shall provide a shelf to store the AED above the Bleeding Control Kit.
- 6.3.3. Cabinet shall be manufacturer finished - painted steel or brushed stainless steel.
- 6.3.4. Cabinet shall be constructed with a full acrylic (glass) view-type door with a roller (cam) latch.
- 6.3.5. Cabinet shall be equipped with a 200900-alarm system with strobe.
- 6.3.6. Cabinets shall be:
 - 6.3.6.1. Modern Metal Products 104SR3 semi-recessed, or Modern Metal Products 104R1, fully recessed.
 - 6.3.6.2. JL Industries 2017F10SA semi-recessed, full acrylic view-style door with strobe alarm, or JL Industries 2015F10SA, fully recessed, full acrylic view-style door with strobe alarm.

7. Lockers

7.1. For UIHC:

7.1.1. Staff lockers

7.1.1.1. Two (2) person duplex lockers, 15-inch wide, mortise and tenon door frames, finished end panels, sloping tops, "Z" type closed bases, friction catch latch for use with padlocks.

~~7.1.1.1.~~7.1.1.2. Extend lockers to ceiling or add soffit.

~~7.1.1.2.~~7.1.1.3. Soundproof, "Quiet" lockers. No combination locks.

~~7.1.1.3.~~7.1.1.4. Approved Manufacturers: Penco, Lyon, Republic Steel, [Herman Miller](#).

7.1.2. Patient/Visitor lockers shall have ~~COMPX REGULATOR keyless locks-K20, KP20 Series Cabinet Lock~~ or approved equal.

8. Cubicle Curtains:

8.1. For UIHC:

8.1.1. Comply with NFPA 13. Mesh extensions of 18-inches required on top of curtain unless coordinated with sprinkler installation.

8.1.2. Owner shall approve chosen design.

8.1.3. Cubicle Track and IV Track: Surface mounted track and carrier assemblies: "On the Right Track," General Cubicle or Owner approved equal.

9. Alcohol-Based Gel Dispensers:

9.1. Shall not be installed in corridors that are less than 6-foot wide.

9.2. There shall be at least 4-foot of space between dispensers.

9.3. Dispensers shall not be hung within 6-inches of or directly above adjacent ignition sources (including outlets and switches), measuring out from the center of the dispenser.

9.4. The dispensers shall be hung 42-to-48-inches above the finished floor.

10. Projection Screens:

10.1. Screen size, surface and placement shall be specified or approved by ITS EI-Physical Infrastructure.

10.2. Provide motorized tension projection screen when screen size is larger than 50-inches by 80-inches.

10.3. For UIHC:

10.3.1. Manual projection screens shall be specified.

10.3.2. Owner approval required for motorized project screens.

10.3.3. Manual with controlled screen return (CSR): Approved manufacturers are Da-Lite Advantage or Draper.

10.3.4. Tensioned concealed (recessed) ceiling mounted, motorized: Approved manufacturers are Da-Lite Tensioned Advantage Electrol or Tensioned Advantage Deluxe Electrol, Draper Tensioned Access/Series V and Stuart – for high resolution and specialized viewing applications.

11. TV Brackets:

11.1. For UIHC:

11.1.1. Television Brackets shall be model to fit TV specified by Owner.

11.1.2. FSR boxes shall be used behind public TVs.

11.1.3. Specific models and locations shall be coordinated with Owner.

11) EQUIPMENT

- 1. For UIHC:
 - 1.1. Ice Machines:
 - 1.1.1. Scotsman with dual filter system.
 - 1.2. Blanket warming cabinets:
 - 1.1.2. Coordinate selection with Owner.

12) FURNISHINGS

- 1. Window Treatments
 - 1.1. Window treatment shall match building standard.
 - 1.2. Basis of Design shall be MechoShade.
 - 1.3. Roller shades are preferred.
 - 1.4. Shade opacity shall be reviewed with Owner.
 - 1.5. Exterior shades are not allowed.
 - 1.6. For UIHC:
 - 1.6.1. Shades shall be Mecho/5 or Slimline.
 - 1.6.2. Coordinate shade and fascia color with Owner.
 - ~~1.6.3. Staff areas to have manual shades. Patient rooms to have m~~Motorized shades. They shall have all shade pockets verified for levelness by Constructor prior to ceiling work being completed and shade installed.
 - 1.7. For UI Housing:
 - 1.7.1. Manual Shades: Provide in the following rooms with indicated fabric type:
 - 1.7.1.1. Seminar rooms and apartment bedroom windows located on public space floors. Fabric shall be blackout type.
 - 1.7.1.2. Public spaces such as, mail room, commons, study rooms, offices, small lounges, and apartment rooms (other than apartment bedrooms) on public space floors. Fabric shall be sheer type.
 - 1.7.2. Motorized shades: Provide in the following rooms with indicated fabric type:

1.7.2.1. Dining, recreation type, lobby, large lounges. Fabric shall be sheer type and shades shall be connected to building's automated shade control system.

1.7.2.2. Multi-purpose rooms. Fabric shall be blackout type and shades shall not be connected to building's automated shade control system.

1.7.3. Shade opacity shall be reviewed with the Owner prior to construction.

13) SPECIAL CONSTRUCTION

1. Radiation Protection:

- 1.1. Laser radiation protection designs shall be submitted to the UIHC Laser Safety Panel for review and approval.
- 1.2. Class 3b or Class 4 laser use rooms shall be provided with an entryway control system.
- 1.3. The safety control design shall include the following: Lighted signage, area control, barriers, and emergency ingress/ egress.
- 1.4. Other considerations: local fume exhaust, general exhaust, water supply, drains, electrical supply, non-reflective surfaces, windows, hazardous material storage, electrical shielding, and electrical isolation systems.

14) CONVEYING SYSTEMS

1. General:

- 1.1. The hydraulic oil tank of any conveying system such as an elevator, lift, or escalator as well as piping shall comply with the SPCC requirements if the capacity of the system is 55 gallons or more. Refer to ENVIRONMENTAL COMPLIANCE section above.

2. Elevators

2.1. General:

- 2.1.1. New elevators shall be designed to the current ASME/ANSI A17.1, Safety Code for Elevators and Escalators.
- 2.1.2. Provide a minimum of one (1) elevator per each new building with inside car dimension minimum 96-inches by 70-inches and a door opening width of 48-inches.
- 2.1.3. Access to basement and penthouse mechanical spaces shall be provided.
 - 2.1.3.1. Minimum of one (1) elevator shall provide service to mechanical penthouses.
- 2.1.4. Modernizing existing elevators shall be designed to current ASME/ANSI A 17.3, Safety Code for Existing Elevators and Escalators.
- 2.1.5. Passenger elevators shall be high-efficiency electric traction with a machine room designed to current ASME/ANSI A17.1 Safety Code for Elevators and Escalators.
- 2.1.6. Hydraulic elevators may be considered for fewer than four (4) stops or when higher load capacities are required.
- 2.1.7. Elevator machine rooms, hoist ways, and lobby spaces shall be environmentally conditioned to allow for proper operation of the elevator.
- 2.1.8. An Elevator pit shall have a sump pit, a sump pump with an alarm connected to the building control system, and no floor drain.
- 2.1.9. Provide one (1) GFCI receptacle in the elevator car.
- 2.1.10. Elevator cars shall be provided with wall protection pads and installation hooks.
- 2.1.11. Elevator car lighting shall be LED.
- 2.1.12. Elevator Telephone:
 - 2.1.12.1. Elevator telephone compartments shall accommodate RAMTEL PN# 733 M
 - 2.1.12.1.1. RAMTEL Telephone shall be provided by Owner and installed by Constructor.
 - 2.1.12.1.2. Constructor to contact Owner for rough-in template.

- 2.1.12.2. Provide shielded cabling for telephone. Cabling shall be grouped with the car traveling cable.
- 2.1.12.3. Owner shall furnish communication line verification devices which shall be connected to the controller using shielded wire.
- 2.1.13. Control system shall be provided with all available diagnostic tool functions, either onboard or in a separate device.
 - 2.1.13.1. Acceptable manufacturers for Controllers:
 - 2.1.13.1.1. Motion Control Engineering (MCE)
 - 2.1.13.1.2. GAL Manufacturing Corporation
 - 2.1.13.1.3. Elevator Controls Corporation (ECC Pixel)
 - 2.1.13.2. Coordinate removal of elevator from service with Owner.
- 2.1.14. Elevator shall have an electronic door screen reopening device.
- 2.1.15. Keys for Independent Service shall be EX513, Access Key EX514, and the light, fan, run/stop key EX511
- 2.1.16. Certificate frames shall be model CF34 Quality Elevator Products with a window dimension of 3 ½-inch by 4 ¼-inch.
- 2.1.17. Controls shall be vandal proof.
- 2.1.18. Perform complete elevator performance check, with Owner present, prior to final State Elevator Inspection.
- 2.1.19. Approved manufacturers and installers shall have been in operation for a minimum of five (5) years and able to meet the response time requirements during any warranty and free service period.
- 2.1.20. Spill-containment shall meet SPCC standards (40 CFR 112).
- 2.1.21. Maintenance, adjustment, and troubleshooting devices or systems shall provide unrestricted access to all parameters, levels of adjustment, and flags necessary for maintenance of equipment.
 - 2.1.21.1. Expiring software, degrading operation, or key shall not be accepted.
- 2.1.22. Manufacturer shall make spare parts available for purchase by the Owner's Elevator Maintenance Constructor.
- 2.1.23. Manufacturer shall provide technical support to the Owner's Elevator Maintenance Constructor for installation, adjustment, maintenance or troubleshooting assistance.
- 2.1.24. Elevators shall be installed by the manufacturer, or a qualified installer licensed in the State of Iowa and able to meet the response time requirements of any warranty or service agreement.

2.1.25. Maintenance and Repair Service:

2.1.25.1. Provide monthly examinations, adjustments, repairs, and lubrication of the elevator equipment for a period of twelve (12) months after the elevator has been accepted as substantially complete.

2.1.25.1.1. Provide 24-hour callback service, including travel time and mileage, during this period at no charge to the Owner.

2.1.25.2. Service shall not cover adjustments, repairs, or replacement of parts due to negligence, misuse, abuse, or accidents caused by persons other than the elevator Constructor.

2.1.25.3. All parts and supplies shall be same as originally used in manufacture and installation.

2.1.25.4. Call-Back Response Time:

2.1.25.4.1. Response to requests for emergency or warranty service, both during regular working hours and outside of regular working hours, shall be a maximum of fifteen (15) minutes by telephone and sixty (60) minutes to arrive on site.

2.1.25.4.2. Call-backs are defined as labor required to free trapped passengers from elevators and/or to make repairs and adjustments to return an elevator to service.

2.1.25.5. Elevator Constructor shall maintain Owner's complete, updated set of straight-line wiring diagrams. Drawings shall be updated with as-built conditions and reflect any changes to circuits resulting from control modifications, parts replacement, or equipment upgrades made during the term of Service.

2.1.26. Constructor shall provide to Owner the Manufacturer's:

2.1.26.1. Spare Parts

2.1.26.2. Manuals

2.1.26.3. Safety and Software Upgrades

2.1.26.4. Electronic tools

2.1.26.5. Adjusting Information

2.1.26.6. Wiring Diagrams

2.1.26.7. Full List of Fault Codes with definitions

2.1.26.8. Product Data:

2.1.26.8.1. Signal and operating fixtures, operating panels, and indicators.

2.1.26.8.2. Electrical characteristics and connection requirements.

2.1.26.8.3. Expected heat dissipation of elevator equipment in machine room.

2.1.27. Submittals and Shop Drawings shall include the following:

- 2.1.27.1. Buffers and other components in hoist way.
- 2.1.27.2. Maximum rail bracket spacing.
- 2.1.27.3. Maximum loads imposed on guide rails requiring load transfer to building structure.
- 2.1.27.4. Loads on hoisting beams.
- 2.1.27.5. Clearances and travel of car.
- 2.1.27.6. Clear inside hoist way and pit dimensions.
- 2.1.27.7. Location and sizes of access doors, hoist way entrances and frames.
- 2.1.27.8. Rail attachment.
- 2.1.27.9. Cab design, dimensions, and layout.
- 2.1.27.10. Hoist way-door and frame details.

2.1.28. Operations and Maintenance Manuals shall include:

- 2.1.28.1. Wiring diagrams
- 2.1.28.2. Adjusting information
- 2.1.28.3. Fault code information

2.1.29. For UIHC:

- 2.1.29.1. Coordinate installation of HCIS equipment (wireless access point, antenna, network switch, camera).
 - 2.1.29.1.1. Equipment shall be provided by Owner and installed by contractor.
 - 2.1.29.1.2. Access control requirements for elevator shall be approved by UIHC Safety & Security.
- 2.1.29.2. Provide an additional traveling cable for 6-strand single-mode fiber with 14/3 AWG wire for connection to HCIS equipment and 120-volt critical/emergency power electrical outlet at car top. Termination of fiber shall be by Contractor.
- 2.1.29.3. Elevator firefighter control panel shall be located within the RCP - Fire Command Center or elevator lobby shall be approved by UIHC Safety & Security.
- 2.1.29.4. Elevators used for patient transport:
 - 2.1.29.4.1. Shall include an auxiliary car operating panel.

2.1.29.4.2. Shall have perimeter lighting Man-D-Tech by DecaLite.

2.1.29.5. Elevators shall include a voice synthesizer for messages to be announced in English and Spanish (sequentially) with special non-standard announcement capabilities as directed by the Owner.

2.1.29.6. The GFCI receptacle shall be 120-volt tamperproof, red bodied, hospital grade, GFCI protected electrical outlet at 18-inches above finish floor.

2.1.29.7. Provide an additional 120-volt critical/emergency power electrical outlet at car top for HCIS provided network switch.

2.1.30. For UI Housing:

2.1.30.1. Facilities provide one (1) freight elevator connecting same levels as residential elevators plus rooftop penthouse, loading dock, foodservice storage, and foodservice kitchen.

2.1.30.2. If design configuration does not allow main freight elevator connection of loading dock/ foodservice storage room directly to foodservice kitchen, provide a second freight elevator to connect loading dock/foodservice storage area to foodservice kitchen.

2.1.30.3. If loading dock, foodservice storage room and foodservice kitchen are on same floor, freight elevator connection is not required.

2.1.30.4. Facilities provide one (1) special purpose elevator to connect street level lobby/entrance with residence hall lobby and dining facility lobby. This "Public" elevator shall not connect to residence hall floors.

2.2. Elevator finishes:

2.2.1. Freight elevators shall have textured aluminum or textured steel floors. Wall finishes shall be steel.
(Also applicable to UIHC.)

2.2.2. Passenger elevator shall have entry-mat quality carpet tile floors or hard surfaces.

2.2.2.1. Carpet tiles shall not contain animal hair.

2.2.2.2. Hard surface options include terrazzo and VCT.

2.2.2.3. Rolled goods shall not be used.

2.2.3. For UIHC:

2.2.3.1. Upper wall panels shall be plastic laminate; Blonde Echo 7939 by WilsonArt.

2.2.3.2. Lower wall panels shall be stainless steel, Linen by Rigidized Metals.

2.2.3.3. Ceilings shall be stainless steel; Aurora Satin Stainless Steel by SnapCab.

2.2.3.4. Flooring shall be Gerflor Mipolam Symboiz #6044 Sea Storm.

2.2.3.5. Bumper Rails shall be installed on both sidewalls and rear wall and shall be 4-inch stainless steel satin finish flat bar type.

2.2.4. For UI Housing:

2.2.4.1. Elevator floors shall be luxury vinyl tile only and interiors of passenger elevators shall be constructed of Forms+Surfaces material.

3. Lifts:

3.1. Vertical platform lifts and incline stair lifts are not allowed.

3.2. Loading dock lifts for material transportation are allowed.

3.3. For UIHC:

3.3.1. Patient Lifts shall be by ARJO.

3.3.2. Lifts are Owner supplied and Owner installed.

3.3.3. Coordinate with Owner during design to include lift accommodations.

4. Escalators:

4.1. Escalators are not allowed.

4.2. For UIHC

4.1-4.2.1. Escalators are allowed.

5. Pneumatic Tube (Transport) Systems:

~~5.1. Must meet existing system. System shall be by Swisslog.~~

~~5.2. Programming of the system shall be by Swisslog.~~

~~5.3. Existing system is a 4 inch by 7 inch oval system maintained by Pevco Systems International.~~

~~5.4. New construction shall use 6 inch round system by Swisslog.~~

~~5.5. All pneumatic tube systems shall be purchased by the Owner, coordinated by contractor.~~

5-6-5.2. Refer to UIHC PNEUMATIC TUBE SYSTEM draft specification in appendices.

15) **RESERVED FOR FUTURE EXPANSION**

16) **RESERVED FOR FUTURE EXPANSION**

17) **RESERVED FOR FUTURE EXPANSION**

18) **RESERVED FOR FUTURE EXPANSION**

19) **RESERVED FOR FUTURE EXPANSION**

20) *RESERVED FOR FUTURE EXPANSION*

21) FIRE SUPPRESSION

1. General:
 - 1.1. New buildings shall be designed with automatic fire protection systems throughout the building.
 - 1.2. Major renovations (20,000 square feet or more) shall be designed with automatic fire suppression systems in the space renovated.
 - 1.3. Wet pipe type system is preferred.
 - 1.4. Partially renovated buildings shall be considered for automatic wet sprinkler fire protection coverage during the design scope of the project.
 - 1.5. All projects shall be hydraulically recalculated to prevent incorrect information from old hydraulic calculations.
 - 1.6. System shall be designed in accordance with NFPA and FM Global for the application intended.
 - 1.7. Each individual floor shall be isolated into its own sprinkler zone.
 - 1.8. Size exterior fire department connections according to requirements of the local authorities having jurisdiction.
 - 1.9. Sprinkler system tamper and flow valves shall be monitored by the building's fire alarm panel.
 - 1.10. Use dry pipe system in non-heated areas in lieu of chemical system.
 - 1.11. Fire pump room shall have outdoor and direct interior access.
 - 1.12. Identification shall be provided on all equipment and piping.
 - 1.13. Wall and Ceiling Access Doors:
 - 1.13.1. Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.
 - 1.13.2. Size to allow maintenance access all concealed valves and equipment.
 - 1.14. Fire protection systems shall be installed per NFPA IFC, IBC.
 - 1.15. Materials and equipment shall be specifically approved, listed, and labeled for fire protection service by UL or FM Global.
 - 1.15.1. All installations shall follow FM Global Lockout-Tagout process and procedures.
 - 1.15.2. System control valves shall be clearly locked and labeled to protect downstream systems until accepted by the Owner.
 - 1.15.3. Equipment identification tags shall be in the form of a plastic laminate tag located in a visible location on the equipment. If this is not possible, a brass tag on a chain attached to the equipment may be installed.

1.15.4. Pipe labels shall be white letters on red background with no directional arrows and shall be installed on both sides of a wall or floor penetrations and a maximum spacing of twenty (20) linear feet of piping and shall include the following text:

1.15.4.1. FIRE SPRINKLER (for all piping 2 inch or larger)

1.15.4.2. STANDPIPE (for all standpipes)

1.15.4.3. DRAIN (for all drain piping)

1.15.5. Pipe labels shall conform to ANSI A13.1 length and letter size shall meet the following minimum requirements:

O.D. of Pipe	Label Length	Size of Letters
Up to and including 1 ¼-inch	8-inch	½-inch
1 ½-inch to 2-inch	8-inch	¾-inch
2 ½-inch to 6-inch	12-inch	1 ¼-inch

1.16. Submittals and Shop Drawings shall include:

1.16.1. Hydraulic calculations,

1.16.2. Isometric drawings,

1.16.3. Sprinkler and drain piping,

1.16.4. Material/product cut sheets.

1.17. For UIHC:

1.17.1. The condition of the existing fire protection piping at the UIHC main campus shall be discussed during Design of the fire protection and suppression system as Microbiological Induced Corrosion (MIC) has been found within the existing fire protection piping.

1.17.2. Replacement of some sections of the existing fire protection piping grid may be required as a part of the project.

1.17.3. Renovations shall be designed with automatic fire suppression systems.

1.17.4. Pre-action systems may be installed in surgical suites and other areas programmed to include a high density of computer equipment or medical equipment only when required by code or requested ~~approved~~ by the Owner.

1.17.5. Inergen gaseous systems shall be installed below raised floors and shall be installed in conjunction with back-up pre-action systems in areas where water damage to equipment would be extremely expensive or disruptive to facility operations.

1.17.6. Sprinkler line draining required for construction may only be scheduled on a Monday, Tuesday, Wednesday, or Thursday.

1.17.7. Coordinate all equipment identification numbers with the Owner.

2. Piping and Pumps:

2.1. Piping:

2.1.1. Mains shall be run in hallways and corridors.

2.1.2. Mechanical joint piping systems may be used for fire protection systems.

2.1.2.1. If mechanical joint systems are used, fittings shall be rolled-grooved fittings.

2.1.2.2. Mechanical joint systems shall not be cut grooved.

2.1.2.3. Plain-end fittings shall not be used.

2.1.3. The fire department connection (FDC) shall be located as close as possible to a fire hydrant and the main Fire Alarm Control Panel.

2.1.3.1. Locate horn/strobe directly above the FDC on the exterior of the building.

2.1.4. Provide each standpipe take off with a 2 ½-inch by 1 ½-inch cap attached to a chain.

2.1.5. Hose threads shall conform to the standards for the Authority Having Jurisdiction.

2.1.6. Refer to UTILITY DISTRIBUTION DUPLEX BACKFLOW PREVENTOR STATION detail in appendices.

2.1.7. For UIHC:

2.1.7.1. All FDC shall be Croker, Potter-Roemer or Owner approved equal.

2.1.7.2. Minimum FM Global approved Schedule 40 steel sprinkler pipe shall be used for all water-based fire protection piping.

2.1.7.3. All sprinkler piping shall be concealed above ceilings.

2.1.7.4. Pre-action systems:

2.1.7.4.1. Shall be cross-zoned, double interlocked, self-resetting systems.

2.1.7.4.2. Pre-action systems shall be complete, prefabricated assemblies.

2.1.7.4.3. Manufacturers shall be Reliable or Viking "Total Pac".

2.1.7.5. Standpipes shall be installed in the corner of stairwells while allowing code required clearance.

2.1.8. Other Piping:

2.1.8.1. Wet systems – Use schedule 40 black ~~steel~~ iron piping

2.1.8.2. Dry systems and Pre-action systems – Use schedule 40 galvanized sprinkler piping

2.1.8.3. MRI/Magnet affected areas – Use copper piping with metal fusible link heads.

2.1.8.4. Piping before backflow preventer – Use cement lined ductile.

2.2. Pumps:

2.2.1. Fire pump electrical feeder shall originate from its own dedicated outdoor transformer or from the load side of the main building transformer, ahead of all secondary disconnects.

2.2.2. Electric fire pump controllers shall be equipped with automatic transfer switch (emergency power).

2.2.2.1. The transfer switch shall be equipped with its own listed disconnect means.

2.2.3. Fire pump controller shall be wired directly from normal power and emergency power sources.

2.2.3.1. Other disconnects, including molded cases, between controller and power source(s) shall not be allowed.

2.2.4. Fire pumps shall be horizontal split-case with electric motor and OSHA acceptable coupling guards. Fire pump and motor shall be mounted on a one-piece steel frame.

2.2.5. Pump shall be sized to eliminate the need for pressure relief valves.

2.2.6. All fire pump piping drain points shall be extended to a floor drain or trench drain capable of handling the normally expected drainage from the system.

2.2.7. Jockey pumps shall be manufactured by the same company as the associated main fire pump.

2.2.8. For UIHC:

2.2.8.1. Fire pump controllers shall be manufactured by Master Control Systems.

2.2.8.2. Fire pump controllers shall be the primary reactor type with an automatic transfer switch for transfer of the load to an auxiliary generator.

2.2.8.3. Fire pump controllers shall be the across-the-line type for combined manual and automatic transfer.

2.2.8.4. Fire pump controllers shall be housed in NEMA 12 enclosures.

2.2.8.5. Fire pump controllers shall be interconnected to the existing fire alarm central processing unit.

2.2.8.6. Fire pump controllers shall be installed on concrete housekeeping pads to avoid water from entering the base of the enclosure.

2.2.8.7. Fire pumps shall be manufactured by ITT A-C Pump, Aurora Pump, Peerless, or Owner approved equal.

2.3. Valves:

2.3.1. Valves shall be located to allow access without requiring additional equipment to operate.

2.3.2. Zone valves:

2.3.2.1. Zone valve shall be located on the floor being served. Check valves and zone main drains shall accompany zone valve.

2.3.2.2. Zone valves shall be in a fire protected enclosure (stairwell) at a maximum 7 feet above finished floor.

2.3.3. Zone Valve Cabinets:

2.3.3.1. Cabinets shall be 32-inches wide by 34-inches high by 8-inches deep with solid cover (no glass).

2.3.3.2. Basis of Design shall be Larsen Model HC3234-R for recessed units and Larsen Model HC-3234-SM for surface-mounted units or equivalent by Samson or Potter-Roemer.

2.3.3.3. Zone valve cabinets shall, per the direction of the Owner, be either white or painted to match the adjacent area.

2.3.3.4. Zone valve cabinets shall be provided with the manufacturer's standard cylinder lock with flexible cam. Coordinate keying with the Owner.

2.3.4. Hose valves shall be located in the cabinet to allow for placement of one (1) 5-pound carbon dioxide fire extinguisher and one (1) 2 ½-gallon water extinguisher.

2.3.4.1. Fire hose valve cabinets shall be mounted so the handle of the tallest fire extinguisher in the cabinet is 42-inches above finished floor.

2.3.4.2. During renovation projects, all existing fire hose valve cabinets shall be left active for as long as possible.

2.3.5. For UIHC:

2.3.5.1. Zone valves shall be installed in cabinets in corridors.

2.3.5.2. Zone valves shall be installed to allow zone control of wet sprinklers for all zones.

2.3.5.3. Exact location of all zone valves (including existing) shall be reviewed and approved by UIHC Safety and Security and Owner's Representative.

2.3.5.4. All zone valves shall be installed in cabinets.

2.3.5.5. Fire hose valve cabinets (for fire department connection)

2.3.5.6. Install fire hose valve cabinets only at locations where required by code. Coordinate locations with UIHC Safety & Security during design.

2.3.5.7. Fire hose valve cabinets shall be stainless steel, fire rated, vertical duo clear tempered safety glass, with red vertical lettering and ¼-inch flat trim.

2.3.5.8. Design basis shall be Larsen Model HC-2434-R for recessed units (typical) and Larsen Model 2434-SM, for surface-mounted units (Mechanical Rooms).

2.3.5.9. Alternate manufacturers shall be, Samson, or Potter-Roemer.

~~2.3.5.9.~~2.3.5.10. Monitored isolation valves shall be installed in electrical rooms with a low point drain. \$\$

2.3.6. For UI Housing:

2.3.6.1. OSY valves only where required by code.

2.3.6.2. All other valves shall be butterfly and ball valves.

2.4. Drains:

2.4.1. Drainage piping shall be provided for all test locations that is sufficient to carry the full flow of water that can be expected during testing of the systems.

2.4.2. Main drain shall be parallel with the sprinkler riser.

2.4.3. Floors above ground shall be designed to drain to the exterior of the building, while below grade floors shall be designed to drain to sanitary sewer or, if possible, daylight, with auxiliary drains installed to handle the remaining trapped water.

2.4.4. Drains that are piped to floor drains shall be at minimum 6-inch floor drains that can handle full flow discharge of a fully pressurized sprinkler system.

2.4.5. Design system to drain back to its individual floor zone valve.

2.4.6. If auxiliary or test drains are needed, coordinate with Owner.

2.4.7. Install a tamper-proof ball valve (with a zone addressable module) and a ½-inch drain leg in each electrical room or closet.

2.4.8. Exterior discharge of water shall be away from building entrances or populated areas, particularly at the location for testing the main drain of a system.

2.4.9. For UIHC:

2.4.9.1. Drains shall route to sanitary sewer.

2.5. Pressure Gauges:

2.5.1. A pressure gauge shall be installed on the main supply of each sprinkler system, upstream from the main test valve, and in each zone.

2.6. Sprinklers:

- 2.6.1. Design all sprinkler heads to fully comply with the NFPA 13 requirements for spacing, while considering soffits, ceiling-mounted medical equipment, cabinetry and other obstructions within a specific room or area.
- 2.6.2. Flexible sprinkler piping or heads shall not be allowed.
- 2.6.3. Sprinkler piping containing ethylene glycol shall be drained to a sanitary sewer.
- 2.6.4. For lay-in and metal pan ceilings, center all sprinkler heads in their respective ceiling tile.
- 2.6.5. For radiant panel ceilings, avoid installing sprinkler heads in active radiant panels.
 - 2.6.5.1. Where spacing requirements dictate that a sprinkler head must be installed in a location occupied by a radiant panel, locate the head such that it does not conflict with the radiant piping attached to the top of the panel.

2.6.6. For UIHC:

- 2.6.6.1. Facilities shall fully conceal sprinkler heads.

2.6.6.2. The standard head for light hazard installation shall be an FM Global- approved, quick response, fully concealed head.

~~2.6.6.2.~~ 2.6.6.3. [Flexible sprinkler piping is allowed within UIHC facilities.](#)

2.6.7. UI Housing:

- 2.6.7.1. Facilities shall fully conceal sprinkler heads.

2.7. Testing:

- 2.7.1. All piping shall be hydraulically tested and witnessed by the Owner.
- 2.7.2. Water based fire protection piping shall be hydrostatically tested for a period of two (2) hours at 200 psig, or 50 psi above the maximum system pressure, whichever is greater and with no loss of pressure.
- 2.7.3. Dry pipe fire protection piping shall be hydraulically tested for a period of two (2) hours at 200 psig or 50 psi above the maximum system pressure, whichever is greater, and with no loss of pressure. System shall undergo an additional air pressure test for a period of twenty-four (24) hours at 40 psi with no pressure loss.
- 2.7.4. Dry pipe fire protection systems shall be tested to ensure the installed air compressor can fill the system in less than thirty (30) minutes.
- 2.7.5. Clean Agent Fire Suppression systems shall be tested per NFPA 2001.
- 2.7.6. For new systems, back flow protection devices shall be tested and tagged with test ports and pressure gauges installed, prior to the system being put into service.
- 2.7.7. For new systems, contractor shall conduct a Forward Flow test that is witnessed by the owner's representative and AHJ.

22) PLUMBING

1. General:

- 1.1. Campus water distribution systems operate between 60 psig and 100 psig. Coordinate need for pressure reducing stations, or other application specific requirements, with Owner.
- 1.2. Domestic water heating systems shall be designed in accordance with Chapter 49 ASHRAE Handbook, HVAC System and Applications.
- 1.3. Desired temperature for normal faucet applications is a maximum of 110 degrees F at the point of usage.
- 1.4. Other applications may require varying temperatures (dishwashers, cage washers, etc.) and shall be individually evaluated. Install separate heaters or booster heaters at outlets requiring temperatures higher than 110 degrees F.
- 1.5. Pipes shall not be routed over electrical equipment rooms, telecom closets, elevator equipment rooms, elevator shafts and major medical equipment.
- 1.6. The Design Professional shall plan access for servicing and maintenance of equipment.
- 1.7. Piping riser shall not be routed through Custodial or IT Spaces.
- 1.8. Shut-off valves shall be provided at pipe branches and where required to facilitate partial system isolation. Each floor shall have a minimum of one (1) shut-off valve, located on the main branch.
- 1.9. Equipment, fixtures, or other appliances attached to any piping system shall have a shut off valve located at the connection to the piping system.
- 1.10. All valves shall be located with sufficient room for maintenance or replacement.
- 1.11. Additions to all new and existing supply piping shall extend off the top of the pipe, with the exception of condensate piping.
- 1.12. Wall and Ceiling Access Doors:
 - 1.12.1. Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.
 - 1.12.2. Size to allow maintenance access all concealed valves and equipment.
- 1.13. **For UIHC:**
 - 1.13.1. Plumbing risers that span more than two floors shall be install inside of chases.
 - 1.13.2. Ensure piping does not interfere with access to pneumatic transport tube diverter and HVAC system components.
 - 1.13.3. Install dielectric connections in the plumbing systems where any dissimilar metals are in contact.

2. Plumbing Identification:

- 2.1. Label all piping at least every 20-feet along all pipes, at least one (1) in every room and on both sides of walls that pipes penetrate.
- 2.2. Valve identification:
 - 2.2.1. All valves shall be tagged unless valves are ¾-inch in diameter and adjacent to equipment served.
 - 2.2.2. Valve tags shall include the valve number and project number.
 - 2.2.3. Coordinate the specific numbering sequence with the Owner during the construction phase of each project.
- 2.3. Equipment identification:
 - 2.3.1. Provide equipment identification on all equipment furnished under this division.
 - 2.3.2. Where practical, provide plastic laminate tags indicating the equipment identification number in a clearly visible spot.
 - 2.3.3. Where no appropriate flat surface exists for a plastic laminate tag, provide brass tags on chains attached to the equipment.
 - 2.3.4. Equipment tags are distinct from the Preventive Maintenance numbers that the Owner's personnel install after the construction phase.
 - 2.3.5. Coordinate all equipment identification numbers with the Owner.

2.4.—Medical Gas ~~Schedule:shall~~

2.4.1-2.4. ~~f~~Follow NFPA 99 labeling code. Include system pressure on tags. ~~Label medical gas pipes according to the following schedule:~~

2.4.1.

SYSTEM	LETTERS	BACKGROUND
Carbon dioxide	black	grey
Instrument air	white	red
Medical air	black	yellow
Nitrogen	white	black
Nitrous oxide	white	blue
Oxygen	white	green
Vacuum	black	white
WAGD	white	purple

2.5.—Plumbing ~~Schedule:pipes shall be labeled~~

2.5.1-2.5. ~~Label plumbing pipes~~ according to ~~ANSI/AMSE code chart.~~ the following schedule:

SYSTEM	LETTERS	BACKGROUND
Domestic cold water	black	light blue
Domestic hot water	black	light blue
Domestic hot water recirculation	black	light blue
Dionized water	black	light blue
Sanitary sewer	black	yellow
Sanitary vent	black	yellow
Storm drain	white	brown
Overflow storm drain	white	brown
Compressed air	white	black

2.5.2-2.5.1. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<u>OD of Pipe or insulation</u>	<u>Marker Length</u>	<u>Size of Letters</u>
Up to and including 1 ¼-inch	8-inch	½-inch
1 ½-inch to 2-inch	8-inch	¾-inch
2 ½-inch to 6-inch	12-inch	1 ¼-inch
8-inch to 10-inch	24-inch	2 ½-inch
Over 10-inch	32-inch	3 ½-inch

2.5.3-2.5.2. Acceptable Manufacturers: 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

3. Plumbing Piping Insulation:

3.1. General:

- 3.1.1. Insulation systems shall be compliant with Midwest Insulation Constructors Association (MICA) National Commercial and Industrial Insulation Standards, latest edition.
- 3.1.2. Insulate all piping systems per ASHRAE 90.1.
- 3.1.3. Systems shall be clean and dry prior to installing insulation.
- 3.1.4. Insulation that indicates exposure to moisture, including piping or ductwork condensation, shall be removed, and replaced. Wet insulation, or insulation that has been wet, will not be accepted.
- 3.1.5. After testing and cleaning, colder than ambient systems shall not be put into operation until insulation and vapor barriers are complete.
- 3.1.6. Joints shall be sealed using the Manufacturer's approved adhesive.
- 3.1.7. Elastomeric piping insulation installed outdoors shall be jacketed or coated.
- 3.1.8. Insulation and vapor barrier shall be continuous through all wall and floor penetrations and hangers.
- 3.1.9. Repair vapor barrier breaches on below ambient piping systems with ASJ tape or chilled water mastic.
- 3.1.10. All-service insulation laps and butt strips shall be securely attached. Joints that peel or gap shall be secured using outward-clench staples or mastic.
- 3.1.11. Appurtenances shall be insulated to prevent condensation or burn hazards. Seal joints on below ambient piping systems.

3.1.12. Wood or plastic block hanger inserts shall not be used.

3.2. Insulation Materials:

3.2.1. Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible.

3.2.2. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

3.2.3. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

3.2.4. Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

3.3. Storm Sewer Piping Insulation:

3.3.1. Where required, insulation shall be 1-inch.

3.3.2. Storm drain bodies shall be insulated.

3.3.3. Horizontal storm piping immediately downstream of the drain bodies shall be insulated to the first vertical elbow.

3.3.4. Sections of storm piping in noise-sensitive areas if such routing cannot be avoided.

3.3.5. Insulation Materials:

3.3.5.1. Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible.

3.3.5.2. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

3.4. Sanitary Sewer Piping Insulation:

3.4.1. Exposed sanitary piping in occupied spaces shall be insulated.

3.4.2. Insulation Materials:

3.4.2.1. Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible.

3.4.2.2. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

3.4.2.3. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame

spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

3.4.2.4. Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

3.5. Refrigerant Piping Insulation:

3.5.1. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

3.5.2. Vapor barriers shall be applied to all refrigerant return line insulation.

3.5.3. A weather-resistant covering or field-applied paint shall be applied on all exterior pipe insulation on refrigerant piping.

3.6. Jacket Covering:

3.6.1. Review with the Owner specific types of jacketing proposed for each installation.

3.6.2. Metal Jacket Covering:

3.4.2.5. Metal jacketing may be used on below ambient piping systems outside of the building.

3.4.2.6. Metal jacketing on steam and steam condensate systems may be banded, riveted, or screwed.

3.4.2.7. Metal jacketing on below ambient systems shall be banded, with all joints lapped and sealed with silicone. Screws and rivets shall not be used.

3.4.2.8. Minimum jacketing thickness shall be 0.020-inches.

3.6.3. PVC Jacket Covering:

3.4.2.9. Install PVC jacketing on all piping within Mechanical Equipment Rooms.

3.4.2.10. PVC jacketing shall be installed on exposed piping, other than steam and steam condensate, up to 8-feet above finished floor.

3.4.2.11. Minimum jacketing thickness shall be 0.020-inches.

3.4.2.12. Self-adhered flexible cladding systems shall not be used.

3.6.4. PVC Fittings:

3.4.2.13. Mineral fiber or pre-molded inserts shall prevent condensation at fittings. Refer to MICA Plate 2-500.

3.4.2.14. PVC fittings laps shall be mechanically fastened with stainless steel tacks, outward-clench staples, or ASJ tape.

3.4.2.15. PVC tape alone is not acceptable.

3.4.2.16. Joints on PVC fittings on below-ambient systems shall be sealed with mastic or taped with PVC or ASJ tape to maintain vapor barrier.

3.7. Hanger Inserts:

3.7.1. Piping shields shall be installed at hangers and supports.

3.7.2. Shields shall be mechanically secured to the piping by tape, bands, or other visible method.

3.7.3. Provide rigid insulation inserts at hangers for Domestic Water systems pipe sizes 2-inches and larger.

3.7.4. Inserts shall be a minimum 180 degrees and extend a minimum of two (2) inches beyond the hanger shield. Refer to MICA Plate 1-610

3.7.5. Insulation Material at Hangers

3.7.5.1. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 'K' value at 300°F; 1200°F maximum service temperature; 16-gauge stainless steel tie wires on maximum 12-inch centers.

3.7.5.2. Type E: Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

4. Instrumentation:

4.1. Thermometers:

4.1.1. Thermometers and gauges shall have dial faces between 2-inches and 5-inches in diameter.

4.1.2. Thermometers installed more than 8 feet above finished floor shall have minimum dial face of 4-inches, installed to allow reading from floor level.

4.1.3. Thermometers shall be of the dry-well type and installed with thermal conductive material in the dry wells.

4.1.4. Thermometers and gauges shall be selected with expected operating conditions in the middle of the device's range.

4.1.5. Thermometers and pressure gauges shall be accurate to 1 percent of full scale.

4.2. Gauges:

4.2.1. Gauges shall be installed with gauge cocks.

- 4.2.2. Provide pressure gauges immediately upstream and downstream of skid mounted, domestic booster pump assemblies.
- 4.3. Domestic Water Utility Meters:
 - 4.3.1. Design Professional shall coordinate sizing and location of meters with Owner and Utility Operator.
 - 4.3.2. Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices for meter specification and connection details.
 - 4.3.3. Domestic Water meter shall have $\frac{3}{4}$ -inch pathway to the Utility Network Cabinet.
- 5. Plumbing Piping:
 - 5.1. Install all mechanical pipes as high as possible (while allowing for maintenance access) to prevent any existing or future ceilings from being forced too low.
 - 5.2. Routings of mechanical piping shall be parallel or perpendicular to building lines.
 - 5.3. All piping installed in chases shall be designed to allow future installation of additional vertical risers and, at the bottom of the chase, additional horizontal piping associated with future projects.
 - 5.4. Install horizontal sections of mechanical piping mains above-ceiling in corridors.
 - 5.5. All above-ceiling sections of branch lines shall be at least $\frac{3}{4}$ inch diameter to allow for future capacity additions.
 - 5.6. Provide isolation valves on all branch lines and on all equipment.
 - 5.7. Pipes shall not be routed over electrical equipment rooms and Telecom closets.
 - 5.8. Where mechanical piping risers span more than two floors, those risers shall be installed inside of fire-rated chases.
 - 5.9. Do not install mechanical piping:
 - 5.9.1. Within 18-inches horizontally of any pneumatic transport tube diverter.
 - 5.9.2. Below any pneumatic transport tube diverter.
 - 5.9.3. Within 18-inches horizontally of any terminal air box.
 - 5.9.4. In the door swing space of any duct access door.
 - 5.9.5. Within 12-inches of the front of any electrical junction box.
 - 5.9.6. Within 12-inches of any roof perimeter or penetration requiring roof flashing.
 - 5.9.7. Within 4-inches of the new roof surface elevation.
 - 5.10. Install di-electric brass unions connections in the mechanical piping systems where any dissimilar metals are in contact.

- 5.11. All types of mechanical piping risers, except cooling coil condensate and refrigerant piping, shall have drain valves at their bottom as well as isolation valves on their horizontal supply and return branches where they connect to their risers.
- 5.12. Water Service Entrance:
 - 5.12.1. Domestic water systems shall have backflow prevention devices at the point of building entry.
 - 5.12.2. Metering devices, taps, or other fittings shall be located upstream of backflow preventers.
 - 5.12.3. If a common supply serves both the domestic water system and the fire protection system, the two (2) systems shall be split outside the building.
 - 5.12.4. Refer to UTILITY DISTRIBUTION DUPLEX BACKFLOW PREVENTER STATION DETAIL in Appendices.
- 5.13. Backflow Prevention Devices:
 - 5.13.1. All backflow preventers shall be fully accessible on both sides and on its bottom.
 - 5.13.2. The backflow preventer shall be field tested and certified prior to use.
 - 5.13.3. Gate valves shall be installed upstream of strainer for backflow devices and shall be epoxy coated.
 - 5.13.4. Domestic water backflow prevention devices shall be epoxy coated, Watts 957 (2 ½-inches to 10-inches) with Watts strainer.
 - 5.13.5. Provide individual isolation valve upstream of each strainer.
 - 5.13.6. All backflow preventers shall be located and configured to allow ready accessibility for maintenance and testing. Minimum clearance is 24-inches in all directions.
 - 5.13.7. Backflow preventers located more than 4-feet above finished floor shall have an access platform.
 - 5.13.8. Pit installations of backflow preventers shall not be allowed.
 - 5.13.9. Drainage from backflow preventers shall be air-gapped, gravity drain only to a floor drain or floor.
 - 5.13.10. Potable water systems shall have two (2) backflow preventers in parallel, each at 100 percent capacity.
 - 5.13.11. Dedicated fire suppression water system shall have one (1) FM Global approved double-check assembly.
 - 5.13.12. Provide ¾-inch, full port ball valve directly downstream of backflow preventer for chemical disinfectant.
 - 5.13.13. Maintain minimum clearance of 18-inches.

5.13.14. Close, cap, and insulate valve after chemical treatment.

5.13.15. For UIHC:

5.13.15.1. For protection of entire additions or wings, install a reduced pressure backflow preventer.

5.13.15.2. Acceptable Manufacturers: Watts 909 (with integral gate valves) or Owner approved equal.

5.13.15.3. For protection of pipe branches above 2-inches, install a Watts 909 unless the Owner authorizes otherwise.

5.13.15.4. For protection of pipe branches up to and including 2-inches, install a Watts 909 QT-S unless the Owner authorizes otherwise.

5.14. Domestic Water:

5.14.1. General:

5.14.1.1. Branch lines above the ceilings shall be ¾-inch minimum.

5.14.1.2. Provide isolation valves on all branch lines.

5.14.1.3. Manual air vents shall be installed at the top of each riser.

5.14.1.4. Install drain valves at the bottom of all risers.

5.14.1.5. Chain operators shall be required on all valves greater than 4-inches and located 10-foot or more above finished floor in mechanical rooms.

5.14.1.6. PVC piping shall not be used for any domestic water systems.

5.14.1.7. For UIHC:

5.14.1.7.1. Any mixing valve installed in conjunction with an electronic faucet shall be piped with flexible stainless-steel supplies and stops; rigid piped supplies are not acceptable.

5.14.1.7.2. Mixing valves shall have check valves downstream of its shut-off valves.

5.14.2. Domestic Hot Water Recirculation:

5.14.2.1. Install the hot water recirculating lines for all plumbing fixtures such that they are no more than 10-feet from the end of an individual branch run.

5.14.2.2. For locations where sensor-operated faucets are approved by the Owner:

5.14.2.2.1. Install the hot water recirculating lines such that they are no more than 6-inches from the supply stop for that fixture and install an isolation valve above ceiling for the hot water recirculating line.

- 5.14.2.3. Install combination balancing/flow measurement valves on the hot water recirculating piping at each horizontal main where it attaches to its riser, at other points where required and at the location of these combination balancing/flow valves shall be accurately shown on all as-built drawings.
- 5.14.2.4. All hot water and hot water recirculating branches shall parallel the cold water: the hot water recirculating piping shall be designed as a reverse return system.
- 5.14.2.5. All hot water and hot water recirculating systems shall have their design velocities limited to 4-feet per second to prevent erosion-corrosion.
- 5.14.3. Piping:
 - 5.14.3.1. Pipe and fittings shall be copper, Type L, hard or soft drawn for solder joint connections, ASTM B88.
 - 5.14.3.2. Unions 2 ½-inches and larger shall have flange joints.
- 5.14.4. For UIHC:
 - 5.14.4.1. All aboveground domestic water pipes up to 4-inch diameter shall be ASTM B88 Type K copper.
 - 5.14.4.2. All joints for copper piping up to and including 4-inch diameter ~~preferred~~ preferred to may be press fittings on domestic water pipes.
 - 5.14.4.3. All aboveground domestic water pipes 4-inch diameter and above shall be either ASTM B88 Type K copper or, where authorized by the Owner, ductile iron (ASTM A377).
 - 5.14.4.4. All joints for copper piping over 4-inch diameter shall be sill-brazed.
 - 5.14.4.5. All aboveground piping systems above 2-inch diameter shall have flanged fittings on all valves, strainers, and any other equipment.
- 5.14.5. Valves:
 - 5.14.5.1. All valves 3-inches diameter and less shall be ball valves.
 - 5.14.5.2. Ball Valves:
 - 5.14.5.2.1. Ball valves, 3-inches and smaller, shall be soldered, bronze body, 150PSI rated, full port, stainless steel ball and trim, Teflon seats and seals.
 - 5.14.5.2.2. Acceptable Manufacturers: Apollo, Stockham, Milwaukee, Nibco, National Utilities Co., RUB.
 - 5.14.5.3. Butterfly Valves:
 - 5.14.5.3.1. Butterfly valves, 6-inches and larger, shall be gear operated.
 - 5.14.5.4. Valve Handle Extensions:
 - 5.14.5.4.1. Valves on piping systems with insulation thicknesses of 1-inch or greater shall have handle extensions.

5.14.5.4.2. Moving parts shall be a minimum of 1-inch beyond the face of the insulation to allow for operation without damaging the vapor barrier.

5.14.5.4.3. Insulation vapor barrier shall be sealed to the valve handle extension cover.

5.14.5.5. Globe Valves:

5.14.5.5.1. Globe valves shall be maximum 2-inches.

5.14.5.6. Check Valves:

5.14.5.6.1. Check valves 2-inches and smaller shall be soldered, bronze, 125-pound, horizontal swing, Nibco or equal.

5.14.5.6.2. Check valves 2-1/2" to 8" shall be bronze or cast-iron body, double disc wafer type, 316 SS shaft, metal-to-metal, or Viton seat.

5.14.5.7. Drain Valves:

5.14.5.7.1. Low point drain valves shall be equipped with a hose adaptor fitting.

5.14.5.7.2. Lavatory Stop Valves:

5.14.5.7.3. For UIHC:

5.14.5.7.3.1. All lavatory supply stops shall be 1/2-inch fip by 3/8-inch compression, 1/4-turn ball valve style.

5.14.5.7.3.2. Sweat or compression stops are not acceptable.

5.14.5.7.3.3. Lavatory supply stops shall be Keeney models 2048pc, 2058pc or equal.

5.14.6. Strainers:

5.14.6.1. Strainers, 2-inches and smaller, shall be threaded, bronze, 250-pound, 20-mesh stainless steel screen, Watts Model 777 or equal.

5.14.6.2. Strainers 2 1/2-inches to 12-inches shall be flanged, cast iron, 125-pound, 0.045-inch perforated stainless-steel screen, Hoffman Model 450 or equal.

5.14.6.3. Prior to project completion, Constructor shall remove strainer construction screens.

5.14.6.4. Contractor shall wire the removed screen to suction piping near strainer.

5.14.6.5. Only the Owner shall remove screens from project site.

5.14.7. Water Hammer Arrestor:

5.14.7.1. Bellows-type, pre-charged, all lead-free stainless-steel construction, asse 1010 approved, pdi certified.

5.14.7.2. For UIHC:

5.14.7.2.1. Water hammer arrestors shall not be permitted.

5.14.8. Pressure Reducing Valves (PRV):

- 5.14.8.1. For sizes up to and including 2-inch, Watts 25AUB, equal by Wilkins or Owner approved equal. No low flow/bypass regulators are required.
- 5.14.8.2. For sizes above 2-inch diameter, Watts U5B-Z3 (epoxy-coated with stainless steel and Viton upgrades) or Owner approved equal. (Carefully review the proposed size. Proper sizing of these PRVs typically require a PRV smaller than the line size.) For sizes up to 3-inch, no low flow/bypass regulators are required.
- 5.14.8.3. PRVs shall be specified to be chemical resistant due to the chemical treatment now in use in several buildings and shall be installed at locations that provide full access for maintenance.
- 5.14.8.4. All PRVs without integral unions shall have flanges on both ends.
- 5.14.8.5. All PRVs with an integral union on one end shall have a flange on the other end.
- 5.14.8.6. Provide two (2) ¼-inch ports on each main downstream of the PRV to allow for future remote sensing of the water pressure and temperature.
- 5.14.8.7. Review with the Owner whether the actual sensing will be included within a given project.
- 5.14.8.8. All PRV assemblies shall be provided with a bypass line that includes a valve, equal to line size but with a 2-inch diameter maximum and a dial type pressure gauge with a ball valve shut-off.

5.15. Sanitary Waste and Vent:

5.15.1. General:

- 5.15.1.1. All sanitary waste systems shall be designed for a maximum of 140-degrees F material. No material shall be dumped in any sanitary waste system having a temperature of more than 140-degrees F.
- 5.15.1.2. Equipment requiring indirect waste (backflow preventers, ice machines, autoclaves, etc.) shall be served by a drain.
- 5.15.1.3. More than one (1) piece of equipment may be served by a drain, provided equipment is in close proximity.
- 5.15.1.4. Size drains for combined load.
- 5.15.1.5. Drain piping shall not be routed across walkways, maintenance areas, or other traffic areas.

5.15.1.6. For UIHC:

- 5.15.1.6.1. All flanges on water closets shall be 3-inch and the floor sealed appropriately.
- 5.15.1.6.2. Waste lines may be increased to 4-inch at the next fitting closest to the water closet.
- 5.15.1.6.3. Horizontal lengths of all branch sanitary runs (as measured to either the building main or a sewage ejector) shall not exceed 80 linear feet.
- 5.15.1.6.4. Cleanouts shall not be installed over 60 linear feet apart.
- 5.15.1.6.5. Typical cleanouts shall be installed on the next level up, either in a floor or wall configuration.
- 5.15.1.6.6. Cleanouts shall be in soiled utility rooms or housekeeping rooms.
- 5.15.1.6.7. Plumbing vents-thru-roof shall not be installed any closer than 25-feet to the nearest outside air intake or operable window.
- 5.15.1.6.8. Sanitary tees, crosses or double combinations shall not be installed.
- 5.15.1.6.9. Plumbing vents that go through the roof need a 180-degree downturn.
- 5.15.1.6.10. Install all waste piping as high as possible to maximize clearance height.

5.15.2. Sanitary and Vent Piping - Above Grade:

5.15.2.1. All sizes may be standard weight cast iron, ASTM A74.

5.15.2.1.1. Joints shall be compression gasket type.

5.15.2.2. All sizes may be standard weight cast iron, ASTM A888. Joints shall be heavy duty, neoprene sleeve gasket, 300 Series stainless steel shield, clamp, and screws with at least four screws.

5.15.2.3. All sizes may be Schedule 40 rigid unplasticized PVC-DWV, ASTM D2665 and D2661.

5.15.2.3.1. Joints shall be solvent-weld socket type.

5.15.2.4. Pipe 4-inches and under may be DWV copper, ASTM B306.

5.15.2.4.1. Joints shall be solder type.

5.15.2.5. For UIHC:

5.15.2.5.1. Pipe 2 1/2-inches and under ~~shall~~ may be Type ~~KL~~ copper.

5.15.3. Sanitary and Vent Piping - Below Grade:

5.15.3.1. All sizes may be standard weight cast iron, ASTM A74. Joints shall be compression gasket type.

5.15.3.2. All sizes may be standard weight cast iron, ASTM A888.

5.15.3.3. Joints shall be heavy duty, neoprene sleeve gasket, 300 Series stainless steel shield, clamp, and screws with at least four (4) screws.

5.15.4. P-Traps:

5.15.4.1. Factory P-traps shall not be installed on floor-mounted fixtures such as janitor's closets, or floor drains.

5.15.4.2. These fixtures shall be installed with either a P-trap with cleanout plug or a running trap. Factory P-traps are acceptable at other locations.

5.16. Acid Waste and Vent:

5.16.1. Pipe and fittings shall ~~may~~ be ~~either glass or~~ CPVC. All materials must be rated and approved for acid waste use.

5.16.2. Sinks in research laboratories shall include Orion BT1, one-quart sized bottle traps in lieu of standard p-traps.

5.16.3. For acid waste and vent systems handling waste discharges above 105-degrees F, install glass borosilicate piping with stainless steel clamps.

5.16.4. For UIHC:

5.16.4.1. Acid waste and vent systems handling waste discharges at, or below 105-degrees F install either:

5.16.4.1.1. Polyvinylidene fluoride, schedule 40, ASTM E-84

5.16.4.1.2. Fire retardant schedule 40 polypropylene piping.

5.16.4.1.3. All joints shall be electrically fused.

5.16.4.1.4. Acceptable manufacturers: Kynar, Hylar, Orion or approved equal.

5.17. Natural Gas Systems:

5.17.1. Piping:

5.17.1.1. Pipe 2-inches and under shall be standard weight steel, threaded and coupled, ASTM A53. Joints shall be screwed.

5.17.1.2. Pipe 2 1/2-inches and over shall be standard weight steel, beveled ends, ASTM A53. Joints shall be butt welded and flanged.

5.17.2. Shutoff Valves:

5.17.2.1. 2-inches and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.

5.17.2.1.1. Acceptable Manufacturers: Apollo, Nibco or Watts.

5.17.2.2. 2-inches and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port.

5.17.2.2.1. Acceptable Manufacturers: Walworth, DeZurik.

5.17.2.3. 2 ½-inches thru 4-inches, 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port.

5.17.2.3.1. Acceptable Manufacturers: Walworth, DeZurik.

5.17.2.4. 6-inches and larger, 125# steam @ 450°F, 175# CWP, cast iron body, flanged, resilient faced plug, gear and handwheel operator, full port.

5.17.2.4.1. Acceptable Manufacturers: Walworth, DeZurik.

5.18. Pure Water Systems:

5.18.1. These requirements shall apply to Reverse Osmosis (RO), Distilled and Deionized (DI) Water.

5.18.2. Pipe (all sizes) shall be Schedule 80 polypropylene without plasticizers or pigments, ASTM D-1785. Fittings shall be socket fused or flanged, ASTM D-4101.

5.18.3. For UIHC:

5.18.3.1. Pipe (all sizes) shall be Schedule 80 polyvinylidene fluoride (PVDF) without plasticizers or pigments, ASTM D3222.

5.18.3.2. Fittings shall be IR butt fusion welded. Shutoff valves shall be diaphragm type.

5.19. Compressed Air (Non-Medical):

5.19.1. For Renovation Projects:

5.19.1.1. Abandoned piping shall be removed back to nearest shutoff valve or active main and capped.

5.19.2. Piping:

5.19.2.1. Piping (all sizes) shall be Type L copper, ASTM B88. Joints shall be solder.

5.19.3. Shutoff Valves:

5.19.3.1. 3-inches and under, 150 psi saturated steam, 600 psi CWP, full port, solder ends, bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals.

- 5.20. Foundation Drainage Systems:
 - 5.20.1. Perforated pipe for subgrade drains shall be SDR-35, Schedule 40 PVC, or HDPE conforming to ASTM F2688 or F2306.
 - 5.20.2. Pipe shall be installed in a geotextile envelope with clean rock.
 - 5.20.3. Perforated pipe in a 'sock' shall not be allowed.
- 5.21. Storm Sewer:
 - 5.21.1. Provide cast iron cleanouts at grade with concrete pad.
 - 5.21.2. Foam core or cell core PVC is not permitted.
 - 5.21.3. Storm water shall not be directed to sanitary sewer system.
 - 5.21.4. Storm Piping - Above Grade:
 - 5.21.4.1. All sizes may be standard weight cast iron, ASTM A74. Joints shall be compression gasket type.
 - 5.21.4.2. All sizes may be standard weight cast iron, ASTM A888. Joints shall be heavy duty, neoprene sleeve gasket, 300 Series stainless steel shield, clamp, and screws with at least four screws.
 - 5.21.4.3. All sizes may be Schedule 40 rigid unplasticized PVC-DWV, ASTM D2665 and D2661. Joints shall be solvent-weld socket type.
 - 5.21.4.4. For UIHC:**
 - 5.21.4.4.1. PVC shall not be used.
 - 5.21.5. Storm Piping - Below Grade:
 - 5.21.5.1. All sizes may be standard weight cast iron, ASTM A74. Joints shall be compression gasket type.
 - 5.21.5.2. All sizes may be standard weight cast iron, ASTM A888. Joints shall be heavy duty, neoprene sleeve gasket, 300 Series stainless steel shield, clamp, and screws with at least four screws.
 - 5.21.6. Cleanouts:
 - 5.21.6.1. Cleanouts shall be provided at the first bend below the roof, at the base of all risers and at points where the system changes from horizontal to vertical or from vertical to horizontal.
 - 5.21.6.2. Cleanouts shall be line-size for storm mains up to 4-inches diameter.
 - 5.21.6.3. For storm mains above 4-inches diameter, provide 4-inch clean-outs.

5.21.7. Primary Roof Drains:

- 5.21.7.1. Primary roof drains shall be the beehive (dome) type, with drain bowls, clamping rings, under deck clamps, extension flanges, and domes being cast iron in composition.
- 5.21.7.2. Clamping rings shall have four (4) bolts.
- 5.21.7.3. Drains with three (3) bolts are not approved.
- 5.21.7.4. Drain rims shall be elevated above the roof decking by setting the primary roof drain casting at deck level and installing a gasketed, threaded, adjustable extension flange with secondary clamping collar.
- 5.21.7.5. Clamping collar elevation shall be lower than the roof surface elevation but shall not result in steep roof transitions at roof drains.
- 5.21.7.6. Roof system shall not be required to slope more than 1-inch per foot around drains.
- 5.21.7.7. Primary roof drains shall be located at least 12-inches from adjacent perimeter parapet walls or roof penetrations requiring flashing.
- 5.21.7.8. Approved Manufacturers are Zurn, Josam, Wade, Jay R. Smith, or Watts [four (4) bolt model only].

5.21.8. Secondary Roof Drains:

- 5.21.8.1. Secondary drainage systems shall be installed using secondary roof overflow drains with the top of the internal water dam set 2-inches higher than the primary roof drains.
- 5.21.8.2. Overflow drain composition and method of setting shall be like that described for primary roof drains. However, overflow drain secondary clamping collar shall be set with elevation to be flush with the field of roof to prevent the need to sump the roof around overflow drains.
- 5.21.8.3. Design overflow drains and coordinate with the roof system design, to prevent ponding of water around the overflow drains.
- 5.21.8.4. Secondary roof drains shall be located at least 24-inches from adjacent primary roof drain and at least 12-inches from adjacent perimeter parapet walls or roof penetrations requiring flashing.
- 5.21.8.5. Approved Manufacturers: Zurn, Josam, Wade, Jay R. Smith, or Watts (four-bolt model only).

5.22. Testing:

5.22.1. All piping shall be hydraulically pressure tested. Pneumatic testing shall not be allowed due to safety concerns.

5.22.1.1. **For UIHC:**

5.22.1.1.1. Newly installed domestic water pipes must remain dry prior to occupancy. If pipes become wet during pressure testing, a flushing program must be initiated no later than 1 week after the test. It is recommended that nitrogen or pneumatic testing be used for the pressure testing if occupancy is greater than 4 weeks or if a flushing program cannot be initiated and maintained.

5.22.1.1.2. Microbial testing must occur as stipulated after the pipes are placed back into service.

5.22.1.1.3. UIHC Engineering Services will conduct the following tests prior to occupancy.

5.22.1.1.3.1. Legionella

5.22.1.1.3.2. Fecal coliform with result of <1 cfu/100ml

5.22.1.1.3.3. Heterotrophic plate count incubated for 7 days <500 cfu/ml

5.22.2. Test all piping systems at a minimum of 1 ½ times the expected working pressure, or a minimum of 100 psig and a maximum of the design pressure of the pipe and fittings.

5.22.3. Test all systems for a minimum of four (4) hours.

5.22.4. When test pressure exceeds 125 psig, test pressure shall not exceed a value which produces a hoop stress in the piping greater than 50% of the specified minimum yield strength of the pipe.

5.22.5. Natural gas shall be tested at twice the working pressure or a minimum of 3 psig.

5.22.6. Sanitary sewer shall be tested at 10-feet of head pressure for minimum of four (4) hours.

5.22.7. Domestic ~~Water Chemical~~-Treatment, Clean, ~~and~~ Flush, ~~and~~ Testing:

5.22.7.1. ~~Domestic Water Disinfection—Domestic Water:~~

5.22.7.1.1. Disinfections shall be performed Monday through Thursday, starting between 8:00 AM and 9:00 AM.

5.22.7.1.2. Pipes shall be disinfected according to AWWA standards.

5.22.7.1.3. Disinfection shall take place over a period of twenty-four (24) hours (no longer or shorter).

5.22.7.1.4. Disinfection shall be performed before hydro testing.

5.22.7.1.5. Hydro testing shall not begin until bacteria results have been returned from the lab.

5.22.7.1.6. Constructor shall anticipate a three (3) working day turn-around time from the time that the sample is taken until the results are returned.

5.22.7.2. Method of Chlorination:

5.22.7.2.1. Piping shall be filled with water at a rate no greater than 1-foot per second within the main.

5.22.7.2.2. Precautions shall be taken to ensure that air pockets are eliminated.

5.22.7.2.3. Water shall remain in the pipe for twenty-four (24) hours.

5.22.7.2.3.1. If the water temperature is below 41 degrees F, water shall remain in the pipe for forty-eight (48) hours.

5.22.7.2.4. Take Chlorine residue tests at each sampling point after the twenty-four (24) hour period.

5.22.7.2.5. Contractor shall report results to Owner and/or Utility Operator.

5.22.7.2.6. For Utility Operator projects:

5.22.7.2.6.1. Utility Operator shall provide 5-g calcium hypochlorite required for dose of 50 mg/L.

5.22.7.3. Domestic Water Flush—~~Domestic Water:~~

5.22.7.3.1. Remove air relief vents after testing. Provide GPS locations for each vent.

5.22.7.3.2. Constructor shall supply all equipment and personnel required to perform flush.

5.22.7.3.3. Constructor shall contact the Owner and/or Utility Operator for water source.

5.22.7.3.4. Flushing shall be started between 8:00 AM and 9:00 AM, Monday through Thursday.

5.22.7.3.5. Systems shall be flushed two (2) times, with two (2) samples per flush.

5.22.7.3.6. Flushing shall continue until residual chlorine is verified by Technician (approximately four (4) hours).

5.22.7.3.7. Constructor shall install a temporary hydrant at the end of the water main for flushing purposes.

5.22.7.3.7.1. The temporary hydrant shall be full-sized.

5.22.7.3.8. Constructor is responsible to route the flushed water to the storm sewer as indicated in the documents or directed by the Owner and/or Utility Operator.

5.22.7.3.9. Flush through fire hydrants.

5.22.7.3.9.1. Contractor to provide temporary fire hydrants as needed to meet phasing requirements.

5.22.7.3.10. Notify the Owner and/or Utility Operator of de-chlorination plan prior to disposal of heavily chlorinated water.

5.22.7.3.11. Neutralizing chemical shall be applied to the wastewater to neutralize thoroughly the residual chlorine.

5.22.7.3.12. Contact Federal, State, provincial, and local regulatory agencies to determine provisions for disposal of heavily chlorinated water.

5.22.7.4. Domestic Water Cleaning—~~Domestic Water~~:

5.22.7.4.1. Piping shall be free of all foreign materials.

5.22.7.4.2. Joint surfaces shall be free of lumps and blisters.

5.22.7.4.3. Piping shall be power washed clean inside and out prior to installation.

5.22.7.4.4. Owner and/or Utility Operator shall witness cleaning.

5.22.7.5. Domestic Water Sampling—~~Domestic Water only~~:

5.22.7.5.1. Review water sampling requirements with Owner during design.

5.22.7.5.2. For Utility Operator projects:

5.22.7.5.2.1. Water sampling shall be performed by the Utility Operator.

5.22.7.5.2.2. The Owner/Utility Operator shall collect the sample, take the sample to the lab, and notify the Constructor of the results.

5.22.7.5.3. The Constructor shall supply equipment and personnel required to perform the tests.

5.22.7.5.4. Water sampling shall take place at approximately 11:30 AM.

5.22.7.5.5. Following the sampling, the Constructor shall allow three (3) days for laboratory processing before hydro test.

5.22.7.5.6. Testing shall be completed and passed prior to final connections to existing systems.

5.22.7.6. Domestic Water Hydro Test:

5.22.7.6.1. Hydro test all piping.

5.22.7.6.2. Testing shall not begin until satisfactory biological test results have been received from the Owner and/or Utility Operator.

5.22.7.6.3. Tests shall be made against capped ends or new valves.

5.22.7.6.4. Test pressure shall be one-and-a-half (1½) times working pressure, and a minimum of one hundred fifty (150) pounds.

5.22.7.6.5. All piping shall be capped by mechanical caps and restraint joints.

5.22.7.6.6. Owner and/or Utility Operator shall witness all hydro tests.

5.22.7.6.7. Test shall be for four (4) hours. No tests started after 12:00 PM.

5.22.7.6.8. Test may only lose 5 psig.

5.22.7.6.9. For Utility Operator projects: Gauges shall be Utility Operator provided.

5.22.7.7. Final Connections to Existing Domestic Water Main:

5.22.7.7.1. Water mains and appurtenances shall be flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connection to the active distribution system.

Follow sanitary construction practices during final connection so that no foreign material or groundwater contamination enters the adjacent piping.

5.22.7.

5.22.7.1-5.22.8. A system pre-inspection, to identify system readiness, shall be scheduled with the Owner seven (7) days prior to beginning system chemical treatment.

5.22.8-5.22.9. The following conditions must be met prior to beginning treatment, cleaning, and flush:

5.22.8.1-5.22.9.1. All domestic plumbing fixtures installed and piped.

5.22.8.2-5.22.9.2. Emergency eyewash and showers installed and piped.

5.22.9-5.22.10. Constructor to provide provisions for capturing discharge water and protecting adjacent surfaces.

5.22.10-5.22.11. Domestic pumps operating. Pumps may be operating in hand.

5.22.11-5.22.12. Domestic sub-systems, such as chillers, watercoolers, etc., installed and piped. Accessories such as filters, chemical feed systems, and U.V. lights to be bypassed or turned off.

5.22.12-5.22.13. Water softener complete and valved to bypass resin.

5.22.13-5.22.14. Water polishing, DI and RO systems disconnected at isolation valve. Constructor to provide provisions for capturing discharge water and protecting adjacent surfaces.

~~5.22.14~~~~5.22.15~~ Water Heater valved to allow flow and isolated from energy source.

~~5.22.15~~~~5.22.16~~ Constructor to provide access for injecting chemicals. Constructor to provide provisions for capturing discharge water and protecting adjacent surfaces.

~~5.22.16~~~~5.22.17~~ Piping system must be flushed for three (3) days prior to the chlorination process.

6. Pumps:

6.1. Domestic Hot Water Pumps:

6.1.1. Domestic Hot Water Recirculation Pumps

6.1.2. Circulating pumps shall be lead-free bronze or stainless-steel construction, permanently lubricated, in-line circulation pumps.

6.1.3. Pumps shall be installed in an accessible location

6.1.4. Approved Manufacturers: B&G, Grunfoss, or Owner Approved equal.

6.2. Sanitary Sewage Pumps:

6.2.1. Owner approval is required for installation of sewage ejectors.

6.2.1.1. If approved, all sewage ejectors shall have heavy duty self-priming duplex pumps.

6.2.2. Sewage ejectors shall be provided with automatic alternators to distribute operation to both pumps on each successive cycle and to operate both pumps when one pump cannot handle the load.

6.2.3. Sewage ejectors shall be Hydromatic model MPC, equivalent by Metropolitan or Owner approved equal.

6.2.4. Provide twin level alarms.

6.2.4.1. The first alarm shall be an audible local alarm and the second alarm shall be wired back to the BAS.

6.2.5. Overhead lifting hooks shall be provided to aid in motor and/or pump replacement.

6.2.6. All sewage basins shall be poured concrete, precast concrete, or fiberglass, or Owner approved equal and shall have a minimum diameter of 36-inches. Covers for sewage basins shall be airtight.

6.3. Sump Pumps:

6.3.1. All sump pumps shall be the heavy-duty submersible duplex pump type with automatic alternators (with stainless steel ball floats) to distribute operation to both pumps on each successive cycle and to operate both pumps when one pump cannot handle the load.

- 6.3.2. Provide twin-level alarms.
 - 6.3.2.1. The first alarm shall be local, and the second alarm shall be wired back to the Building Automation and Control Systems (BACS).
- 6.3.3. Overhead lifting hooks shall be provided to aid in motor and/or pump replacement.
- 6.3.4. All sump pump basins shall be poured concrete, precast concrete, fiberglass, or Owner approved equal and shall have a minimum diameter of 36-inches.

7. Plumbing Equipment:

7.1. Water Heaters:

7.1.1. General:

- 7.1.1.1. Design Professional shall coordinate Project Requirements with Owner
- 7.1.1.2. The use of tank-type or steam semi-instantaneous water heaters shall be determined based on project size and type.
- 7.1.1.3. In general, projects with a low domestic hot water demand shall be tank-type and project with high domestic hot water demand shall be semi-instantaneous.
- 7.1.1.4. Semi-instantaneous, tankless water heating systems, using campus utility steam or hot water are the preferred heat source for hot water systems.
- 7.1.1.5. Water heaters and hot water storage tanks shall meet efficiencies set forth in the current edition of ASHRAE/IES Standard 90.1.
- 7.1.1.6. Water heaters shall meet the requirements of State of Iowa Administrative Rules, Chapters 94 and 95, for state registration purposes.

7.1.2. Tank-type Water Heater:

- 7.1.2.1. If water heater tank capacity is 120 gallons or more or if heat input capacity is 1.6 MMBtu/hr or more, then additional requirements may apply. Review with Owner.
- 7.1.2.2. Electric Water Heater
 - 7.1.2.2.1. Water heater shall be vertical type, metal cabinet, baked enamel finish, glass-lined ASME stamped welded steel tank, 150 PIS working pressure, fiberglass or foam insulation, brass connections, magnesium anode rod, automatic thermostat with external adjustment, UL Listed.
 - 7.1.2.2.2. Electric water heaters shall be used only if approved by Owner.
 - 7.1.2.2.3. Acceptable Manufacturers: AO Smith, American, Bock, Bradford White, Rheem, Ruud, State, HPT
- 7.1.2.3. Gas Fire Water Heater

- 7.1.2.3.1. Water heater shall be gas-fired, condensing, vertical type, minimum 92% efficiency, sealed combustion, metal cabinet, baked enamel finish, 160 PSI working pressure, fiberglass or foam insulation, brass water connections, ASME approved, UL Listed.
 - 7.1.2.3.2. Condensing water heaters shall be provided with neutralization tank by JJM Boiler Works, Nutrasafe, or approved equal.
 - 7.1.2.3.3. Acceptable Manufacturers: AO Smith, Bock, Bradford White, HPT, PVI, Rheem, State, Lochinvar, Aereco, Fulton
- 7.1.2.4. Steam Semi-Instantaneous Water Heaters:
- 7.1.2.4.1. Packaged steam-to-water domestic water heating system shall be pre-packaged and completely factory assembled, run-tests and shipped to the site as an integral unit assembled on a skid including all equipment and accessories required for operation.
 - 7.1.2.4.2. Heater shall be capable of being disassembled in place without having to remove the shell from the domestic water piping.
 - 7.1.2.4.3. The heaters support shall provide clearance for tube bundle removal.
 - 7.1.2.4.4. Heater shall be double wall shell and tube and cross flow design with integral demand anticipator requiring no electrical connection.
 - 7.1.2.4.5. Water heater shall be provided with inlet strainer, condensate trap and vacuum breaker.
 - 7.1.2.4.6. Acceptable Manufacturers: Thermaflow, Patterson-Kelley PKD, Ace Mini-Pack, Armstrong Flow-Rite, PVI Quickdraw.
 - 7.1.2.4.7. For UIHC:**
 - 7.1.2.4.7.1. Pneumatic control valves are currently installed throughout campus. Review with Owner the use of electronic controls vs. pneumatic controls.
 - 7.1.2.4.7.2. Acceptable Manufacturers: Ajax, Reco, or Owner approved equal.
 - 7.1.2.4.8. For Athletics:
 - 7.1.2.4.8.1. Heat exchanger shall be plate and frame and the unit shall be controllable via network interface.
- 7.1.2.5. Domestic Hot Water Expansion Tanks:
- 7.1.2.5.1. Dumping excess water due to expansion shall not be permitted.
 - 7.1.2.5.2. Each water heater shall be provided with a dedicated expansion tank.

- 7.1.2.5.3. Expansion tanks shall be installed with provisions for draining and venting.
- 7.1.2.5.4. Expansion tanks shall be welded steel construction, ASME rated and stamped, heavy duty butyl diaphragm and rigid polypropylene liner mechanically bonded to tank to provide a 100% non-corrosive water reservoir, diaphragm and liner shall be approved for use in potable water systems, all wetted components of FDA approved materials.
- 7.1.2.5.5. Tank shall comply with federal act s.3874.
- 7.1.2.5.6. Acceptable Manufacturers: Amtrol, B&G, ELBI, Taco, Watts, Wessels

7.2. Water Softeners:

- 7.2.1. The Design Professional shall coordinate the sizing and specifications of water softeners with Owner.
- 7.2.2. Coordinate project specific hardness and softening requirements with Owner.
- 7.2.3. Water Service Quality:
 - 7.2.3.1. Water supply typically has 7-to-10 grains of hardness on Main Campus and 25 grains of hardness on The University of Iowa Research Park (Oakdale Campus).
- 7.2.4. Design water softening systems to supply water at less than 1 grain of hardness.
- 7.2.5. All water softening equipment shall be installed with a test port immediately downstream from the softening equipment.
- 7.2.6. Provide Neptune meter immediately downstream of the Water Softener
- 7.2.7. Softeners shall have twin, alternating, fiberglass tanks.
- 7.2.8. Top of unit control panel shall not be mounted more than 84-inches above finished floor.
- 7.2.9. Top of brine tank shall not be mounted more than 60-inches above finished floor.
- 7.2.10. Acceptable Manufacturers: Culligan, Marlo, Fleck
- 7.2.11. For UIHC:**
 - 7.2.11.1. Domestic hot water systems shall be softened.
 - 7.2.11.2. Water service process equipment / systems (i.e., pure water systems, etc.) shall be softened.
 - 7.2.11.3. Hydronic system fill (i.e., heating water, chilled water, etc.) shall be softened. Other water systems shall be softened only in specific applications. Acceptable Manufacturers: Culligan or Owner approved equal.
- 7.2.12. For UI Main Campus:

- 7.2.12.1. Potable hot water systems shall have water softening. Other water systems shall be softened only in specific applications.
- 7.2.13. For Athletics:
 - 7.2.13.1. All Systems shall have water softening.
- 7.2.14. For UI Housing:
 - 7.2.14.1. Applicable for dining facilities only.
- 7.2.15. For The University of Iowa Research Park (Oakdale Campus):
 - 7.2.15.1. All systems shall have water softening.
- 7.3. Domestic Water Booster Pumps:
 - 7.3.1. Booster pumps shall be triplex configuration, unless otherwise directed by the Owner during design.
 - 7.3.2. Each pump shall be sized for 50% connected load, providing N+1 capacity.
 - 7.3.3. Each pump shall be provided with a dedicated VFD.
 - 7.3.4. Packaged pressure boosting system shall be completely factory assembled, run-tested, and shipped to site as an integral unit assembled on a steel skid including pumps, motors, valves, Type "L" copper suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with Logic and power controls.
 - 7.3.5. Control panels shall be NEMA 1 enclosure, factory mounted and wired.
 - 7.3.6. Packaged system shall be provided with a hydro-pneumatic tank with carbon steel or fiberglass shell and a replaceable FDA-approved, heavy-duty bladder to separate the air and water.
 - 7.3.7. Tank shall be constructed in accordance with Section VIII of the ASME code and be N.B. stamped.
 - 7.3.8. Acceptable Manufacturers: Bell & Gossett, Metropolitan, SyncroFlo, VC Systems, or approved equivalent
- 7.4. Water Purification Systems:
 - 7.4.1. For UIHC:**
 - 7.4.1.1. Copper-Silver Purification System
 - 7.4.1.1.1. The use of CuAg system shall be project specific, as directed by the Owner.
 - 7.4.1.2. In John W. Colloton Pavilion (JCP), an existing chlorine dioxide system is in place - no Liquitech system shall be added to that distribution grid until or unless the chlorine dioxide system is removed.

- 7.4.1.3. CuAg systems shall be provided for domestic hot water system only.
 - 7.4.1.4. Shall be installed upstream of water heaters and downstream of HWC/CW mixing point.
 - 7.4.1.5. Acceptable Manufacturers: Liquitech or Owner approved equal.
 - 7.5. Air Compressor (Non-Medical):
 - 7.5.1. All non-medical air compressors shall have duplex pumps.
 - 7.5.2. Acceptable Manufacturers: Quincy, Powerex, Amico or Owner approved equal.
 - 7.6. Grease Interceptor:
 - 7.6.1. Provide an easily accessible grease interceptor at the exterior of the facility for grease removal from kitchen functions.
 - 7.6.2. Grease interceptor shall be located below grade and sized and installed per requirements of local city and state jurisdictions.
 - 7.6.3. Grease interceptors are not permitted below 500-year flood level plus 2-feet unless it is incorporated into a flood mitigation barrier system that will prevent floodwaters from encroaching over the interceptor.
 - 7.6.4. For UIHC:**
 - 7.6.4.1. All grease interceptors shall be the bacteria-driven type to minimize cleaning requirements.
 - 7.7. Oil Interceptor:
 - 7.7.1. Provide with cathodic protection and with explosion proof level switch with local light and audible alarm to indicate high oil level.
 - 7.7.2. The alarm shall be wired back to the BACS.
- 8. Plumbing Fixtures:
 - 8.1. General:
 - 8.1.1. Fixtures shall be wall mounted.
 - 8.1.2. Fixtures and related equipment shall be of commercial grade or better.
 - 8.1.3. Fixtures (sinks, urinals, water closets, etc.) shall be white in color.
 - 8.1.4. Fixture hardware (faucets, flush valves, etc.) shall be chrome color.
 - 8.1.5. Strainers shall be specified for sinks. Pop-up drain stoppers shall not be used except for in residence halls.
 - 8.1.6. Spring return valves on faucets shall not be used.

- 8.1.7. Flush valves that operate with sensory technology shall use batteries, not solar panels.
- 8.1.8. Note locations of electric water coolers and fixtures with automatic flush valves (battery), with courtesy flush button, on electrical and plumbing plans.
- 8.1.9. Note all plumbing fixtures on the architectural drawings.
- 8.1.10. For Athletics:
 - 8.1.10.1. Review use with owner in facilities that have seasonal use.
- 8.1.11. For UIHC:**
 - 8.1.11.1. For typical stainless-steel plumbing fixtures, all units shall be by Elkay or Bradley.
 - 8.1.11.2. All shower bodies shall be acrylic (not gelcoat) unless the Owner authorizes otherwise.
 - 8.1.11.3. All shower valves shall be pressure and temperature compensating by Symonns or Owner approved equal.
 - 8.1.11.4. Shower heads shall not use loop-type tubing.
 - 8.1.11.5. Mixing valves for shower shall be temperature/pressure mixing valves by Powers.
 - 8.1.11.5.1. Approved models: Powers e480-00 or e480-01 installed with unions or Owner approved equal.
 - 8.1.11.6. Faucets for clinic and inpatient handwashing shall be a rigid/swing gooseneck with 4-inch wrist blades and a laminar flow device in the spout inlet, no aerators.
 - 8.1.11.6.1. Chicago Faucet 895-317GN2AFCABCP or Owner approved equal.
 - 8.1.11.7. Where a sensor operated faucet is to be used, use the following as basis of design:
 - 8.1.11.7.1. Sidewall Base: Chicago Faucet HyTronic Model 116.314. AB.1,
 - 8.1.11.7.2. Power Transformer: Chicago Faucet Model 240.630.00.1 (requires an electrical outlet),
 - 8.1.11.7.3. Gooseneck: Chicago Faucet Model GN2AJKABCP, and Thermostatic mixing valve ½-inch Honeywell AM-1 series.
 - 8.1.11.8. Mixing valves for individual faucets shall be thermostatic water mixing valves Safety Mix by Symmons or Owner approved equal.

8.2. Water Closets:

8.2.1. Water closets shall have an automatic flush valve, be wall-mounted, 500-pound minimum load with floor mounted heavy-duty rated carrier.

8.2.1.1. Approved Manufacturers: Sloan, Zurn, and Delaney

8.2.2. Water closets shall have check hinges.

8.2.3. For UIHC:

8.2.3.1. Non-Patient care areas:

8.2.3.1.1. Water closets shall be floor mount, rear discharge (bottom discharge if conditions dictate), flush valve type, white vitreous China, siphon jet, elongated bowl, 1 ½-inch top spud, and bolt caps.

8.2.3.1.1.1. Acceptable Manufacturers: American Standard (3312.001), or approved equal

8.2.3.1.2. Flush Valve (Manual):

~~8.2.3.1.3.~~

~~8.2.3.1.3.1.~~ 8.2.3.1.2.1. Exposed, manual operation, chrome plated, 1-inch IPS screwdriver stop-check valve with vandal resistant cap, high back pressure vacuum breaker, non-hold-open handle.

~~8.2.3.1.3.2.~~ 8.2.3.1.2.2. Acceptable Manufacturers: Sloan or approved equal.

~~8.2.3.1.4.~~ 8.2.3.1.3. Flush Valve (Sensor Operated):

~~8.2.3.1.4.1.~~ 8.2.3.1.3.1. Exposed, sensor operation, chrome plated, 1-inch IPS screwdriver stop-check valve with vandal resistant cap, high back pressure vacuum breaker, non-hold-open handle, battery or plug-in 120V.

~~8.2.3.1.4.2.~~ 8.2.3.1.3.2. Hard-wired shall not be permitted.

~~8.2.3.1.4.3.~~ 8.2.3.1.3.3. Acceptable Manufacturers: Sloan or approved equal.

~~8.2.3.1.5.~~ 8.2.3.1.4. Seat shall be white, extra heavy, open front, injection molded solid, anti-microbial plastic, self-sustaining hinge, stainless steel or plated steel posts and nuts.

~~8.2.3.1.5.1.~~ 8.2.3.1.4.1. Acceptable Manufacturers: Bemis (3155C), Church (3155C), Beneke (533PC), Olsonite (95), or same as water closet manufacturer.

8.2.3.2. Patient Care Areas:

8.2.3.2.1. Water closets shall be floor mount, rear discharge (bottom discharge if conditions dictate), flush valve type, white vitreous China, siphon jet, elongated bowl, 1 ½-inch top spud, bedpan lugs and bolt caps.

8.2.3.2.1.1. Acceptable Manufacturers: American Standard (3312.001) or approved equal.

8.2.3.2.2. Flush Valve (Manual):

8.2.3.2.3.1. Exposed, manual operation, chrome plated, 1-inch IPS screwdriver stop-check valve with vandal resistant cap, high back pressure vacuum breaker, wall and spud flanges, bedpan washer and wall brace.

8.2.3.2.3.2. Acceptable Manufacturers: Sloan, or approved equal

8.2.3.2.4. Seat shall be white, extra heavy, open front, injection molded solid, anti-microbial plastic, self-sustaining hinge, stainless steel or plated steel posts and nuts.

8.2.3.2.4.1. Acceptable Manufacturers: Bemis (3155C), Church (3155C), Beneke (533PC), Olsonite (95), or same as water closet manufacturer.

8.2.3.3. Bariatric Toilets:

8.2.3.3.1. Bariatric water closets shall be floor mount, bottom discharge, flush valve type, white vitreous China, elongated bowl, 1 ½-inch top spud, and bolt caps.

8.2.3.3.2. Bariatric water closets shall be provided with Big John toilet seat rated at 1,200-pound capacity.

8.2.3.3.3. Bariatric water closets require independent cleanout access.

8.2.3.3.4. Acceptable Manufacturers: Kohler, American Standard (Right Width Elongated Right Height), or approved equal

8.3. Urinals:

8.3.1. Waterless urinals shall not be allowed.

8.3.2. Urinal flush valves shall be side mount, automatic. Flush valves shall have a manual override function.

8.3.2.1. Approved Manufacturers: Sloan, Zurn, and Delaney.

8.3.3. For UIHC:

8.3.3.1. Urinals shall be wall mount, white vitreous China, flush valve type, washout action, elongated rim, extended side shields, 2/4-inches top spud and 2-inch outlet.

8.3.3.2. Acceptable Manufacturers: American Standard (6590.00), Kohler (K-4991-ET), Sloan (SU-1006/SU-1005), Gerber (27-780), Toto (UT447), Zurn (Z5750)

8.3.3.3. Flush Valve (Manual):

8.3.3.3.1. Exposed, manual operation, chrome plated, ¾-inch IPS screwdriver stop-check valve with vandal resistant cap, high back pressure vacuum breaker, non-hold-open handle.

8.3.3.3.2. Acceptable Manufacturers: Zurn (Z6003AV), Sloan (Royal 186), American Standard (6045.101), Kohler (K13518-CP), Delany (541), Toto (TMU1NNC-12)

8.3.3.4. Flush Valve (Sensor):

8.3.3.5.1. Exposed, sensor operation, chrome plated, ¾-inch IPS screwdriver stop-check valve with vandal resistant cap, high back pressure vacuum breaker, non-hold-open handle.

8.3.3.5.2. Acceptable Manufacturers: Zurn, Sloan, American Standard, Kohler, Delany, Toto

8.4. Lavatory:

8.4.1. Lavatory faucets shall be hands free, automatic and shall use batteries or 120 v power. Solar panels shall not be used.

8.4.2. Wall mount, white vitreous China, 4-inches high contoured backsplash, single faucet hole.

8.4.3. Acceptable Manufacturers: American Standard (0356.421), Kohler (K-2005), Sloan (SS03003), Toto (LT307), Zurn (Z5364)

8.4.4. For UIHC:

8.4.4.1. Sink Trim:

8.4.4.1.1. Manual Wrist Blade:

8.4.4.1.1.1. Two handle mixing faucet, brass construction, chrome-plated finish, rigid gooseneck spout, laminar flow outlet, 4-inch wrist blade handles at 4-inch centers, ceramic disc cartridge.

8.4.4.1.1.2. Acceptable Manufacturers: Chicago Faucet (895) or approved equal

8.4.4.2. Lavatory Trim:

8.4.4.2.1. Manual Wrist Blade:

8.4.4.2.1.1. Two (2) handle mixing faucet, brass construction, chrome-plated finish, rigid gooseneck spout, laminar

flow outlet, 4-inch wrist blade handles at 4-inch centers, ceramic disc cartridge.

8.4.4.2.1.2. Acceptable Manufacturers: Chicago Faucet (895) or approved equal

8.4.4.3. Electronic Sensor Faucet (Wall Mount):

8.4.4.3.1. Electronic sensor faucet, single hold, dual supply for hot and cold water, concealed internal temperature mixer, rigid gooseneck spout, plug-in single-use transformer

8.4.4.3.2. Acceptable Manufacturers: Chicago Faucet (116.314.AB.1) or approved equal

8.4.4.4. Electronic Sensor Faucet (Deck Mount):

8.4.4.4.1. Electronic sensor faucet, single hold, dual supply for hot and cold water, concealed internal temperature mixer, rigid gooseneck spout, plug-in single-use transformer

8.4.4.4.2. Acceptable Manufacturers: Chicago Faucet (116.103.AB.1) or approved equal

8.5. Shower Valves:

8.5.1. Showers shall have anti-scald mixing valves.

8.5.2. Shower valve shall be single handle.

8.6. Water Coolers:

8.6.1. Water coolers shall follow ADA guidelines, be dual level, refrigerated type, equipped with stainless steel surround.

8.6.2. Provide gooseneck bottle fillers in combination with water coolers in high traffic areas and at all locations where water coolers are installed.

8.6.3. Bottle Fillers used in combination with drinking fountains basis of design shall be Elkay LK1110.

8.6.4. For UI Athletics:

8.6.4.1. Review locations with Owner.

8.6.4.2. Supplemental domestic water chillers shall not be allowed.

8.6.5. For UIHC:

8.6.5.1. Electric water coolers shall be Halsey-Taylor, Elkay, or Owner approved equal.

8.6.6. For UI Housing facilities:

8.6.6.1. Review locations with Owner.

8.6.6.2. Water coolers shall be installed per sleeping room floor near the main vertical circulation area, in the fitness center, adjacent to or in the main lobby and adjacent to (not within) multi-purpose room(s).

8.6.6.3. Water cooler shall be located a maximum of 36-inches from cooling unit.

8.6.6.4. Bottle Fillers used in combination with drinking fountains basis of design shall be Elkay LK1110.

8.7. Hose Bibbs and Wall Hydrants:

8.7.1. Hose bibbs and wall hydrants shall comply with UPC standards listed in chapter 6, i.e., ASSE 1001 or CSAB 64.2.1.1.

8.7.2. A hose connection shall be installed on roofs and in each mechanical room.

8.7.3. Hose connections shall be located on the exterior of each building.

8.7.4. A minimum of one (1) hose connection shall be installed on each side of the building.

8.7.5. Spacing for hose connections is one (1) every 100-feet.

8.7.6. Hose connections shall be installed within 15-feet of the main entrance to the building, if feasible.

8.7.7. Provide isolation valves on interior feed to deactivate outdoor hose bibbs during winter.

8.7.8. Exterior hose connections shall be recessed socket type.

8.7.9. For UIHC:

8.7.9.1. All wall hydrants shall be Woodford or Owner approved equal.

8.7.10. For UI Housing facilities:

8.7.10.1. Install a wall hydrant or roof hydrant every 100-feet at roofs with vegetation.

8.8. Floor Drains:

8.8.1. Mechanical rooms shall have a minimum of one (1) floor drain.

8.8.2. Additional floor drains shall be installed as required to maintain a minimum ratio of one (1) floor drain for every 500-square feet of floor area. These floor drains are in addition to drains required for equipment.

8.8.3. Mechanical room floor drains shall not be connected to the storm sewer system.

8.8.4. Flooring shall pitch toward the floor drain to eliminate standing water.

8.8.5. Provide floor drains in all toilet rooms. Square drains shall be used for tile floors, round drains for concrete floors.

8.8.6. For UIHC:

8.8.6.1. Floor drains may be installed in toilets rooms where authorized by the Owner.

8.8.6.2. In toilet rooms without showers, they shall only be installed in multi-stall restrooms

8.8.7. For UI Housing:

8.8.7.1. Trench drains shall be installed around pumps and air handler units.

8.8.7.2. Floor drains in mechanical rooms and janitor closets shall have a minimum pipe size of 3-inches and a removable strainer, minimum size 6 ½-inches.

8.9. Emergency Showers and Eyewash Stations:

8.9.1. Emergency showers and eyewashes shall be provided as required by OSHA or project program requirements. Coordinate with Owner.

8.9.2. Piping to emergency showers and eyewashes shall comply with ANSI Z358.1 2004.

8.9.3. Emergency showers shall have a local alarm.

8.9.4. For mechanical and custodial spaces only, the basis of design for eyewash stations and their associated mixing valves shall be Speakman SE-505 and Leonard TA-300, respectively.

8.9.5. The eyewash station shall be installed as close as possible to the mop sink.

8.9.6. For UIHC:

8.9.6.1. Eye Wash to be a deck mounted device, operated with one hand like Acorn S0650, Bradley S19-280W, or Guardian 1848 with a Guardian G3600LF, thermostatic mixing valve.

8.9.6.2. Eye washes are not to be installed behind locked doors in clinics or inpatient units.

8.9.7. For University's Utility Operator:

8.9.7.1. Emergency showers and eyewashes shall be provided as required by OSHA or project requirements. Coordinate with Utility Operator.

8.9.7.2. Piping including tepid water system to emergency showers and eyewashes shall comply with ANSI Z358.1 2004.

8.9.7.3. Emergency showers shall discharge to floor drains.

8.9.7.4. Emergency showers shall have a local alarm.

9. Medical Gas Systems:

9.1. General:

- 9.1.1. All medical gas systems within the Hospital shall be Category 1 medical gas systems.
- 9.1.2. The minimum size of medical gas piping installed above-ceiling shall be ½-inch diameter.
- 9.1.3. The maximum length of run for ½-inch diameter medical gas piping shall be 30-foot.
- 9.1.4. During the Design Phase, the Design Professional shall coordinate all medical gas systems with the Owner, including the project's User group, Respiratory Therapy, Anesthesia (if required), and the Owner's Representative.
- 9.1.5. The Design Professional shall determine the adequacy of capacity of any existing oxygen main which is under consideration for supplying oxygen to a specific project. (A bulk oxygen tank east of the Hospital is the main supply of oxygen used at the facility. The main distribution system extends through the Lower Level and has risers at multiple points.)
- 9.1.6. The Design Professional shall consider possible future additions to the medical gas distribution system for a specific project. (Installation of piping sizes larger than ½-inch diameter is often a cost-effective means to accommodate future expansion or revisions.)
- 9.1.7. Medical Gas Valves shall be installed at locations per NFPA guidelines. Where there are questions at non-standard locations, review the specifics with Respiratory Therapy.
- 9.1.8. Isolation valves for each horizontal take-off from medical gas risers shall be installed and in accessible locations.
- 9.1.9. Lockable valve boxes shall be required when requested by the Owner.
- 9.1.10. Zone Valve Boxes shall be Amico VBU-P with secondary sensor part in the box, not in the ceiling.
- 9.1.11. For all medical gas system components except for medical air compressors and medical vacuum pumps, Beacon Medaes or Amico are the approved manufacturers.
- 9.1.12. Abandoned gas piping must be removed back to a shut off valve.

9.2. Back-up Cylinder Rooms for Oxygen and Other Medical Air:

- 9.2.1. Back-up cylinder systems shall be manual systems by Western, Beacon Medaes, or Amico.
- 9.2.2. Rooms shall be designed per NFPA 99 including appropriate wall construction and ventilation.
- 9.2.3. Medical gas cylinders shall be properly secured per NFPA 99.
- 9.2.4. Design of room shall be coordinated with Owner, Respiratory Therapy, and relevant User group.
- 9.2.5. Shut-off valves on the incoming building supplies shall be no higher than 5-feet 6-inches above finished floor.
- 9.2.6. Medical gas cylinders for back-up cylinder rooms will be Owner furnished.

9.2.7. Refer to UIHC MEDICAL AIR – RESERVED CYLINDER ROOM LAYOUT DETAILS in Appendices.

9.3. Medical Gas Piping:

9.3.1. Oxygen, medical air, nitrous oxide, carbon dioxide, medical vacuum, waste anesthetic gas disposal:

9.3.1.1. Pipe 3-inches and under shall be Type L copper, ASTM B819, cleaned and capped.

9.3.1.1.1. Joints shall be BCuP silver braze. 200 psi rated.

9.3.1.2. Pipe over 3-inches shall be Type K copper, ASTM B819, cleaned and capped.

9.3.1.2.1. Joints shall be BCuP silver braze. 200 psi rated.

9.3.2. Nitrogen, Instrument Air:

9.3.2.1. All sizes shall be Type K copper, ASTM B819, cleaned and capped.

9.3.2.2. Joints shall be BCuP silver braze. 300 psi rated.

9.4. Medical Gas Outlets:

9.4.1. Coordinate the type of medical gas outlet required at each location. (DISS outlets are installed in most areas.

9.4.2. Quick connect outlets are required in some rooms where speed is a consideration, but heavy usage is not expected.)

9.4.3. Coordinate the generation of the required medical gas outlets during the Design Phase.

9.4.4. Specification requirements shall provide for an extra 5%, no less than 1% and no greater than 10%, of each type of medical gas outlet to be furnished within each project to allow change outs of the medical gas outlet type where the Owner may request so at the completion of construction.

9.4.5. All remaining unused medical gas outlets shall be turned over to the Owner.

9.5. Area Alarm Panels:

9.5.1. Coordinate the location of all area alarm panels with the Users.

9.5.2. Locate area alarm panels adjacent to medical zone valve boxes.

9.5.3. The specifications shall require that the Contractor set and adjust all timing and sequencing of alarms per the directions Owner during the Construction Phase.

9.5.3.1. This is work that is done via internal settings at each area alarm panel.

9.6. Medical Compressed Air System:

9.6.1. Install duplex medical air compressors for each new addition or where medical air capacity expansion is required.

- 9.6.2. All compressors shall meet current NFPA guidelines for medical air compressors.
- 9.6.3. All medical air compressors shall be of the liquid-cooled rotary screw or scroll type with internal sound dampening on its enclosure.
- 9.6.4. Do not locate any medical air compressors immediately above, below or near any noise sensitive areas.
- 9.6.5. Install all medical air compressors and their controls on emergency power which is fed via automatic transfer switches.
- 9.6.6. The compressors shall be fed from separate electrical load centers.
- 9.6.7. Install dual-source cooling to each water-cooled air compressor.
 - 9.6.7.1. The primary source shall be the building-wide chilled water system and the back-up source shall be the domestic cold-water system.
- 9.6.8. Install crosstie piping to other existing medical air compressors to create additional redundancy.
- 9.6.9. Install the outside air intakes for medical air compressors from either the roof or other location approved by NFPA 99.
- 9.6.10. Install desiccant dryers for all medical air compressors, unless authorized otherwise by the Owner.
- 9.6.11. Interconnect the signal from the pressure sensor on the common medical air discharge main into:
 - 9.6.11.1. Master alarm system installed in the maintenance shop area of General Hospital.
 - 9.6.11.2. Main Telecon Alarm Center.
 - 9.6.11.3. Acceptable Manufacturers: Kolbelco, Powerex, Amico or Quincy.

9.7. Medical Vacuum Pumps:

- 9.7.1. Install duplex medical vacuum pumps for each new addition or where medical vacuum capacity expansion is required.
- 9.7.2. Air-cooled vacuum pumps are acceptable only at sizes below 20 hp.
- 9.7.3. Water-cooled vacuum pumps are acceptable at all sizes.
- 9.7.4. All water-cooled vacuum pumps shall be installed with a primary and a back-up source of cooling water.
- 9.7.5. Install all medical vacuum pumps on emergency power which is fed via automatic transfer switches.
- 9.7.6. Install crosstie piping to other existing medical vacuum pumps to create additional redundancy.

9.7.7. Interconnect the signal from the pressure sensor on the common medical vacuum intake main into master alarm system that is installed in the General Hospital and the main telecom Alarm Center

9.7.8. Acceptable Manufacturers: Quincy, Powerex or Amico.

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

1. General:

- 1.1. Heating, ~~and cooling,~~ and ventilation system loads for the purpose of sizing systems and equipment shall be determined in accordance with procedures described in the ASHRAE Handbook -Fundamentals.
- 1.2. Outdoor design conditions shall be selected from the latest edition of ASHRAE Handbook - Fundamentals, or from data obtained from the National Climate Center or similar recognized weather source.
- 1.3. Heating design temperature shall be -25 degrees. ~~not be lower than the 99 percent dry bulb (dB).~~
- 1.4. Cooling design temperature shall be 92 F dB, 76 F wb and for cooling towers 79 F wb. In 100% outdoor air applications, design to 85 F db and 76 wb.
- 1.5. ~~Winter humidification shall not be provided for general comfort applications.~~
- 1.6. Humidification shall be provided for 100 percent outdoor air systems or special areas (e.g., labs, museums, rare books, all UIHC). Winter humidification shall not be provided for general comfort applications beyond ASHRAE specifications.
- 1.7. ~~Ventilation systems shall be designed to provide outdoor air ventilation rates in accordance with ANSI/ASHRAE Standard 62.~~
- 1.8. Supply / Exhaust fan HVAC system configurations are preferred over single fan systems. ~~Exhaust/return fans shall be included in the HVAC design. Single fan systems are prohibited.~~
- 1.9. Fresh air intakes shall be designed above grade and shall be no closer than 50 feet to parking areas and loading docks.
- ~~1.10. Piping systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.~~
- ~~1.11.1.10.~~ HVAC equipment shall have a minimum efficiency at the specified rating condition, not less than the values shown in ASHRAE 90.1. Compliance with minimum efficiency requirement specified for HVAC equipment shall include compliance with Integrated Part-Load Value (IPLV) as well as standard or full-load requirements.
- ~~1.11.~~ Centralized heating and chilled water are preferred systems, where available.
 - ~~1.11.1.~~ For 100 percent outside air requirements, a steam heat exchanger shall be used to incorporate antifreeze protection for pre-heat coils; pre-heat to be steam to glycol heat exchanger.
 - ~~1.11.2.~~ Pre-heat and reheat applications shall incorporate a steam-to-hot-water heat exchanger for better temperature control.
- ~~1.12.~~ Electric heating systems shall not be used.

~~1.14.1.13.~~ The Design Professional shall plan access for servicing and maintenance of equipment.

~~1.15.1.14.~~ Minimize mechanical rooftop equipment and roof penetrations by consolidating equipment in mechanical rooms.

~~1.16.~~ Piping riser shall not be routed through Custodial or IT Spaces.

~~1.17.~~ Shut-off valves shall be provided at pipe branches and where required to facilitate partial system isolation. Each floor shall have a minimum of one (1) shut-off valve, located on the main branch.

~~1.18.1.1.~~ Equipment, fixtures, or other appliances attached to any piping system shall have a shut-off valve located at the connection to the piping system.

~~1.19.1.1.~~ All valves shall be located with sufficient room for maintenance or replacement.

~~1.20.~~ Additions to all new and existing supply piping shall extend off the top of the pipe, with the exception of condensate piping.

~~1.21.1.15.~~ Vibration and sound transmission from mechanical equipment and systems shall not exceed consider ASHRAE sound criteria design guidelines, Table 42, ASHRAE HVAC Applications Handbook, Chapter 47.

~~1.22.~~ Size each unit (heat exchanger, cooler, fan coil, or air handler) connected to the central chilled water system for a minimum inlet temperature of 44 degrees F and a minimum temperature differential of 16 degrees F.

~~1.23.1.16.~~ Provide an off-season chilled water distribution pump for year-round chilled water loads. Provide appropriate Sequence of Operation to ensure chilled water pumps operate to maximize efficiency.

~~1.24.1.17.~~ The use of once-through cooling of any equipment is prohibited. Water-cooled systems shall use chilled water.

~~1.25.~~ Penetrations through firewalls, floor or roof decks shall have firestopping material installed at the penetrations and shall be shown on the drawings.

~~1.26.1.1.~~ Wall and Ceiling Access Doors:

~~1.26.1.1.1.1.~~ Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.

~~1.26.2.1.1.1.~~ Size to allow maintenance access all concealed valves and equipment.

2. Refrigerant Management:

2.1. Owner is required to comply with Title VI of the Clean Air Act relating to ozone depleting substances.

2.2. Owner's preference is to use HFC refrigerants for comfort, commercial, and industrial process cooling. Class I refrigerants (CFCs) shall not be allowed.

2.3. Design Professional shall notify Owner when project includes cooling equipment that contains over 50 pounds of refrigerant.

- 2.4. Venting refrigerant into the atmosphere is prohibited. Provisions for proper handling and disposal of refrigerants shall be made. Design Professional shall coordinate with the Owner.
3. Maintenance Access:
 - 3.1. Coils, energy recovery equipment, wheels, heat exchangers, motors, etc., shall be removable and replaceable without removing adjacent equipment, piping, ductwork, conduit, etc.
 - 3.2. Coils within a unit shall be removable without requiring removal of any other coil in the same unit.
 - 3.3. Piping shall be offset to allow for removal of coils without removal of piping header.
 - 3.4. Locate hangers to allow removal of maintainable components without undue torque on remaining equipment, piping, ductwork, conduit, etc.
 - 3.5. All air handling units shall have labels installed on them. Coordinate numbering with the Owner's Rep. during the construction phase.
 - 3.6. The air handling unit manufacturer shall be required to provide a minimum of four hours of training for the Owner's personnel on each new air handling unit above 2000 cfm.
 - 3.7. Wall and Ceiling Access Doors:
 - 3.7.1. Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.
 - 3.7.2. Size to allow maintenance access all concealed valves and equipment.
4. Lab and Specialty Systems:
 - 4.1. Lab Systems:
 - 4.1.1. Lab HVAC system shall be designed as one hundred percent (100%) outside air, Variable Air Volume (VAV) supply and exhaust system. Constant Air Volume (CAV) applications, system, or zones, require a Deviation Request.
 - 4.1.2. Lab exhaust systems shall be designed for continuous operation.
 - 4.1.3. Any component of the exhaust air system requiring maintenance access shall be accessible, without human exposure to the exhaust airstream, while the exhaust system is in operation.
 - 4.1.4. Where feasible, ventilation to offices, conference rooms, corridors, and other non-lab spaces shall be provided from a different air handling system.
 - 4.1.4.1. Exception: Lab office space where air is transferred to adjacent laboratory to maintain airflow direction requirements.
 - 4.1.5. Serve special use lab spaces, such as animal holding, BSL-3, etc., from a dedicated supply and exhaust system.

- 4.1.6. Labs and adjacent spaces shall be designed and balanced to maintain appropriate airflow direction and/or space pressure relationships from low hazard areas to high hazard areas at all times.
- 4.1.7. Airflow and/or pressure relationships shall be clearly identified in the documents. Any room with a positive or negative pressure relationship should be balanced to .02 and alarmed at less than .01
- 4.1.8. In lab spaces where the dominant design consideration is sensible cooling load, a stand-alone cooling system served by a year-round chilled water loop shall be evaluated for potential energy savings over a traditional all air system.
- 4.1.9. Design Professional shall determine the required ventilation rates to maintain air quality and safety of the room while minimizing overall energy use.

4.1.10. Minimum air changes shall be as follows:

	Minimum Air Changes per Hour (ACH)	
Time-of-Day Schedule	Occupancy Sensor	Occupancy Sensor
	Occupied	Unoccupied
Occupied	6	6
Unoccupied	6	4

4.1.11. Written notification shall be submitted to the owner if a space requires ventilation rated other than indicated minimums.

4.1.12. Indicate design minimum air changes on the Room Airflow Matrix. Refer to Article [25.7](#). Controls, [7.7.4-25.7](#) Air Flow Matrix, below.

4.1.13. Design Professional shall verify the HVAC system design is capable of reliable control throughout the full potential range of minimum and maximum airflows that may be required for any given space.

4.1.14. Design Professional shall not oversize HVAC control devices.

4.1.15. Lab spaces shall have dedicated and separate exhaust air systems from non-research functions in the building.

4.1.16. Recirculated air equipment (fan coil units and induction units) shall not be used in Tissue Culture or similar rooms where the introduction of bacteria would affect research.

4.1.17. Lab HVAC systems, including fume hoods and safety cabinets, shall be fully commissioned.

4.2. Redundancy:

4.2.1. N+1 redundancy of critical central HVAC systems shall be provided with multiple air handling units and exhaust fans to provide redundancy and improve reliability.

4.2.2. These systems shall be designed to include manifold air-handling units and exhaust fans to achieve N+1 redundancy and maintain operation at all times.

4.2.3. Systems utilizing a fan array design approach may also be considered to meet these requirements.

4.3. Temperature Controls:

4.3.1. Occupancy sensors shall be designed to provide full coverage of the laboratory area and shall have an output to the Building Automation System (BAS) for use in the temperature and ventilation control sequences.

4.3.2. Space temperature deadbands shall be as follows:

	Temperature Deadband (F)	
Time-of-Day Schedule	Occupancy Sensor Occupied	Occupancy Sensor Unoccupied
Occupied	+/- 1	+/- 3
Unoccupied	+/- 1	+/- 6

4.4. Pressure and Airflow Control:

- 4.4.1. Supply and exhaust air shall be monitored by airflow measuring stations (AFMS) to maintain positive or negative pressure relationships.
- 4.4.2. Through-the-wall room pressurization controllers shall be avoided.
- 4.4.3. Laboratories requiring positive pressure, such as genome DNA processing rooms, tissue culture laboratories, clean laboratories, or sterile facilities etc., shall have personnel entry door, anteroom, or other means of maintaining pressure relationship.

4.5. Ductwork:

- 4.5.1. Fully duct supply, exhaust, and outside air systems for all spaces.
- 4.5.2. Special use hoods (such as radioisotope hoods) ducted Biological Safety Cabinets, or high pressure drop applications shall be separately exhausted, and not incorporated into a common exhaust plenum system, to avoid any particular application driving the static pressure requirements of the entire exhaust system.
- 4.5.3. Smoke dampers and/or fire dampers shall not be installed in laboratory exhaust ducts serving fume hoods, safety cabinets, or other containment equipment.
- 4.5.4. Duct materials shall be evaluated with vapors being exhausted.
- 4.5.5. 304 stainless steel shall be used as the basis of design for most solvents and potentially flammable vapors.
- 4.5.6. All stainless-steel duct seams and joints shall be welded.
- 4.5.7. Plastic laboratory exhaust duct shall be FM Global approved for use without automatic sprinkler protection.

4.6. Fume Hoods:

- 4.6.1. Fume Hoods shall be restricted air bypass-style type and set up for variable air volume (VAV) control.
- 4.6.2. Fume Hoods shall be designed for a minimum face velocity of 110 FPM at a sash working height of 18-inches.

- 4.6.3. Shall have been tested and certified per the latest version of ASHRAE Standard 110.
- 4.6.4. The location of fume hoods, supply/exhaust air devices, lab equipment, casework, and walkways are to be designed to eliminate potential disruption to the airflow at the face of the fume hood opening.
- 4.6.5. Hoods shall not be located near doors or primary walkways.
- 4.6.6. Ambient air velocity, caused by supply outlets, etc., shall not exceed ~~30~~40 FPM at the hood face.
- 4.6.7. Fume hoods shall be provided with a local monitor that gives a visible indication of face velocity and a visible/audible alarm when the face velocity is out of the acceptable design range.
- 4.6.8. Fume hood monitor/controller and lab control system shall be integrated with the Building Automation System (BAS) with all available points mapped back to the BAS.
- 4.6.9. Mott Casework shall be the fume hood basis of design.
- 4.6.10. Refer to FUME HOOD INSTALLATION DETAIL in Appendices.
- 4.6.11. For UIHC:**
 - 4.6.11.1. Fume Hoods shall be provided with proximity sensors and automatic sash closures.
 - 4.6.11.2. High performance (low velocity) hoods may be considered for locations where this will result in the potential of a lower life cycle cost for the project.
 - 4.6.11.3. Provide durable, weatherproof flexible connections at inlets.
 - 4.6.11.4. Hamilton Industries or Owner approved equal.
- 4.7. Biological Safety Cabinets (BSC):
 - 4.7.1. Class II, Type A1 or Type A2 (recirculated), shall not be hard ducted to the building exhaust system.
 - 4.7.2. Class I, Class II-B1 (partially exhausted) and Class II-B2 (fully exhausted) shall be hard ducted to a dedicated building exhaust air system.
 - 4.7.3. Class II-B1 and Class II-B2 shall be factory provided with means of shutting down the internal fan whenever the static pressure in the connected building exhaust air system drops below the required set point.
 - 4.7.4. Exhaust systems serving BSC shall include variable frequency drive to increasing the system static pressure to compensate for loading of the HEPA filters.
- 4.8. Storage Cabinets:
 - 4.8.1. Flammable storage cabinets shall not be vented.

4.8.2. Locate vented corrosive storage cabinets underneath fume hoods, if present.

5. Exhaust Fans:

- 5.1. Exhaust discharge shall be a minimum of ten feet above the roof or highest building surface within 50 feet of the stack and discharged with a minimum velocity of 3,000 FPM.
- 5.2. If project conditions do not allow the minimum requirements listed above, configuration exhaust dispersion modeling of the building and surrounding facilities shall be completed to assure acceptable indoor air quality of all facilities.
- 5.3. Exhaust fans shall be located to provide full access for maintenance and be as close to the exhaust stack as possible.
- 5.4. Exhaust fans shall be direct drive with sealed bearings.
- 5.5. It is preferred that the fan be located exterior to the building. When the exhaust fan must be in an interior mechanical space, provide minimum exhaust of one air change per hour in that space.
- 5.6. **For UIHC: (Isolation Rooms)**
 - 5.6.1. Label the exhaust air duct from isolation rooms at intervals of 50 foot. Also label each isolation room exhaust fan, motor controls and any VFDs as such.
 - 5.6.2. Arrange the duct systems for isolation rooms to include flow tracking (for pressurization control) via the use of TABs on both the incoming supply air and the leaving exhaust or return air ducts.
 - 5.6.3. Isolation rooms shall have direct drive exhaust fans.
 - 5.6.4. The return or exhaust intakes from isolation rooms shall be installed at floor level and filtered with pleated Meril 8 filter.
 - 5.6.5. The room pressure controller for isolation rooms shall be a TSI model RPC30 or SETRA model RCM2 with a non-flashing display.
 - 5.6.6. Isolation rooms shall have either neutral/negative switching or neutral/positive switching; negative/positive switching is prohibited.
 - 5.6.7. Ceiling diffusers with integral HEPA filters (in lieu of installing above-ceiling in-line HEPA filters) shall be used for positive pressure isolation rooms.
 - 5.6.8. Status monitoring through the building automation system shall be provided for all exhaust fans.
 - 5.6.9. Internal sound attenuation lining up to 40-foot upstream of the fan inlet is acceptable.

6. Equipment:

- 6.1. Provide major equipment with pressure, temperature, and flow indicators at time of installation to establish unit performance.

~~6.2. Provide equipment with bearings lubricated for life by the manufacturer.~~

~~6.3.6.2.~~ Where periodic lubrication is needed, specification shall require lubrication points to be readily accessible for lubrication.

~~6.4.6.3.~~ Remote lubrication systems shall be metal.

~~6.5.6.4.~~ Provide access doors [to all serviceable MEP equipment \(i.e., at all](#) coils, filters, motors, belts, air flow stations ~~etc~~).

~~6.6.6.5.~~ All coils shall be fully drainable.

~~6.7.6.6.~~ Mechanical equipment/systems shall be installed on minimum 3 ½-inch concrete housekeeping pad, with steel support framing, as required, to allow proper housekeeping, drainage, and full access.

~~6.8.6.7.~~ Sub floors beneath housekeeping pads shall be sealed to prevent leakage through cracks in pads.

~~6.9.6.8.~~ Motors shall be premium efficiency.

~~6.10.6.9.~~ Motors shall not be designed to operate in the service factor.

~~6.11.6.10.~~ Motors shall be designed to operate continuously at all speeds with variable speed drives having carrier frequency of 12 KHZ or higher and without large fluctuations in amps drawn at any single speed.

~~6.12.6.11.~~ Equipment shall have a hand/off/auto switch to allow manual override of the normal controls.

7. HVAC Identification:

7.1. General Piping Marker Requirements:

7.1.1. Label all piping at least every 20-feet along all pipes, at least one (1) in every room and on both sides of walls that pipes penetrate.

7.1.2. Building hydronic piping systems shall be labeled with tag containing the following information. Tag to be attached at chemical feed point/system:

7.1.2.1. System water volume.

7.1.2.2. Chemical additive and ratio.

7.1.2.3. Date of system startup.

7.2. General Ductwork Marker Requirements:

7.2.1. Apply ductwork markers on all ductwork systems in the following locations where clearly visible:

7.2.1.1. On both sides of walls that ducts penetrate.

7.2.1.2. At least every 20 feet along all ducts.

7.2.1.3. On each riser and each leg of each branch connection.

7.2.1.4. At least once in every room and each story traversed.

7.2.1.5. At all ductwork access doors.

7.2.2. Labels shall indicate the AHU number (AHU##) or exhaust fan number (EF###), system (supply, return, exhaust, hazardous exhaust), and a flow direction arrow.

7.3. Valves:

7.3.1. All valves shall be tagged unless valves are ¾-inch in diameter and adjacent to equipment served.

7.3.2. Valve tags shall include the valve number and project number.

7.3.3. Coordinate the specific numbering sequence with the Owner's Rep. during the construction phase of each project.

7.4. Equipment:

7.4.1. Provide equipment identification on all HVAC equipment.

7.4.2. Where practical, provide plastic laminate tags indicating the equipment identification number in a clearly visible spot.

7.4.3. Where no appropriate flat surface exists for a plastic laminate tag, provide brass tags on chains attached to the equipment.

7.4.4. Equipment tags are distinct from the Preventive Maintenance numbers that the Owner's personnel install after the Construction Phase.

7.4.5. Coordinate all equipment identification numbers with the Owner.

7.5. Ductwork Markers:

7.5.1. Ductwork systems shall be provided with labels with custom labeling describing duct system. Refer to table in Part 3 for system and label description.

7.5.2. Vinyl Markers:

7.5.2.1. Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.

7.5.2.2. Letters shall be at least 1 ¼-inch in size.

7.6. HVAC Pipe Label Schedule:

7.6.1. Pipes to be marked shall be labeled according to ANSI guidelines with the text as shown in the following table.

PIPE SERVICE	LETTERING COLOR	BACKGROUND COLOR
HIGH TEMP HOT WATER - OVER 240°F	BLACK	YELLOW
LOW PRESSURE STEAM (15 psi or less)	BLACK	ORANGE
LOW PRESSURE CONDENSATE	BLACK	LIGHT GREY
MEDIUM PRESSURE STEAM (16-85 psi)	BLACK	DARK GREY
MEDIUM PRESSURE CONDENSATE	BLACK	LIGHT GREY

PIPE SERVICE	LETTERING COLOR	BACKGROUND COLOR
HIGH PRESSURE STEAM (over 85 psi)	WHITE	DARK GREY
HIGH PRESSURE CONDENSATE	BLACK	LIGHT GREY
PUMPED CONDENSATE	BLACK	LIGHT GREY
HEATING WATER SUPPLY	WHITE	MEDIUM BLUE
HEATING WATER RETURN	WHITE	MEDIUM BLUE
CHILLED WATER SUPPLY	WHITE	DARK BLUE
CHILLED WATER RETURN	WHITE	DARK BLUE
CONDENSING WATER	BLACK	SILVER
COOLING TOWER MAKE-UP WATER	WHITE	LIGHT BLUE
REFRIGERANT (LIQUID/SUCTION)	WHITE	GREEN
CONDENSATE DRAIN	BLACK	YELLOW
COMPRESSED AIR	BLACK	YELLOW
CONTROLS COMPRESSED AIR	WHITE	BLACK

7.7. Ductwork Label Schedule:

7.7.1. Label ductwork according to the following schedule:

DUCTWORK SERVICE	LETTERING COLOR	BACKGROUND COLOR
SUPPLY AIR	WHITE	BLUE
RETURN AIR	WHITE	GREY
EXHAUST / RELIEF AIR	WHITE	BLACK
OUTSIDE AIR	WHITE	GREEN
HAZARDOUS EXHAUST	BLACK	ORANGE

7.8. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD OF PIPE OR INSULATION	MARKER LENGTH	SIZE OF LETTERS
Up to and including 1 ¼-inches	8-inches	½-inches
1 ½-inches to 2-inches	8-inches	¾-inch
2 ½-inches to 6-inches	12-inches	1 ¼-inches
8-inches to 10-inches	24-inches	2 ½-inches
OVER 10-inches	32-inches	3 ½-inches

8. HVAC Piping Insulation:

8.1. General:

8.1.1. Insulation systems shall be compliant with Midwest Insulation Constructors Association (MICA) National Commercial and Industrial Insulation Standards, latest edition.

8.1.2. Insulate all piping systems per ASHRAE 90.1.

8.1.3. Systems shall be clean and dry prior to installing insulation.

8.1.4. Insulation that indicates exposure to moisture, including piping or ductwork condensation, shall be removed, and replaced.

- 8.1.5. Wet insulation, or insulation that has been wet, will not be accepted.
- 8.1.6. After testing and cleaning, colder than ambient systems shall not be put into operation until insulation and vapor barriers are complete.
- 8.1.7. Joints shall be sealed using the Manufacturer's approved adhesive.
- 8.1.8. Elastomeric piping insulation installed outdoors shall be jacketed or coated.
- 8.1.9. Insulation and vapor barrier shall be continuous through all wall and floor penetrations and hangers.
- 8.1.10. Repair vapor barrier breaches on below ambient piping systems with ASJ tape or chilled water mastic.
- 8.1.11. All-service insulation laps and butt strips shall be securely attached. Joints that peel or gap shall be secured using outward-clench staples or mastic.
- 8.1.12. Appurtenances shall be insulated to prevent condensation or burn hazards. Seal joints on below ambient piping systems.

8.1.13. Wood or plastic block hanger inserts shall not be used.

~~8.1.13.~~8.1.14. All valves must have extensions that account for insulation thickness.

8.2. Chilled Water Piping:

8.2.1. Insulation Materials:

8.2.1.1. Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

8.2.1.2. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

~~8.2.1.2.~~8.2.1.2.1. EPDM not allowed on chilled water piping within UIHC.

8.2.1.3. Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

8.2.2. Review locations of each insulation type with Owner.

8.3. Heating Water Piping:

8.3.1. Insulation Materials:

8.3.1.1. Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn,

25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

8.3.1.2. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

~~8.3.1.2.~~8.3.1.2.1. EPDM not allowed on heating hot water piping within UIHC.

8.3.1.3. Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.

8.4. Refrigerant Piping:

8.4.1. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1-inch thick per layer where multiple layers are specified.

8.4.2. Vapor barriers shall be applied to all refrigerant return line insulation.

8.4.3. A weather-resistant covering or field-applied paint shall be applied on all exterior pipe insulation on refrigerant piping.

8.5. Jacket Coverings:

8.5.1. Review with the Owner specific types of jacketing proposed for each installation.

8.5.2. Metal Jacket Covering:

8.5.2.1. Metal jacketing shall not be used on systems other than steam and steam condensate inside buildings.

~~8.5.2.1.~~8.5.2.2. Metal jacketing shall be used on exposed steam and steam condensate piping to 8-feet above finished floor. In Mechanical Rooms, piping jacketing shall be full height.

~~8.5.2.2. Metal jacketing shall not be used on systems other than steam and steam condensate inside buildings.~~

8.5.2.3. Metal jacketing may be used on below ambient piping systems outside of the building.

8.5.2.4. Metal jacketing on steam and steam condensate systems may be banded, riveted, or screwed.

8.5.2.5. Metal jacketing on below ambient systems shall be banded, with all joints lapped and sealed with silicone. Screws and rivets shall not be used.

8.5.2.6. Minimum jacketing thickness shall be 0.020-inches.

8.5.3. PVC Jacket Covering:

8.5.3.1. Install PVC jacketing on all piping within Mechanical Equipment Rooms.

8.5.3.2. PVC jacketing shall be installed on exposed piping, other than steam and steam condensate, up to 8-feet above finished floor. [In Mechanical Rooms, piping shall be full height.](#)

8.5.3.3. Minimum jacketing thickness shall be 0.020-inches.

8.5.3.4. Self-adhered flexible cladding systems shall not be used.

8.5.3.5. PVC Fittings:

8.5.3.5.1. Mineral fiber or pre-molded inserts shall prevent condensation at fittings.

8.5.3.5.1.1. Refer to MICA Plate 2-500.

8.5.3.5.2. PVC fittings laps shall be mechanically fastened with stainless steel tacks, outward-clench staples, or ASJ tape.

8.5.3.5.3. PVC tape alone is not acceptable.

8.5.3.5.4. Joints on PVC fittings on below-ambient systems shall be sealed with mastic or taped with PVC or ASJ tape to maintain vapor barrier.

8.6. Removable Insulation Jackets:

8.6.1. The use of removable insulation jackets shall be required for insulating large and non-cylindrical shaped piping components (e.g., check valves, pressure regulating valves, calibrated balance valves, gate valve bonnets, strainers, line sets, and the like).

8.6.2. Removable insulation jackets shall consist of outer covering, interstitial insulation material, and inner covering.

8.6.3. Inner and outer covering shall be constructed from a minimum 16.5 oz./yd² PTFE fiberglass composite and suitable for insulating surface temperatures up to 550°F.

8.6.4. Interstitial insulation blanket shall be minimum 1-1/2" thick and shall consist of either:

8.6.4.1. Silica and glass-fiber insulation felts and blankets – minimum 6 lb./ft³ density.

8.6.4.2. E-type glass-fiber felts and blankets – minimum 6 lb./ft³ density.

8.6.5. Construction:

8.6.5.1. Inner and outer covering with interstitial insulation material shall be joined into a single assembly using a double sewn lock stitch with 4-6 stitches/inch.

8.6.5.2. The thread used shall be able to withstand minimum 550°F surface temperatures without degradation.

8.6.5.3. The use of hog rings, staples, and wires for closure of assembly are not acceptable.

8.6.5.4. The interstitial insulation shall be sewn as an integral part of the inner and outer coverings to prevent shifting of the insulation. Insulation pins are not an allowable method of preventing the insulation from shifting and shall not be used.

- 8.6.6. No raw cut jacket edges shall be exposed.
- 8.6.7. Jackets shall be fastened to equipment and piping components using hook and loop (Velcro) straps and minimum 1-inch slide buckles.
- 8.6.8. Jacket coverings shall have an inner covering edge with a continuous strip of hook & loop closure (Velcro) that is parallel to the seam and overlaps the outer covering by a minimum of 2-inches.
- 8.6.9. Provide for equipment and appurtenances that operate in the following temperature ranges:
 - 8.6.9.1. 55 degrees F or lower
 - 8.6.9.2. 120 degrees F or higher
- 8.7. Hanger Inserts:
 - 8.7.1. Piping shields shall be installed at hangers and supports.
 - 8.7.2. Shields shall be mechanically secured to the piping by tape, bands, or other visible method.
 - 8.7.3. Provide rigid insulation inserts at hangers for Chilled Water systems.
 - 8.7.4. Provide rigid insulation inserts at hangers for Heating Water systems pipe sizes 2- inches and larger.
 - 8.7.5. Inserts shall be a minimum 180 degrees and extend a minimum of 2-inches beyond the hanger shield.
 - 8.7.5.1. Refer to MICA Plate 1-610.
 - 8.7.6. Insulation Material at Hangers:
 - 8.7.6.1. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 'K' value at 300°F; 1200°F maximum service temperature; 16-gauge stainless steel tie wires on maximum 12-inch centers.
 - 8.7.6.2. Type E: Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; moisture resistant; suitable for -297°F to +300°F.
- 9. Ductwork Insulation:
 - 9.1. General:
 - 9.1.1. Ductwork insulation pins shall be securely fastened. Loose or unattached pins will not be accepted.
 - 9.1.2. Rigid insulation inserts shall be installed at trapeze hangers.
 - 9.1.3. Inserts shall be taped to the duct wrap and shall extend a minimum of 2 inches beyond the hanger.
 - 9.1.4. Insulation and vapor barrier shall be continuous between the hanger and the ductwork.

9.1.5. Taping insulation or vapor barrier to the hanger will not be accepted.

9.2. Insulation Type:

9.2.1. Exterior Duct Wrap-Flexible:

9.2.1.1. Joints shall be sealed with FSK or foil tape.

9.2.1.1.1. Tape shall be securely adhered with the manufacturer's recommended squeegee.

9.2.1.2. Duct wrap insulation longitudinal joints shall be mechanically fastened with outward-clenching staples.

9.2.1.3. Cupped head welded pins or stick pins shall be used on ductwork over 18-inches in either dimension.

9.2.1.3.1. Pins shall be placed at 12-inches on center, maximum.

9.2.1.4. Flexible Fiberglass Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.

9.2.2. Semi Ridged Fiberglass Board Wrap (Indoor use):

9.2.2.1. Semi rigid insulation shall be installed using both adhesives and welded pins.

9.2.3. Semi-rigid Fiberglass Board Wrap (Outside use):

9.2.3.1. ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density

9.2.4. Interior Flexible Duct Liner:

9.2.4.1. Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb./cu ft minimum density; coated air side for 4000 fpm air velocity.

9.2.5. Double-Wall Ductwork Insulation:

9.2.5.1. Double wall ductwork insulation shall be fiberglass; 0.27 maximum 'K' value at 75°F mean temperature; 1.5 lb./cu ft density.

9.3. For UIHC:

9.3.1. Do not install exposed duct lining on any ductwork within UIHC unless authorized by the Owner. If approved, all lined ductwork must have double wall construction for infection control precautions.

9.3.2. Review insulation type for ducts in Mechanical Rooms and on risers in main chases with Owner.

10. HVAC Equipment Insulation:

10.1. General:

10.1.1. Equipment insulation shall comply with MICA Plates 4-100 through 4-660.

10.1.2. Insulation on below ambient system equipment shall be installed without voids between the insulation and the equipment.

10.1.3. HVAC equipment requiring insulation shall include, but no limited to, heat exchangers, air separators, buffer tanks, steam condensate return stations, and chilled water pumps.

10.2. Insulation Type:

10.2.1. Glass Fiber Blanket:

10.2.1.1. ANSI/ASTM C612; 0.400.058 W/(m·K) maximum 'K' value at 300°F/149°C; 2.5 lb./cu ft. 40 kg/m³.

10.2.1.2. Suitable to 850°F/454°C, with all service jacket (ASJ) vapor retarder jacket having 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

10.2.2. Glass Fiber Board:

10.2.2.1. ANSI/ASTM C612; 0.280.040 maximum 'K' value at 200°F/93°C; 6.0 lb./cu ft 96 kg/m³;

10.2.2.2. Suitable to 850°F/454°C, 25/50 flame spread/smoke developed when tested in accordance with ASTM E84 (UL 723).

10.2.3. EPDM, for refrigerate piping only:

10.2.3.1. NBR/PVC Blend is not permitted.

10.2.3.2. Elastomeric cellular foam ANSI/ASTM C534.

10.2.3.3. Flexible plastic; 0.250.035 W/(m K) maximum 'K' value at 75°F/24°C, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

10.2.3.4. Maximum 1-inch 25 mm thick per layer where multiple layers are specified.

10.2.4. Removable Insulation Jackets:

10.2.4.1. Refer to "HVAC PIPING INSULATION" standards section for removeable insulation jacket requirements.

11. Instrumentation:

11.1. Utility Meters:

11.1.1. Chilled Water Utility Meters:

11.1.1.1. Refer to UTILITY DISTRIBUTION CHILLED WATER BUILDING INTERFACE DETAILS and UTILITY DISTRIBUTION CHILLED WATER BUILDING INTERFACE DETAILS (WITH OFF

SEASON COOLING REQUIREMENTS) in Appendices for meter specification and connection details.

11.1.2. Hot Water Utility Meters:

11.1.2.1. Refer to UTILITY DISTRIBUTION HOT WATER METER DETAIL in Appendices for meter specification and connection details.

11.2. Control and Signal Cabling:

11.2.1. Separate raceways and junction boxes to metering and controlling devices shall be installed for each voltage class, including separating AC from DC.

11.2.2. 480 VAC conductors are to be installed at least 12-inches away from any lower voltage signal cabling raceways.

11.2.3. Conductor shall not be installed in shared junction boxes that include signal wiring.

11.3. Pressure Gauges:

11.3.1. Gauges shall be 4 ½-inches diameter with aluminum or stainless-steel case with phosphor bronze bourdon tube, brass socket for air, steam, water or oil application, ¼-inch or ½-inch bottom connection.

11.3.2. Gauges shall be 1% full scale accurate with bronze brushed brass movement and adjustable pointer.

11.3.3. Standard ranges to be either pressure or pressure and vacuum as required of application.

11.3.4. Select gauge range for normal reading near center of gauge.

11.4. Pressure Gauge Accessories:

11.4.1. All pressure gauges shall have valves and pressure snubbers.

11.4.2. All pressure gauges on steam shall have pigtail syphon.

11.4.3. Shutoff Valve shall be ¼-inch ball valve as specified for each piping system.

11.4.4. Pressure snubber shall be brass with ¼-inch connections, porous metal type.

11.5. Thermometers:

11.5.1. Review Thermometer type with Owner.

11.5.2. Thermometers shall be one of the following.

11.5.2.1. Alcohol/Spirit Filled Type:

11.5.2.1.1. 9-inches long phenolic case, steel stem, accuracy of 1% full scale.

11.5.2.1.2. Adjustable elbow joint with 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, and locking device to allow rotation of thermometer to any angle.

11.5.2.1.3. Select thermometer for appropriate temperature range.

11.5.2.1.4. Stem:

11.5.2.1.4.1. Copper plated steel, aluminum, or brass for separable socket.

11.5.2.1.4.2. Stem lengths as required for application with minimum insertion of 3-inches.

11.5.2.1.5. Thermometers for water, steam, or oil shall have brass or steel separable socket.

11.5.2.1.6. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

11.5.2.1.7. Thermometers for air shall have an aluminum or brass duct flange.

11.5.2.2. Digital Type:

11.5.2.2.1. ½-inch LCD digital display, solar powered, with high impact ABS case.

11.5.2.2.2. Accuracy of 1% of reading or 1°F, whichever is greater.

11.5.2.2.3. Adjustable elbow joint with locking device to allow rotation of thermometer to any angle.

11.5.2.2.4. Fahrenheit/Celsius switchable with -50/300°F or -45/150°C range.

11.5.2.2.5. Through-case potentiometer recalibration adjustment.

11.5.2.2.6. Stem lengths as required for application, with minimum insertion of 2 ½-inches.

11.5.2.2.7. Thermometers for water, steam, or oil shall have brass or steel separable socket.

11.5.2.2.8. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

11.5.2.2.9. Thermometers for air shall have an aluminum or brass duct flange.

11.5.2.2.10. Digital display shall operate at 10 Lux (one foot-candle) or more.

11.5.2.2.10.1. Use this thermometer only where ambient temperatures are below 140°F and there is sufficient light under normal occupied space conditions for the digital display to function.

11.5.2.2.10.2. Use a different thermometer type where there is inadequate light available (i.e., dark mechanical rooms, locations where the thermometer is shielded from light, etc.).

12. HVAC Piping:

12.1. General:

12.1.1. Take-offs on HVAC piping shall not be from the bottom side.

12.1.2. Install all mechanical pipes as high as possible (while allowing for maintenance access) to prevent any existing or future ceilings from being forced too low.

12.1.3. Routings of mechanical piping shall be parallel or perpendicular to building lines.

12.1.4. All piping installed in chases shall be designed to allow future installation of additional vertical risers and, at the bottom of the chase, additional horizontal piping associated with future projects.

12.1.5. Horizontal sections of mechanical piping mains shall be routed above-ceiling in corridors.

12.1.6. All above-ceiling sections of branch lines shall be at least ¾-inch diameter.

12.1.7. Provide isolation valves on all branch lines and on all equipment to facilitate partial system isolation. Each floor shall have a minimum of 1 shut-off valve with a drain valve located on the main branch.

12.1.8. Equipment, fixtures, or other appliances attached to any piping system shall have a shut off valve located at the connection to the piping system.

12.1.9. All valves shall be located with sufficient room for maintenance or replacement.

~~12.1.7.~~

~~12.1.8.~~ 12.1.10. Pipes shall not be routed over electrical equipment or through custodial rooms and Telecom closets/rooms.

~~12.1.9.~~ 12.1.11. Where mechanical piping risers span more than two floors, those risers shall be installed inside of fire-rated chases.

~~12.1.10.~~ 12.1.12. Do not install mechanical piping:

~~12.1.10.1.~~ 12.1.12.1. Within 18-inches horizontally of any pneumatic transport tube diverter.

~~12.1.10.2.~~ 12.1.12.2. Below any pneumatic transport tube diverter.

~~12.1.10.3.~~ 12.1.12.3. Within 18-inches horizontally of any terminal air box.

~~12.1.10.4.~~ 12.1.12.4. In the door swing space of any duct access door.

~~12.1.10.5.~~ 12.1.12.5. Within 12-inches of the front of any electrical junction box.

~~12.1.10.6~~-~~12.1.12.6~~. Within 12-inches of any roof perimeter or penetration requiring roof flashing.

~~12.1.10.7~~-~~12.1.12.7~~. Within 4-inches of the new roof surface elevation.

~~12.1.11~~-~~12.1.13~~. Install di-electric brass unions connections in the mechanical piping systems where any dissimilar metals are in contact.

~~12.1.12~~-~~12.1.14~~. All types of mechanical piping risers, except cooling coil condensate and refrigerant piping, shall have drain valves at their bottom as well as isolation valves on their horizontal supply and return branches where they connect to their risers.

~~12.1.13~~-~~12.1.15~~. The water velocity in piping shall not exceed 7-feet/second.

~~12.1.14~~-~~12.1.16~~. Maximum design pressure-drop of 4-feet/100-feet of equivalent pipe length.

~~12.1.15~~-~~12.1.17~~. Install manual air vents at all high points in water systems.

~~12.1.16~~-~~12.1.18~~. Refer to DIFFERENTIAL PRESSURE TRANSDUCER detail in the appendix for all hydronic systems.

12.2. Hydronic System Design:

12.2.1. Hydronic piping systems on either a total building, partial building, or a room basis shall utilize a reverse return piping arrangement if three (3) of the four (4) criteria below are met:

12.2.1.1. Loads are widely spread throughout the project scope area.

12.2.1.2. Distribution piping can make a complete loop starting and ending in either the mechanical room, or internal source of the hydronic piping in the building, for an entire building or starting and ending at hydronic piping distribution mains for a partial portion of the building.

12.2.1.2.1. The project scope area is greater than 5,000-square feet.

12.2.1.2.2. The hydronic system flow rate for the project scope area is greater than 25 gpm.

12.2.2. Hydronic piping systems shall always utilize a reverse return piping arrangement in the following situations:

12.2.2.1. Multiple identical devices require equal flow proportions from a common supply.

12.2.2.2. Multiple devices are served by a common zone valve or circulator [e.g., several fin tube elements served by one (1) zone valve]

12.3. Chilled Water System Design:

12.3.1. Provide thermometers and pressure gauges on both the inlet and discharge sides of any device connected to the chilled water system.

12.3.2. Chilled water loops shall be two (2) pipe systems.

12.3.3. Chilled water and/or process chilled water systems that require year-round use shall have a winter interface with chilled water pump and pump control sized for the winter load.

12.3.4. Some applications (large temperature rise, water quality issues) may require separation of the chilled water and the medium cooling the device.

12.3.5. Size the heat exchanger for an inlet chilled water temperature of 44-degrees F and a minimum chilled water temperature differential of 12-degrees F.

12.3.6. Control chilled water flow to the heat exchanger according to the temperature of the departing chilled water.

12.3.7. PVC shall not be used for chilled water systems.

12.3.7.1. Minimum pipe size shall be ¾-inch.

12.3.8. Chilled Water Piping:

12.3.8.1. Welded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 40.

12.3.8.2. Threaded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 80.

12.3.8.3. Copper systems shall use a minimum of Type L copper, ASTM B88, joints shall be solder.

12.3.8.4. Mechanical press may be allowed with written permission from Owner.

12.3.8.5. For UIHC:

12.3.8.5.1. Copper systems shall be Type K.

12.3.8.6. Mechanical joint piping systems may be used in exposed areas and in other approved locations with Owners written approval.

12.3.8.6.1. Gaskets shall be rated to 250-degrees F / 120- degrees C.

12.3.8.6.2. Provide minimum 3-inch spacing between fittings on insulated, mechanically coupled systems, such as Victaulic, to allow for insulation on fittings.

12.4. Heating Water, Glycol Water:

12.4.1. Welded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 40.

12.4.2. Threaded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 80.

12.4.3. Copper systems shall use a minimum of Type L copper, ASTM B88, joints shall be solder.

12.4.4. Mechanical press may be allowed with Owners written permission.

12.4.5. For UIHC:

12.4.5.1. Copper systems shall be Type K.

12.4.5.2. All heating water piping is to be welded or copper piping. Lock and groove (VITAU LIC) style pipe is not approved for use in UIHC.

12.4.6. Mechanical joint piping systems may be used in exposed areas and in other approved locations with Owners written approval.

12.4.6.1. Gaskets shall be rated to 250-degrees F / 120- degrees C.

12.4.6.2. Provide minimum 3-inch spacing between fittings on insulated, mechanically coupled systems, such as Victaulic, to allow for insulation on fittings.

12.5. Mechanical Equipment Couplings:

12.5.1. Mechanical Couplings, 2-inch through 12-inch.

12.5.1.1. Manufactured in two (2) segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12.

12.5.1.2. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000.

12.5.1.3. Mechanical Coupling bolts shall be zinc-plated, heat-treated carbon steel track head.

12.5.2. Rigid Type:

12.5.2.1. Coupling housings with offsetting pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.

12.5.3. Flexible Type:

12.5.3.1. Use in locations where vibration attenuation and stress relief are required.

12.5.3.2. Flexible couplings may be used in lieu of flexible connectors at equipment connections.

12.5.3.3. Three (3) couplings, for each connector, shall be placed near the vibration source.

12.5.4. Flange Adapters:

12.5.4.1. Use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges.

12.5.4.2. Basis of design shall be Victaulic style 741.

12.5.4.3. For direct connection to ANSI Class 300 flanges, basis of design shall be Victaulic Style 743.

12.6. Shutoff Valves:

12.6.1. General:

12.6.1.1. Chain operators shall be required on all valves greater than 3-inches and located 10-foot or more above finished floor in mechanical rooms

12.6.2. Ball Valves:

12.6.2.1. Ball valves may be used on piping 3-inches and under.

12.6.2.2. Ball valves shall be 125 psi saturated steam, 600 psi WOG, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and stem, Teflon seats and seals.

12.6.3. Valve Handle Extension:

12.6.3.1. Valves on piping systems with insulation thicknesses of 1-inch or greater shall have handle extensions.

12.6.3.2. Moving parts shall be a minimum of 1-inch beyond the face of the insulation to allow for operation without damaging the vapor barrier.

12.6.3.3. Insulation vapor barrier shall be sealed to the valve handle extension cover.

12.6.4. Butterfly Valves:

12.6.4.1.2 ½-inch up to 6-inches:

12.6.4.1.1. fully lugged end, ductile or cast-iron body (not in contact with fluid);

12.6.4.1.2. bronze, aluminum bronze or EPDM coated ductile iron disc;

12.6.4.1.3. EPDM seat, stainless steel stem, extended neck, 175 psi bubble tight, bidirectional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body, 10 position, locking operator up to 6-inch size.

12.6.4.1.4. Cv of at least 1580 in 6-inch size.

12.6.4.2. 6-inch through 12-inch:

12.6.4.2.1. fully lugged end, ductile or cast-iron body (not in contact with fluid),

12.6.4.2.2. bronze, EPDM coated ductile iron or aluminum bronze disc,

12.6.4.2.3. EPDM seat, stainless steel stem, extended neck, 175 psi bubble tight, bidirectional dead-end shutoff without backing flange or nuts and with cap screws extending to the centerline of the valve body, weatherproof gear operator.

12.7. Balancing Valves:

12.7.1. Balancing valves shall be provided with multiple stops.

12.7.2. Ball valves are not acceptable for balancing.

12.8. Strainers:

- 12.8.1. Strainers shall be furnished with pipe nipple ball valve, threaded hose connection, and cap to blow down.
- 12.8.2. Strainers shall be installed no more than 36-inches above floor, unless approved by Owner.
- 12.8.3. All strainers shall be cleaned at the end of any construction phase.
- 12.8.4. The Contractor shall submit an end-of-construction report certifying that all strainers have been cleaned.

12.9. Pneumatic Control Piping:

- 12.9.1. Exposed locations shall be hard copper tubing.
- 12.9.2. Concealed inaccessible locations shall be hard or soft copper tubing.
- 12.9.3. Concealed accessible locations shall be hard copper tubing.
- 12.9.4. Buried in concrete shall be hard or soft copper tubing.
- 12.9.5. Inside control panels and enclosures shall be Polyethylene tubing.
- 12.9.6. Penetrations through fire and smoke barriers (walls and floors) shall be either hard or soft copper tubing.
- 12.9.7. Remove all pneumatic tubing not required, terminate at hard copper with approved brass plugs or caps, and leak tested.

12.10. Air Vents:

- 12.10.1. Hose bibbs shall be installed for manual air vents at all high points of the hot water systems.
- 12.10.2. Automatic air vents shall not be used.
- 12.10.3. For Athletics:
 - 12.10.3.1. Spiral Automatic vents may be used.

12.10.4. For UIHC:

- 12.10.4.1. Install manual air vents at accessible locations including at the top of all risers, and at all high points in the piping system, but not in patient rooms.

12.11. Expansion Tanks:

- 12.11.1. Expansion tanks shall be located on the suction side of pumps.
- 12.11.2. Bladder type:
 - 12.11.2.1. Tank shall be welded steel, ASME construction and stamped.
 - 12.11.2.2. Tank shall be complete with heavy-duty replaceable butyl bladder, charging valve, lifting ring, drain tapping, and system connection.

12.11.2.3. 125 psig working pressure and 240°F maximum operating temperature.

12.12. Air Separator:

12.12.1. Combination air/dirt separators are required on all systems and shall be coalescing type.

12.12.2. Separators shall be ASME constructed and stamped for 125 psi working pressure and 350°F operating temperature.

12.12.3. Separators shall be line size or larger, with maximum pressure drop of 1 psi.

12.12.4. When furnished, strainers shall be removable, and the blowdown fittings shall have drain valves.

12.13. Triple Duty Valves:

12.13.1. Triple duty valves shall not be permitted.

12.14. Chemical Pot Feeders:

12.14.1. Top of feeder to be located no more than 36 inches above finished floor.

12.14.2. Verify final location with Owner to verify safe chemical transfer.

12.14.3. Provide isolation valves at the inlet, outlet, and drain outlet.

12.14.4. Locate valves immediately adjacent to feeder.

12.15. Testing

12.15.1. All piping shall be hydraulically tested and signed off by the Owner. Pneumatic testing shall not be allowed due to safety concerns.

12.15.2. Test all piping systems at a minimum of one and a half (1 ½) times the expected working pressure, or a minimum of 100 psig and a maximum of the design pressure of the pipe and fittings.

12.15.3. Test all systems for a minimum of four (4) hours.

12.15.4. When test pressure exceeds 125 psig, test pressure shall not exceed a value which produces a hoop stress in the piping greater than 50 percent (50%) of the specified minimum yield strength of the pipe

12.15.5. The Contractor shall provide new valves as required to perform pressure testing of segments of new piping.

12.16. For UIHC:

12.16.1. Corrosion Coupon Rack:

12.16.1.1. Provide corrosion coupon rack on all closed loop systems.

12.16.1.2. Coordinate location with Owner.

12.16.2. Bag Filters:

12.16.2.1. When required, provide size #1 or size #2 bag filter and housing, based on flow rate and system size.

12.16.2.2. Coordinate final location with Owner.

13. HVAC Pumps:

13.1. General:

13.1.1. Pumps shall operate at 1750 rpm unless specified otherwise.

13.1.2. Pump connections shall be flanged, whenever available.

13.1.2.1. **For UIHC:** HVAC pumps shall be supplied with Stainless Steel flex connectors, rubber flex connections are not allowed.

13.1.3. Heating pumps shall be suitable for 225°F water.

13.1.4. All floor-mounted pumps shall be installed on concrete housekeeping pads.

13.1.5. Design professional shall evaluate, and review with Owner, whether base mount spring/vibration isolators are required.

13.1.6. All 3-phase pumps shall be provided with VFDs.

13.1.7. All pumps shall be provided with manual balancing downstream of the pump.

13.1.7.1. For variable speed pumps the manual balancing valves shall be used for flow measurement purposes.

13.1.7.2. For constant speed pumps the manual balancing valves shall be used for balancing purposes.

13.1.7.3. Triple-duty valves shall not be permitted.

13.1.7.4. Refer to HYDRONIC PUMP BALANCING detail in appendices.

13.1.8. All pumps shall have a pressure gauge on the suction and discharge outlets.

13.1.9. Design Professional shall not specify the installation of additional chilled water pumps without Owner approval.

13.1.10. Parallel pumps with unequal head pressure shall not be permitted.

13.1.11. Install all pumps in easily accessible locations.

13.1.12. Install isolation valves on each side of the pump.

13.1.13. Operate Hydronic pumps continuously once chemical inhibitors are added to ensure system circulation.

13.1.14. Acceptable manufactures are Bell and Gossett and Taco.

13.1.15. Refer to PUMP – END SUCTION DETAIL and PUMP – IN-LINE DETAIL in Appendices.

13.2. Base Mounted End Suction Pumps:

13.2.1. Pipe vibration isolators shall be stainless steel.

13.2.2. Centrifugal, single stage.

13.2.3. Casing shall be cast iron, single suction, rated for greater of 150 psi or 1.25 times actual working discharge pressure, flanged suction, and discharge with gauge ports.

13.2.4. Impeller shall be fully enclosed and keyed to shaft.

13.2.5. Shaft shall be high grade alloy steel with copper, bronze, or stainless-steel shaft sleeves.

13.2.6. Bearings shall be grease lubricated roller or ball bearings with grease fittings. If pump will be insulated, grease fittings shall be extended 3-inches with rigid pipe to clear the insulation.

13.2.7. Drive shall be flexible coupling with OSHA approved guard.

13.2.8. Seals shall be mechanical type with internal flushing rated for -20 to 225°F with Buna elastomer, carbon primary ring, and ceramic stationary ring.

13.2.9. Pumps 7 ½-Horsepower and greater shall have Chesterton mechanical split seals or approved equal.

13.2.10. Baseplate shall be heat-treated cast iron or reinforced heavy steel.

13.3. In-Line Pumps:

13.3.1. Horizontal in-line pumps shall have a maximum of 2 HP.

13.3.2. In-line pumps are preferred to be close-coupled.

13.3.3. Centrifugal, single stage, close coupled in line, back pullout design, suitable for horizontal or vertical operation.

13.3.4. Casing shall be cast iron, rated for greater of 125 psi or one and half (1 1/2) times actual working discharge pressure, flanged suction, and discharge with gauge ports.

13.3.5. Impeller shall be fully enclosed, dynamically balanced, keyed to shaft and secured with locknut.

13.3.6. Shaft shall be steel or stainless steel.

13.3.7. Seals shall be mechanical type with internal flushing rated for -20 to 225°F and comprised of Buna elastomer, carbon primary ring, and ceramic stationary ring.

13.4. Alternate Pump Types:

13.4.1. The use of split case base mount pumps and split case vertical mount pumps shall only be used when dictated by specific project conditions and Owner approved.

- 13.4.2. Vertical in-line pumps shall have a maximum of 5-horsepower, be mounted within 4-feet above finished floor, and shall be protected by a strainer.
- 13.5. Suction Diffusers and Strainers:
 - 13.5.1. Base mount end suction pumps shall be provided with suction diffusers.
 - 13.5.2. Prior to project completion, Constructor shall remove strainer construction screens.
 - 13.5.2.1. Wire removed screen to suction piping near strainer.
 - 13.5.2.2. Only the Owner shall remove screens from project site.
- 14. Steam and Condensate Piping:
 - 14.1. General:
 - 14.1.1. Mounting of steam valves shall be at a minimum 45-degree angle off the center of pipe – horizontally mounted is preferred, unless otherwise stated by manufacturer.
 - 14.1.2. Air bleed valves shall be installed at high points of steam condensate lines.
 - 14.2. Low and Medium Pressure Steam & Condensate (0-75 psig):
 - 14.2.1. Pipe 2-inches and under shall be Schedule 40 for steam, Schedule 80 for Condensate, black steel, ASTM A53.
 - 14.2.1.1. Joints shall be screwed or welded.
 - 14.2.2. Pipe 2 ½-inches and over shall be Schedule 40 for Steam, Schedule 80 for Condensate, black steel, ASTM A53.
 - 14.2.2.1. Joints shall be butt welded with flanged connections at valves and equipment.
 - 14.3. High Pressure Steam & Condensate (Greater than 75 psig):
 - 14.3.1. Pipe 2-inches and under shall be Schedule 40 for steam, Schedule 80 for Condensate, ASTM A106 Grb seamless black steel.
 - 14.3.1.1. Joints shall be threaded forged steel 2000# Class fittings or welded.
 - 14.3.2. Pipe 2 ½-inches and greater shall be Schedule 80 ASTM A106 Grb seamless black steel.
 - 14.3.2.1. Joints shall be welded with flanged connections at valves and equipment.
 - 14.4. Clean Steam Piping (Between Humidifier and Manifold):
 - 14.4.1. Piping (All Sizes) shall be Schedule 40 316L stainless steel, ASTM A312.
 - 14.4.1.1. Joints shall be welded.
 - 14.5. Valves:

14.5.1. Gate Valves:

- 14.5.1.1. Valves 2-inches and smaller shall be 150-pound rising stem gate valves with a union on one (1) side. 125 psi S @ 353°F, 300 psi WOG @ 150°F, screwed, bronze, rising stem, screwed bonnet.
- 14.5.1.2. Valves 2 ½-inches and larger shall be OS & Y gate valves. 125 psi S @ 353°F, 200 psi WOG @ 150°F, flanged, iron body, bronze mounted, OS&Y.
- 14.5.1.3. **For UIHC:** Valves over 2" shall be welded.

14.5.2. Throttling Valves - Globe Valves:

- 14.5.2.1. Globe valves shall be used only for throttling purposes.
- 14.5.2.2. Globe valves shall be a minimum of 150-pound and shall be rated for steam.
- 14.5.2.3. 2-inches and under, 125 psi saturated steam, 300 psi WOG, screwed, bronze
- 14.5.2.4. 2 ½-inches thru 10-inches, 125 psi S @ 353°F, 200 psi WOG @ 150°F, flanged, iron body, bronze mounted.

14.6. Strainers:

- 14.6.1. Strainers shall be Y-pattern, rated for steam, with stainless steel baskets.
- 14.6.2. All strainers shall be installed with a blow down valve.
- 14.6.3. Bronze body, screwed ends, screwed cover, 125 psi S @ 353°F, 200 psi WOG @ 150°F.
- 14.6.4. Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 353°F, 175 psi WOG @ 150°F.

15. Steam Specialties:

15.1. General:

- 15.1.1. The campus pumped condensate return system operates with low pressure and is by gravity flow in most areas.
- 15.1.2. Low pressure steam is 20-25 psig.
- 15.1.3. Medium pressure steam is defined as having 20 to 85 psig.
- 15.1.4. Building systems shall be designed for a maximum operating pressure of 15 psig.
- 15.1.5. Sizing of control valves, PRV, traps, etc., shall be based on a delivery pressure setting up to 30 psig.
- 15.1.6. Air vent/vacuum breakers shall be installed on steam equipment as required.
- 15.1.7. Drip legs are required for all steam risers.
 - 15.1.7.1. Drawings shall indicate drip leg locations.

15.1.7.2. Refer to END OF MAIN DRIP STATION PIPING (BUILDING) DETAIL in Appendices.

15.2. Steam Traps:

15.2.1. Traps shall be protected by a strainer upstream.

15.2.2. Isolation valves shall be installed on each side of each trap with blowdown.

15.2.3. Integral check valves shall not be used.

15.2.4. Steam traps sized from ½-inch through 1-inch shall have universal 2-bolt connectors.

15.2.5. Acceptable Manufacturers include Spirax Sarco, Armstrong, Watson McDaniel.

15.3. Pressure Reducing Valves:

15.3.1. Install Isolation valves at all PRVs.

15.3.2. Install pressure gauges on both sides of the PRV.

15.3.3. All PRVs shall be located and configured to allow ready accessibility for maintenance.

15.3.3.1. Provide a minimum clearance of 24-inches in all directions.

15.3.3.2. No PRV shall be located more than 8-feet above finished floor.

15.3.4. PRVs in the distribution system shall not contain a bypass.

15.3.5. For UIHC:

15.3.5.1. PRVs at service entrances shall be eccentric plug control valves by Cashco Ranger.

15.3.5.2. These valves shall have either steel or ductile iron bodies.

15.3.5.3. All PRV assemblies shall be provided with a 3-valve bypass assembly and dial type pressure gauges on both the upstream and downstream sides.

15.4. Condensate Return Stations:

15.4.1. Vent lines from condensate pumps shall not be connected to a relief vent pipe.

15.4.2. Condensate return stations shall be electric duplex type.

15.4.3. Condensate receiving tank shall have a drain installed.

15.4.4. Install a pressure gauge on the system side of the condensate pump discharge check valve.

15.4.5. All condensate pumps shall be capable of handling high temperature condensate.

15.4.6. For UIHC:

15.4.6.1. Any condensate receiver which is not recessed nor on elevated legs shall be installed on a concrete housekeeping pad.

15.4.6.2. Review with Owner prior to the use of steam-powered condensate return pumps where project requires.

15.4.6.3. Acceptable Manufacturers are Armstrong, Spirax/Sarco, Sterling, Johnson.

15.5. Humidifiers:

15.5.1. Direct-steam humidification systems shall not be allowed.

15.5.2. Humidifier shall be provided as a complete packaged unit by the manufacturer.

15.5.3. Humidifier construction shall be able to withstand the use of Reverse Osmosis (RO) water source.

15.5.4. The heat exchanger and headers shall be constructed of stainless steel.

15.5.5. Steam control valve shall be a normally closed modulating type with stainless steel trim and electronic actuator.

15.5.5.1. Valve shall be furnished by humidifier manufacturer.

15.5.6. A thermostatically controlled water valve shall blend cold water into a mixing chamber to temper 212°F water to a maximum of 140°F discharge temperature to sanitary system.

15.5.7. Humidification system dispersion tube hot surfaces in ~~the airstreams of ducts or~~ air-handling units shall be:

15.5.7.1. Stainless steel;

15.5.7.2. Insulated with a product with an insulating value of at least 2.0 maximum 'K' value at 75°F.

15.5.7.2.1. Insulation product shall be closed cell, non-toxic, shall be highly resistant to UV light exposure;

15.5.7.2.2. Shall not absorb water or support microbial growth;

15.5.7.2.3. Shall meet flame spread/smoke developed rating of 25/50.

15.5.8. Reverse Osmosis (RO) or pure ~~water shall~~ water shall be used for humidification. One system per Mechanical Room and sized for all air handling units in that space.

15.5.9. Winter Humidification shall not be provided for general comfort applications.

15.5.10. Humidification shall be provided for one hundred percent (100%) outdoor air systems or special areas (e.g., Labs, Museums, Rare Book Collections, all UIHC).

15.5.11. For UIHC:

15.5.11.1. Humidifier(s) shall be included for each air handling unit.

15.5.11.2. Refer to ASHRAE guidelines for ventilation requirements.

15.5.11.3. Two (2) humidistats shall be used to control the humidifier.

15.5.11.4. One (1) humidistat shall be in the return air duct and one (1) high limit humidistat shall be located in the supply air duct.

15.5.11.5. Note that there are special care areas, such as surgery where the humidity sensor shall be in the occupied area.

15.5.11.6. Acceptable Manufacturers are Dri Steem, ~~or Pure Steam~~, Or Neptronics.

15.6. Safety Relief Valves:

15.6.1. Safety relief valves shall have piping equal to or larger than tapings of the valve.

15.6.1.1. Pipe discharge to exterior of the building.

15.6.2. Rate safety valves for maximum capacity of largest available trim for pressure reducing valve(s) or maximum capacity of bypass valve(s), whichever is larger, at maximum possible pressure upstream of pressure reducing valve.

15.6.2.1. Set at maximum twenty percent (20%) above reduced pressure.

15.6.3. Terminate safety valves outdoors.

15.6.4. Provide drip pan elbow with drain connection to nearest floor drain.

16. Refrigeration Specialties:

16.1. General:

- 16.1.1. Mechanical room installations shall comply with ASHRAE Standard 15.
- 16.1.2. Air-cooled condensing units shall not be placed in conditioned spaces or machine rooms.
- 16.1.3. Design all roof-mounted condensing units to 115°F outside air temperature.
- 16.1.4. Condensing units, if designed to operate at less than 55°F, shall be provided with hot gas bypass and with condenser fan cycle control operated from the head pressure.
- 16.1.5. Valves on refrigerant lines shall be full port.
 - 16.1.5.1. Provide isolation valves on each side of driers.
 - 16.1.5.2. Provide check valves on the discharge of compressors.
- 16.1.6. Pipe discharge from all relief valves to exterior of the building.
- 16.1.7. Insulate suction and hot gas bypass on refrigerant lines in all locations and discharge lines if exposed in occupied areas.
- 16.1.8. Piping and fittings shall be copper, except in an evaporative condenser, where steel piping is acceptable.
 - 16.1.8.1. Use long radius fittings.

16.1.9. For UIHC:

- 16.1.9.1. Interior glycol piping above 2-inch diameter, install either:
 - 16.1.9.1.1. Schedule 40 ASTM A53 seamless black steel with welded joints.
 - 16.1.9.1.2. Where threaded joints must be used due to equipment connections, install with Teflon tape.
 - 16.1.9.1.3. The Design Professional shall specify all Teflon tape, gaskets, and other sealants that are totally compatible with the glycol and inhibitor to be used in the system.
 - 16.1.9.1.4. Type L ASTM B88 copper with wrought fittings -screwed fittings shall not be used.
- 16.1.9.2. Interior glycol piping 2-inch diameter or less, install either:
 - 16.1.9.2.1. Schedule 40 ASTM A53 seamless black steel with welded joints.
 - 16.1.9.2.2. Type L ASTM B88 copper with wrought fittings.
- 16.1.9.3. Install manual air vents at accessible locations including at the top of all risers and at all high points in the piping system, but not in-patient rooms.

16.1.9.4. Install low pressure alarms on glycol piping systems to sense any leakage from the system.

16.1.9.4.1. The low-pressure alarm signal shall be monitored by the building automation system.

16.1.9.4.2. Do not install automatic make-up water connections to glycol piping grids due to the danger of dilution of the glycol/water mixture (and hence potential freezing).

16.1.9.5. Solder shall be 15-percent silver solder.

16.2. Compressors:

16.2.1. Compressors shall have five (5) year manufacturer warranty.

16.2.2. Multiple units are preferred over larger single units.

16.2.3. All compressors shall be single speed.

16.2.4. All 3-phase units shall have adjustable voltage monitors for each phase, with manual reset.

16.2.5. Compressors shall have recycle timers and crankcase heaters.

16.2.6. Provide high- and low-pressure switches.

16.2.7. Solenoid valves shall have a manual lift stem.

16.2.8. Provide driers on all liquid lines with isolation valves on each side of the drier.

16.2.9. Coils shall have copper tubes and aluminum fins.

17. Ductwork:

17.1. General:

17.1.1. Supply/return air systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.

17.1.2. Return air shall be ducted.

17.1.3. Ductwork trapeze hangers shall be installed to allow rigid insulation inserts.

17.2. Flexible Ductwork:

17.2.1. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA, and other U.S. Government agency standards.

17.2.2. Flexible duct shall bear the ADC Seal of Certification.

17.2.3. Flame Spread/Smoke Developed: Not over 25/50.

- 17.2.4. Flexible duct shall have corrosion resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1 ½-inch, 3/4 lb./cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh.
- 17.2.5. Inner liner shall be airtight and suitable for 6-inch WC static pressure through 10-inch diameter and shall be airtight and suitable for 4-inch WC static pressure 12-inches through 16-inches diameter.
 - 17.2.5.1. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A.
 - 17.2.5.2. "R" value shall not be less than 4.0 ft²*°F*hr/Btuh.
 - 17.2.5.3. Temperature range of at least 0 180°F.
 - 17.2.5.4. Maximum velocity of 4,000 fpm.
- 17.2.6. Maximum length of flexible ductwork shall be 36-inches.
- 17.2.7. Flexible ductwork shall be self-supporting and have sweeping radius with no kinks.

17.3. For UIHC:

- 17.3.1. Rigid metal duct systems:
 - 17.3.1.1. Show pressure classification of all duct systems on both the design documents and the ductwork shop drawings.
 - 17.3.1.2. Seal all duct joints and seams to minimize duct leakage.
 - 17.3.1.3. Specify the acceptable leakage criteria for each duct system.
 - 17.3.1.4. Specify pressure testing of all newly installed duct mains for leakage prior to placing into service.
 - 17.3.1.5. Design all duct support systems, including concrete inserts, hangers, rods, etc., to support four (4) times the calculated weight of the duct section (and any adjacent fans).
 - 17.3.1.6. Support all ducts directly from the structure.
- 17.3.2. Duct systems shall be clean/cleaned prior to acceptance by the Owner.
 - 17.3.2.1. When cleaning use Virex or hospital approved disinfectant cleaner prior to installation.
 - 17.3.2.2. Allow for ten (10) minutes of wet kill time before wiping off with clean cloth.
- 17.3.3. All ducts wider than 36-inches shall be we weld pinned.
- 17.3.4. Duct work to remain sealed until installed.

18. Ductwork Accessories:

18.1. Duct Access doors:

- 18.1.1. Access doors with sheet metal screw fasteners are not acceptable.
- 18.1.2. Access doors shall be located before and after re-heat coils.
- 18.1.3. Floor-mounted plenums shall have full-height access doors.

18.2. Sound Attenuation:

- 18.2.1. Specify sound attenuators wherever required on main air handling and exhaust systems.

18.3. Fire Dampers:

- 18.3.1. Fire dampers shall be Style B construction with the damper blades out of the air stream unless otherwise authorized by Owner.
- 18.3.2. Fire Dampers shall not be installed in laboratory exhaust ducts serving fume hoods, safety cabinets or other containment equipment.
- 18.3.3. Fire dampers shall be held open by a fusible link rated at 165°F.
- 18.3.4. Fire dampers shall be UL 555 listed for 1 ½-hour fire resistance unless noted otherwise, dynamic rated with heated airflow at 2,000 fpm and 4-inch WC.
- 18.3.5. Fire dampers shall be installed in a manner that is accessible for testing and inspection.
- 18.3.6. The access door should be as large as possible to get both arms in the duct to replace a fusible link.
 - 18.3.6.1. Each access door shall have a label with letters at least ½-inch high, reading "FIRE DAMPER".

18.4. Fire /Smoke Dampers:

- 18.4.1. Fire/smoke dampers shall be furnished complete with operator's factory mounted and the damper/operator assemblies shall meet all requirements listed below.
- 18.4.2. Fire/Smoke Dampers shall not be installed in laboratory exhaust ducts serving fume hoods, safety cabinets or other containment equipment.
- 18.4.3. Fire/Smoke Dampers shall be provided with two end-switches for open/closed~~positive~~ position feedback to the BAS.
- 18.4.4. Assemblies shall be 1 ½-hour rated under UL Standard 555 and be dynamic rated at 2,000 fpm and 4-inch WC.
- 18.4.5. FSD shall be held open by fusible link or electric resettable link rated at 165°F.
- 18.4.6. F/S dampers shall be installed in a manner that is accessible for testing and inspection.

18.4.7. For UIHC:

18.4.7.1. Fire Dampers shall have a switch to prove open and close status. The switches should be shown on the BAS.

~~18.4.7.1.~~18.4.7.2. FSD shall be held open by 120V, single phase operator.

~~18.4.7.2.~~18.4.7.3. Motors shall be direct coupled gear type with power open and spring return.

~~18.4.7.3.~~18.4.7.4. Torque type (stall) motors are not acceptable.

18.4.7.5. Each FSD shall be provided with a local toggle switch disconnect mounted adjacent to the damper.

~~18.4.7.4.~~18.4.7.6. Dampers shall be on the same power source as AHU (e.g. if AHU is on EM equipment power, damper shall be on EM equipment power, normal-normal).

18.4.8. Manual Volume Dampers:

18.4.8.1. Manual volume dampers shall be provided in the duct branch that serves the diffuser or register.

18.4.8.2. Provide locking quadrant regulators on single and multi-blade dampers

19. Air Terminal Units:

19.1. Terminal Air Boxes:

19.1.1. Terminal Air Boxes (TABs) shall have electronic actuators.

19.1.2. TABs shall have direct digital controls, including discharge supply air temperature, damper position, reheat coil valve position, and air volume.

19.1.3. TABs which require heating shall have two-row heating coils.

19.1.4. All TABs shall be provided with variable air volume capability, even if the specific unit is designed for constant volume airflow.

19.1.5. All TABs shall have ball valves and strainers installed with-in 36-inches of the re-heat coil.

19.1.6. All TABs shall have a brass strainer and ball valve installed on re-heat piping, ball valve and strainer will be installed separately, all in ones are not acceptable.

19.1.7. Provide clearance for inspection, repair, replacement, and service.

19.1.8. Ensure accessibility to terminal unit electrical control panel doors, controllers and operators are located minimum of 36-inches from all obstructions (walls, pipe, etc.).

19.1.9. Wiring and controller compartments, electronic motors, and damper motors shall have a minimum of 36-inch clear wide and deep working space readily accessible from lift out ceiling tiles or access panels.

19.1.10. Provide ceiling access doors or locate units above easily removable ceiling components.

19.1.11. Refer to VAV Terminal Clearance Installation Detail in appendices.

19.1.12. Acceptable TAB manufacturers: Krueger, Price, Titus, Carnes.

19.2. Double Wall Duct Variable Air Volume Terminal Box:

19.2.1. Interior is not acceptable.

19.2.2. Provide with one inch, 1 ½-pound density fiberglass insulation in between the interior and exterior walls.

19.2.3. Insulation shall be UL listed and meet NFPA 90A requirements.

19.3. Laboratory Variable Volume Terminal Air Valves

19.3.1. Air valves should be provided with local BAS controllers, i.e., either Johnson Control or Schneider standard controller; proprietary third-party controls will not be allowed.

19.3.2. Air valve with BAS controller shall measure and provide actual airflow (CFM) to BAS.

19.3.3. Air valve shall not require a minimum/maximum static pressure operating range.

19.3.4. Critical components shall not be located in air stream.

19.3.5. The ability of the airflow measuring components to accurately measure airflow shall not be impacted by lint, dust, and dirt.

19.3.6. The air valves shall be capable of being installed in any orientation and with no requirement for minimum straight duct runs.

19.3.7. Provide 10 to 1 turndown.

19.3.8. Be available with integral reheat coil.

19.3.9. Be available in stainless steel

19.3.10. Be available bubble tight damper option.

20. Air Inlets and Outlets:

20.1. Grills and Registers:

20.1.1. Grilles and registers shall be white unless of aluminum or stainless-steel construction.

20.1.2. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.

20.1.3. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.

20.2. Architectural Square Panel Diffusers:

- 20.2.1. Diffusers shall be white.
- 20.2.2. Diffusers shall be architectural solid square panel and flush with ceiling.
- 20.2.3. The exposed surface shall be smooth, flat, and free of visible fasteners.
- 20.2.4. The face panel shall be 22-gauge steel with a rolled edge or shall be 18-gauge with a smooth ground, uniform edge.
- 20.2.5. The back pan shall be one piece 22-gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).

20.3. Laminar Flow Diffusers:

- 20.3.1. Perforated panel diffuser to be laminar flow type, aluminum construction with manufacturer's standard white baked enamel or acrylic finish.
- 20.3.2. Plate shall be retained to the module frame through the use of quarter-turn fasteners.
- 20.3.3. Safety retainers of stainless-steel cable or chain shall be provided to prevent accidental dropping of plate.
- 20.3.4. Distribution plate shall be installed in aluminum mounting frame.
- 20.3.5. Where filters are required, filters shall be furnished with the diffuser of the type and size indicated.
 - 20.3.5.1. Filters shall not be installed until air balancing occurs.
 - 20.3.5.2. One (1) additional set shall be left with the Owner at completion.

20.4. Linear Diffusers:

- 20.4.1. Linear diffusers plenums shall be constructed of sheet metal and insulated.
- 20.4.2. Liner diffusers shall be aluminum construction.
 - 20.4.2.1. Coordinate finish (aluminum, white, etc.) type with project Design Professional.
- 20.4.3. Quantity of slots and slot configuration shall be determined by Design Professional based on unit performance.
- 20.4.4. Coordinate linear diffuser mounting frame type with ceiling type.

21. Heat Exchangers:

21.1. General:

- 21.1.1. Heat exchangers shall be ASME approved and shall be installed with relief valves, rated for the service, on both steam and hot water systems.
- 21.1.2. Locate heat exchangers to allow removal of the bundle.

- 21.1.3. Refer to HOT WATER CONVERTOR STEAM AND CONDENSATE PIPING DETAIL in Appendices.
- 21.1.4. Install gauges and thermometers to indicate the following:
 - 21.1.4.1. Pressure of entering steam.
 - 21.1.4.2. Pressure and temperature of entering water.
 - 21.1.4.3. Pressure and temperature of leaving water.
- 21.1.5. Provide one (1) expansion tank for each heat exchanger with a sight glass and provisions for draining and venting.
- 21.1.6. Refer to HVAC Equipment Insulation standards section for insulation requirements.
- 21.1.7. For UI Housing:
 - 21.1.7.1. Designs shall consider the use of integral face and bypass coils, especially in situations using steam to pre-heat outside air.
 - 21.1.7.2. Provide two (2) steam traps with bypass for all pre-heat coils.
 - 21.1.7.3. Include redundant systems for heat exchanger (hot water heater) design so service of one does not affect hot water supply needs for the building.
 - 21.1.7.4. Building continuity needs shall be met while service is completed for hot and cold-water delivery pumps.
- 21.2. Shell and Tube Heat Exchanger:
 - 21.2.1. U-tube type with ¾-inch O.D. minimum seamless copper tubes suitable for 125 psig working pressure.
 - 21.2.2. Steel with threaded or flanged piping connections.
 - 21.2.3. Heating fluid in shell and heated fluid in tubes.
- 21.3. Plate and Frame Heat Exchanger:
 - 21.3.1. Install plate heat exchangers where higher quality chilled water is required for protection of sensitive equipment. Review use with Owner.
 - 21.3.2. Units shall be complete, preassembled, pressure tested at the factory and flushed clean.
 - 21.3.3. Units shall bear ASME code stamp for 125 psig water service.
 - 21.3.4. Unit shall be rated and certified in accordance with AHRI 400.
 - 21.3.5. Plate and frame heat exchangers shall be free standing with multiple plates, designed to allow for opening and cleaning in place.
 - 21.3.5.1. Plates shall be 304 or 316 stainless steel.

21.3.6. Gaskets shall be one-piece molded construction, of a material suitable for the fluids, pressures and temperature specified.

21.3.7. Units shall be easily expanded by adding plates to accommodate future requirements.

21.3.7.1. Frame shall have capacity for fifty percent (50%) additional plates.

22. Energy Recovery Units

22.1. Must meet AHRI 1060 manufacturing standards

22.2. The following types shall be considered and used in energy modeling

22.2.1. Run Around Coils

22.2.1.1. Sensible only

22.2.2. Plate Heat Exchanger

22.2.2.1. Air-To-Air

22.2.2.1.1. Sensible

22.2.2.1.2. Sensible and Latent

22.2.3. Tilt Bed

22.2.4. Heat Pipe

22.2.4.1. Heat pipe coils must be field leveled and witnessed by Owner prior to final connections

22.3. Units must include frost control to prevent frost buildup in exhaust air stream

22.4. Plate and heat pipe types must have bypass dampers and face dampers

22.4.1. Size for static pressure drop of the plate or coil

22.5. Hose bibb must be located adjacent to unit for cleaning

22.6. Laboratories must be sensible only

23. Air Handling Units:

23.1. General:

23.1.1. Basis of design shall be modular type construction units.

23.1.1.1. Where modular units are not acceptable due to existing conditions or elevated performance requirements, custom units shall be provided.

23.1.2. Air handling units shall be installed on concrete housekeeping pad, minimum 5 ½-inches thick.

23.1.2.1. Pad thickness shall be coordinated with project specific conditions.

- 23.1.3. Maintenance arms or beams shall be provided to assist in motor replacements.
- 23.1.4. Owner-witnessed manufacturer's testing shall be conducted on-site following installation.
- 23.1.5. Air handling units shall be designed as draw-thru type unless directed otherwise by Owner or project-specific requirements.
- 23.1.6. Design Professional shall review spare capacity requirements with Owner.

23.1.7. For UIHC:

- 23.1.7.1. Housekeeping pad edges shall be painted yellow.
- 23.1.7.2. For UIHC spare capacity shall be a minimum of Fifteen percent (15%).
- 23.1.7.3. Fans shall be configured for N+1 capacity.
- 23.1.7.4. Where AHUs operate in parallel and share a common supply and/or return plenum, each AHU shall be provided with supply air and return air isolation dampers allowing one AHU to shut down without negatively affecting the remaining AHU(s).

23.2. Indoor Modular Air Handling Units:

23.2.1. Unit Construction:

- 23.2.1.1. Minimum 18-gauge G60 galvanized steel exterior panels reinforced and braced with galvanized steel framework.
- 23.2.1.2. Unit shall be double wall insulated constructed panel.
- 23.2.1.3. Exterior wall shall be minimum 18-gauge galvanized steel.
- 23.2.1.4. Interior wall shall be minimum 20-gauge solid galvanized steel.
- 23.2.1.5. Foil facing on insulation shall not be acceptable as a substitute for double wall construction.
- 23.2.1.6. The minimum R-value of the panel assemblies shall be eight (8).
- 23.2.1.7. Acceptable Manufacturers are Daikin, Trane, Carrier, Temtrol or Owner Approved equal.
- 23.2.1.8. Install a stainless-steel drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1.
 - 23.2.1.8.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance one-half (1/2) of the vertical coil height downstream from the downstream face.
- 23.2.1.9. Provide unit with a full length, continuous, base rail channel.
 - 23.2.1.9.1. Base rail channels shall be formed of a minimum 12-gauge galvanized steel.

23.2.2. Access Door Construction:

23.2.2.1. Access doors shall be double wall and insulated with the same materials used in the surrounding unit walls, with continuous gasket.

23.2.2.2. Access doors containing windows shall be double pane tempered, reinforced or safety glass window.

23.2.2.3. Access doors shall be full height, galvanized, double wall, and hinged.

23.2.2.4. Doors shall open against higher pressure side.

23.3. Outdoor Modular Air Handling Units:

23.3.1. Unit Construction:

23.3.1.1. Minimum 18-gauge G60 galvanized steel exterior panels reinforced and braced with galvanized steel framework.

23.3.1.2. Unit shall be double wall insulated constructed panel. Exterior wall shall be minimum 18-gauge galvanized steel.

23.3.1.3. Interior wall shall be minimum 20-gauge solid galvanized steel. Foil facing on insulation shall not be acceptable as a substitute for double wall construction.

23.3.1.4. The minimum R-value of the panel assemblies shall be eight (8).

23.3.1.5. Acceptable Manufacturers are Daikin, Trane, Carrier, Temtrol or Owner Approved equal.

23.3.1.6. Install a stainless-steel drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1.

23.3.1.6.1. Extend drain pans the entire width of each coil, including piping and header if in the air stream, and from the upstream face of each coil to a distance one half (1/2) of the vertical coil height downstream from the downstream face.

23.3.1.7. The external surface of the unit shall be factory painted to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours.

23.3.1.8. Unit casing shall be prepared and coated with a minimum of 1.5 mil enamel finish.

23.3.1.9. The unit's roof shall be double wall constructed.

23.3.1.10. The outer roof shall be sloped a minimum of 0.25-inch per foot.

23.3.1.11. The roof assembly shall have a drip seal that overhangs all the walls of the unit.

23.3.1.12. Provide unit with a full length, continuous, base rail channel.

23.3.1.12.1. Base rail channels shall be formed of a minimum 12-gauge galvanized steel.

23.3.2. Access Door Construction:

- 23.3.2.1. Access doors shall be double wall and insulated with the same materials used in the surrounding unit walls, with continuous gasket.
- 23.3.2.2. Access doors containing windows shall be double pane tempered, reinforced or safety glass window.
- 23.3.2.3. Access doors shall be full height, galvanized, double wall, and hinged.
- 23.3.2.4. Doors shall open against higher pressure side.

23.4. Indoor Custom Air Handling Units:

23.4.1. Unit Construction:

- 23.4.1.1. Minimum 18-gauge G90 galvanized steel exterior panels in accordance with ASTM A90 and A653.
- 23.4.1.2. Acceptable Manufacturers are MarCraft, Haakon, Governair, ClimateCraft
- 23.4.1.3. Exterior shall be painted galvanized finish.
- 23.4.1.4. Unit shall be double wall insulated construction.
- 23.4.1.5. Interior wall shall be minimum 20-gauge 304 stainless steel.
- 23.4.1.6. Roof construction shall match exterior panel construction and performance.
- 23.4.1.7. Walls and Roof shall be a minimum of 4-inches thick with a minimum thermal resistance of $R = 25$ at the center of a panel.
- 23.4.1.8. Insulation material shall be polyurethane injected foam.
 - 23.4.1.8.1. Insulation shall be foamed in place.
 - 23.4.1.8.2. Cut foam board or fiberglass shall not be allowed.
 - 23.4.1.8.3. Insulation density shall be no less than 3.0 lb./ft³.
 - 23.4.1.8.4. All panels and joints shall be thermally broken.
- 23.4.1.9. Floors shall be continuously welded 3/16-inch double panel aluminum treadplate, ASTM B209.
 - 23.4.1.9.1. Floors shall be welded to the unit base;
 - 23.4.1.9.2. Screwed or bolted floors shall not be permitted.
- 23.4.1.10. Floor insulation shall be a minimum of 4-inch thick with a minimum thermal resistance of $R = 20$.
 - 23.4.1.10.1. Insulation material shall be polyurethane injected foam.
 - 23.4.1.10.2. Insulation shall be foamed in place.

23.4.1.10.3. Cut foam board or fiberglass will not be accepted.

23.4.1.10.4. Insulation density shall be no less than 3.0 lb./ft³.

23.4.2. Access Door Construction:

23.4.2.1. Access doors shall have double wall construction and an extruded aluminum frame with thermal break.

23.4.2.2. Door shall be attached to the unit with three (3) axes adjustable stainless-steel hinges.

23.4.2.3. Doors shall open against higher pressure side.

23.4.2.4. Access doors containing windows shall be dual-paned tempered glass with vacuum seal windows, molecular sieve sealant and thermally broken frames shall be supplied as shown on unit drawings.

23.4.2.4.1. Singled paned windows are not acceptable.

23.5. Motors and Drives:

23.5.1. Motors shall have slide rails, adjusting screws, anchor bolts and bedplates.

23.5.2. Motors shall be open drip-proof or TEFC type with grease lubricated bearings.

23.5.3. Motors shall be "variable frequency drive rated" when controlled by VFDs.

23.5.4. No equipment shall be selected or operate above 90% of its motor nameplate rating.

23.6. Motor Controls and Monitoring:

23.6.1. Each fan shall have noninvasive, zero pressure drop flow pressure sensing taps installed in the fan inlet cone for airflow monitoring capability.

23.6.2. Each fan shall be monitored by a current sensor.

23.6.3. Each fan shall be individually wired to a motor controller containing motor overloads and a dedicated micro drive.

23.6.4. Acceptable Manufacturers are ABB, Yaskawa, Toshiba, Danfoss.

23.6.5. Installation of controller(s) on the wall of the AHU is acceptable.

23.6.6. Individual fans shall be independently capable of indexing on and off and changing speed.

23.6.7. A fault in anyone (1) fan cell shall not affect the overall AHU air flow and pressure.

23.7. Fans:

23.7.1. Fan Arrays:

- 23.7.1.1. Utilize fan arrays for supply, return, and relief fans in Custom Air Handling Units sized above 10,000 CFM.
- 23.7.1.2. Lifting rail or hoist shall be provided if any component of the fan array weighs more than 100 pounds.
- 23.7.1.3. Fan cells shall be direct driven, AMCA Arrangement 4, plenum fans, duty Class II or III. Class I fans shall not be used.
- 23.7.1.4. Provide fans cells with backflow prevention device that reduces system effect when the fan is disabled.
- 23.7.1.5. Size fan to account for the backdraft damper pressure drop.
- 23.7.1.6. Fans shall be controlled by Variable Frequency Drives (VFDs).

23.7.1.7. For UIHC:

- 23.7.1.7.1. Fan array systems shall be specified on all units serving patient rooms or other critical areas.
- 23.7.1.7.2. All supply fans above 2,000 cfm shall be furnished with variable frequency drives (VFDs).
- 23.7.1.7.3. VFDs shall be Toshiba and ABB are acceptable unless authorized otherwise by the Owner.
- 23.7.1.7.4. At project completion, the Contractor shall turn over a set of normal replacement parts for each fan, including belts.
- 23.7.1.7.5. Vortex dampers shall not be used at the fan inlet.
- 23.7.1.7.6. Provide tight-sealing isolation dampers to completely block airflows during maintenance and backdraft dampers for normal operation periods.

23.7.2. Plenum Type Fans:

- 23.7.2.1. Direct drive centrifugal plenum fans with airfoil blade design for quiet operation.
- 23.7.2.2. Fan RPM shall not exceed one-hundred ten percent (110%) of scheduled value with the scheduled wheel type.
- 23.7.2.3. Substitution of BI or BIA fans for FC is acceptable if efficiency is not lower.
- 23.7.2.4. Statically and dynamically balanced.
- 23.7.2.5. Grease lubricated ball bearings selected for 200,000 hours L 50 life at the design operating conditions.
 - 23.7.2.5.1. Provide extended lubrication lines for all bearings to an easily accessible location.
- 23.7.2.6. Fans shall be direct drive, if available.

- 23.7.2.7. Factory balanced fans will be used with variable speed controls to operate at all speeds up to the design speed.
- 23.7.2.8. Fan(s) shall have internal spring isolators.
- 23.7.2.9. Fans shall be controlled by Variable Frequency Drives (VFDs).

23.8. Coils:

23.8.1. General:

- 23.8.1.1. Cooling coils or air handling unit systems shall be installed as high as necessary to avoid having to construct a trap that would extend through the floor into a level below.
- 23.8.1.2. If a low condensate trap assembly is unavoidable, completely seal against water leaks through the floor penetration.
- 23.8.1.3. Balance valves shall be installed at each coil.
- 23.8.1.4. When flushing hydronic systems, air handling unit coils shall be bypassed.
- 23.8.1.5. Refer to Controls Standards section for control valve requirements.

23.8.2. Chilled Water Coils:

- 23.8.2.1. Coils shall be drainable.
- 23.8.2.2. Water coils shall be piped for counter flow.

23.8.2.3. For UIHC:

- 23.8.2.3.1. All AHU chilled water coils shall have a duplex basket strainer installed upstream of the coil.
- 23.8.2.3.2. Basket strainer shall be installed in an accessible location, no more than 36-inches above finished floor.
 - 23.8.2.3.2.1. Basket strainer shall be Eaton Model 53BTX or approved equal.
 - 23.8.2.3.2.2. Differential pressure gauges shall be provided at each coil.

23.8.2.4. Construction:

- 23.8.2.4.1. Stainless steel casing and stainless-steel drain pan.
- 23.8.2.4.2. All coils shall have a minimum of 0.025- inch tube wall thickness and 5/8-inch O.D. minimum diameter.
- 23.8.2.4.3. Extended surface type with seamless copper tubes and continuous plate type aluminum fins.
- 23.8.2.4.4. Cooling coils shall be based on eight (8) or ten (10) row configuration.

23.8.2.4.4.1. An eight (8) row configuration is preferred for maintenance purposes.

23.8.2.4.4.2. If greater than eight (8) rows are required, coordinate with Owner.

23.8.2.4.5. Cooling coils shall be maximum 10 fins per inch.

23.8.2.4.5.1. If greater than 10 FPI is required, review with Owner.

23.8.2.5. Performance:

23.8.2.5.1. Coils shall be selected based on 45°F entering water temperature.

23.8.2.5.2. Coils shall be selected base on a 15°F delta T.

23.8.2.5.3. High humidity removal conditions could dictate a lower delta T be used as the design basis.

23.8.2.5.4. Where sub-cooling is required, it shall be acceptable to install and pipe two (2) cooling coils in series.

23.8.2.5.5. Refer to CHILLED WATER COIL PIPING DETAIL in Appendices

23.8.3. Preheat Coils and Reheat Coils (Steam):

23.8.3.1. Steam coils shall be integral face and bypass.

23.8.3.1.1. Coil shall be vertical.

23.8.3.2. Only for renovations where steam must be used, preference for hot water coils (pumped/glycol).

~~23.8.3.2~~-23.8.3.3. Minimum tube wall thickness shall be 0.035 inches.

~~23.8.3.3~~-23.8.3.4. Install flexible connectors between the coil and steam and condensate connections to allow for expansion and contraction.

~~23.8.3.4~~-23.8.3.5. Provide two (2) steam traps at each coil.

~~23.8.3.5~~-23.8.3.6. Preheat coil shall fail open upon freeze stat alarm.

~~23.8.3.6~~-23.8.3.7. Condensate drain outlet to be minimum of 18-inches above AHU base rail.

~~23.8.3.7~~-23.8.3.8. Steam heating coils shall be capable of 80°F air temperature rise (-25°F to 55°F).

~~23.8.3.7.1~~-23.8.3.8.1. This shall apply only to the preheat coil.

~~23.8.3.7.2~~-23.8.3.8.2. Provide two (2) steam traps for each steam heating coil.

~~23.8.3.7.3~~-23.8.3.8.3. Acceptable manufactures: LJ Wing, Aerofin

~~23.8.3.7.4~~-23.8.3.8.4. Refer to STEAM PREHEAT COIL WITH INTERNAL FACE AND BY-PASS DAMPERS DETAIL in Appendices.

23.8.4. Heating Coils (Pumped Hot Water):

23.8.4.1. Construction:

- 23.8.4.1.1. Design Professional shall design for a pumped hot water heating coil for new buildings and new systems.
- 23.8.4.1.2. Minimum ½-inch O.D. tubes. Minimum 0.035-inch tube wall thickness.
- 23.8.4.1.3. Extended surface type with seamless copper tubes and continuous plate type aluminum fins.
- 23.8.4.1.4. Heating coils shall be maximum 12 fins per inch.
- 23.8.4.1.5. Suitable for continuous operation at 200 psi.
- 23.8.4.1.6. Maximum air velocity of 1000 fpm.
- 23.8.4.1.7. Galvanized steel casing.
- 23.8.4.1.8. Coil headers and U-bends shall not be exposed.
- 23.8.4.1.9. Heating coils shall be based on two (2) row configuration or less.
 - 23.8.4.1.9.1. If greater than eight (8) rows are required, review with Owner.

23.8.4.2. Performance:

- 23.8.4.2.1. Hot water heating coils shall be pumped recirculation loop
- 23.8.4.2.2. Coil selections shall be based on 120°F - 130°F entering water temperature.
- 23.8.4.2.3. Pumps coils shall be provided with two fully redundant in-line coil pumps piped in series.
- 23.8.4.2.4. ARI rated with 0.0005 fouling factor.
- 23.8.4.2.5. **For UIHC:**
 - 23.8.4.2.5.1. Heating coil shall be selected for one hundred percent (100%) outdoor air at -25°F.

23.9. Condensate Traps:

- 23.9.1. Condensate drains shall be Type L copper, ASTM B88.
- 23.9.2. Traps for drains shall be sized for the system served. Refer to AHU CONDENSATE DRAIN DRAW-THRU AND BLOW-THRU DETAIL in Appendices.

23.10. Air Blender:

- 23.10.1. Air blenders shall be provided for all AHUs.

23.10.2. Specify blender sections for the mixing of return air and outside air within each air handling unit.

23.10.2.1. If space is not available, confirm with Owner prior to proceeding.

23.10.2.2. Blender shall be fabricated of heavy gauge aluminum with all welded construction.

23.10.2.3. Arrange duct systems for head-on mixing of the outside air and return air streams.

23.10.2.4. Align the control dampers in the outside and return air streams for maximum mixing.

23.10.2.5. Perforated plate air blenders are not permitted to be installed.

23.11. Filter Sections:

23.11.1. Units shall have a magnehelic filter pressure differential indicator installed across filter section.

23.11.2. For Athletics:

23.11.2.1. Magnehelic differential pressure indicators are not required.

23.12. Filters:

23.12.1. Filters shall be standardized sizes: 24-inches by 24-inches or 24-inches by 12-inches shall be used, unless approved by the owner in writing.

23.12.2. Filters shall be MERV-13 or better.

23.12.3. For UIHC:

23.12.3.1. Filters shall be MERV-15 or better.

23.12.4. Pre-Filters:

23.12.4.1. Filters shall be of the preformed, pleated type.

23.12.4.2. All filter racks shall be gasketed.

23.12.4.3. Pre-filters shall be minimum thirty percent (30%) efficient.

23.12.4.4. Filter access doors shall be specified on both sides of the filter section.

23.12.4.5. Roll filters are not acceptable for pre-filters.

23.12.4.6. The Contractor shall replace all filters at project completion.

23.12.5. Final Filters (where required):

23.12.5.1. All filter racks shall be gasketed.

23.12.5.2. Final filters shall be ninety-five percent (95%) efficient, unless HEPA filters are required for the spaces being served.

23.12.5.3. Filter access doors shall be specified on both sides of the filter section.

23.12.5.4. Bag filters shall not be used for final filters.

23.12.5.5. Design Phase selection of coil velocity shall be checked to ensure that moisture does not carry over into the filter section.

23.12.5.6. The Contractor shall replace all filters at project completion.

23.13. Ultraviolet Emitters:

23.13.1. Provide an automatic switch to de-energize the emitters whenever an access door immediately on either side of the cooling coil is opened.

23.13.2. A service switch shall be included to manually de-energize the emitters.

23.13.3. A radiometer shall be specified to measure the relative output of each system.

23.13.3.1. The radiometer shall be set to one hundred percent (100%) as soon as the emitters are operational.

23.13.4. The lamps shall have a separate power source so that the lamps are always energized regardless of the operation of the air handling unit.

23.13.5. The primary set of lamps shall not be installed until after the air handling unit has been completed and cleaned.

23.13.6. The Contractor shall provide a complete set of replacement lamps at project completion.

23.13.7. Acceptable Manufacturers are UV Resources (RLM Extreme), American Ultraviolet, Sterile Aire, UVDI

23.14. Mist Eliminators:

~~23.14.1. Mist eliminators shall be specified:~~

~~23.14.1.1. ——— where there is potential moisture carryover~~

~~23.14.1. in all air handling systems where the design velocity across the cooling coil is over 500 fpm.
Verify max velocity in AHU section.~~

~~23.14.2. For UIHC:~~

~~23.14.1.2-23.14.2.1. Mist eliminators shall be specified only as approved by owner.~~

23.15. Lights:

23.15.1. Marine lights shall be provided throughout AHUs in reasonable sections.

23.15.2. Lights shall be instant-on, light-emitting diode (LED) type to minimize amperage draw and shall produce lumens equivalent to a minimum 75W incandescent bulb (1200 lumens).

23.15.3. LED lighting shall provide instant-on, white light and have a minimum fifty thousand (50,000) hour life.

23.15.4. Light fixture shall be weather-resistant, enclosed and gasketed to prevent water and dust intrusion.

23.16. Control Dampers and Actuators:

23.16.1. Dampers shall be installed to allow the mounting and future maintenance of damper actuators.

23.16.2. One (1) direct coupled actuator shall be used per damper section.

23.16.3. Jack shafting is not acceptable.

23.16.4. Control dampers shall be thermally insulated.

23.16.5. Relief dampers shall be opposed blades.

23.16.5.1. Size dampers at 1,000 - 1,200 FPM velocity based on return fan airflow.

23.16.6. Return air damper shall be parallel blades.

23.16.6.1. Size damper at 1,000 - 1,200 FPM velocity based on return fan airflow.

23.16.7. Outside air dampers shall be parallel blades

24. Terminal Heat Transfer Units:

24.1. Radiant Ceiling Panels:

24.1.1. Radiant ceiling panel systems shall be designed for heating only.

24.1.2. In all patient rooms, install radiant heating panels at the exterior walls.

24.1.2.1. Radiant panel room loops shall have a strainer installed in an accessible location outside of the patient room. Review location with Owner.

24.1.3. The radiant panels shall be installed near each window associated with a patient room.

24.1.4. Radiant panels may also be installed in patient toilets.

24.1.5. Use only two-way control valves for radiant heating panels.

24.1.6. Do not use three-way control valve schemes for temperature control of radiant panels.

24.1.7. The heating hot water service to all radiant panels shall be maintained at or below the maximum temperature recommended by the radiant panel manufacturer.

24.1.8. The heating hot water service to all radiant panels shall be adjustable to allow reduced temperature heating hot water being supplied at different times of the year.

24.1.9. Precautions shall be incorporated into the design to minimize noise in radiant ceiling panel systems.

24.2. Snowmelt Systems:

- 24.2.1. Snowmelt system feasibility shall be evaluated during early design for all new buildings and any building renovation involving entrance steps or ramps.
- 24.2.2. Snowmelt systems shall provide 24/7 protection from accumulation of snow and ice at major building entrances and ADA ramps.
- 24.2.3. Snowmelt systems shall circulate Dowfrost propylene glycol under low pressure through closed-loop piping embedded in concrete over 2-inch rigid foam insulation.
 - 24.2.3.1. Design Professional shall coordinate acceptable glycol mix ratio from owner prior to design.
- 24.2.4. Snowmelt system use shall be limited to the following:
 - 24.2.4.1. Main building entrances.
 - 24.2.4.2. Building entrances on the north and west building; faces a maximum of 10-feet from the building.
 - 24.2.4.3. Discuss the use of snowmelt on the south and east building entrances with Owner.
 - 24.2.4.4. Stairways and ramps at building entrances.
 - 24.2.4.5. Locations on the primary access route to a building entrance that are unable to be cleared with typical UI snow removal equipment (e.g., sidewalks less than 7-foot wide). Discuss instances with Owner.
 - 24.2.4.6. Truck delivery points where delivery ramp is sloped.
- 24.2.5. Snowmelt systems shall not be used in the following:
 - 24.2.5.1. On public sidewalks or roadways farther than 10-feet from building entrance.
 - 24.2.5.2. Where alternate pathways are available that would not necessitate installing snowmelt (e.g., a connecting sidewalk underneath a skywalk providing access to the same location).
- 24.2.6. System shall maintain a heating water temperature of 112°F.
- 24.2.7. Design snowmelt systems for a maximum 150 Btu-h per square foot heat input.
- 24.2.8. Expansion tank must be sized appropriately for system capacity and glycol mix of fifty percent (50%).
- 24.2.9. System requires glycol mix dedicated charging system suitable for automatic or manual fill.
- 24.2.10. Safety relief valve shall be piped to drain back into glycol fill tank.
- 24.2.11. BAS will require a 0-to-10-volt pressure sensor located near suction side of pressure relief.
- 24.2.12. All individual circuits from each manifold shall have isolation valves on supply and return lines.

- 24.2.13. All circuits shall be uniform in length per manifold.
- 24.2.13.1. Maximum length of 300-feet.
- 24.2.14. Each manifold shall have a manual activated bleeder valve.
- 24.2.15. Return temperature sensors are mandatory at each manifold.
- 24.2.15.1. It is preferred to have supply temperature sensors as well.
 - 24.2.15.2. Temperature shall be monitored through DDC and Thermometers.
 - 24.2.15.2.1. Installation requires a piped Tee with appropriate standoff for sensor.
 - 24.2.15.2.2. If the hot water supply temp is greater than 130 degf (adj) the software high temperature limit will disable the system and the steam valves will close. This will be alarmed at the DDC control system. A software reset or manual push button located on control panel will be required to re-enable the system.
- 24.2.16. Manifolds basis of design shall be Uponor 2' by 4' copper valved manifold with 12 outlets
- 24.2.17. All circuits per manifold will serve "like" applications. (Example: steps, north side, south side, ramps).
- 24.2.18. Return manifold will require installation of individual circuit balancing valves with Pete's plugs so thermal balancing can be performed and documented.
- 24.2.19. Supply water temperature shall have a constant setpoint of 110 degrees F (adj) not to exceed the predetermined maximum temperature based on PEX tubing requirements.
- 24.2.20. Each circuit shall be thermally balanced at the return manifold.
- 24.2.21. Pumping shall be a constant volume system with redundant pump(s).
- 24.2.22. Slab sensors are not required by the Owner, but in the event of code issues supply the minimum amount required.
- 24.2.23. Refer to SNOWMELT SCHEMATIC DETAIL in Appendices.
- 24.2.24. Snowmelt Controls Sequence of Operation- For UI Main Campus (Design Professional shall review sequence and alarming requirements for other areas)
- 24.2.24.1. Snow melt system shall be controlled via BAS. The system shall be enabled when UI Landscape Services utilizes the software enable point through the BAS and the outdoor air temperature is below 50 degrees F (adj). The system shall be disabled when the outdoor air temperature is above 52 degrees F (adj) or if the heating water temperature is greater than 130 degrees F (adj).
 - 24.2.24.2. Sequence of Operations:

24.2.24.2.1. When the system has been enabled by UI Landscape Services through the BAS the system shall operate as follows to maintain a heating water temperature of 112 degrees F (adj)

24.2.24.2.2. The lead circulation pump shall start. If the lead pump is commanded to start but fails to start based on a current status switch, the lag pump shall be commanded to start.

24.2.24.2.3. Once the circulation pump has proven operational by the current status switch the heat exchanger shall be allowed to energize.

24.2.24.2.4. The heating water control valve shall be modulated in order to maintain the glycol water temperature of 112 degrees F (adj).

24.2.24.3. Alarming:

24.2.24.3.1. The BAS system shall send a reminder email to UI Landscape services after every 24-hours (adj) that the system has been enabled.

25. CONTROLS

25.1. General:

25.1.1. All systems shall be fully compatible and integrate into the existing University building automation network and shall tie into university virtual server in lieu of a dedicated building server.

25.1.2. New buildings and major renovations shall use Direct Digital Control (DDC) system with devices reporting to a central Building Automation System (BAS) within the building, networked to the campus BAS.

25.1.3. Existing Buildings:

25.1.3.1. Control systems in existing buildings shall be an extension of the existing system. Integration of multiple control systems is not acceptable.

25.1.3.2. If the existing building controls system is a combination of pneumatic and DDC, the new work shall be DDC and the pneumatic shall be upgraded to match the rest of the building.

25.1.3.3. Minor renovations in buildings with pneumatic zone control may re-use existing components with prior approval. New components shall utilize DDC technology.

25.1.4. Field controllers shall be able to accept program uploads and downloads across the network.

25.1.5. Control networks shall be engineered to accommodate point collection, trending, and alarm points available from third-party vendor devices.

25.1.6. Control network shall be networked on a dedicated communication bus and master controller.

25.1.6.1. Size network to accommodate use of fifty percent (50%) of available third-party vendor trends, alarms, etc.

25.1.6.2. Size network to provide an additional twenty percent (20%) capacity.

25.1.7. For UIHC:

25.1.7.1. Minor renovations in buildings with pneumatic zone control may not re-use existing components.

25.1.7-25.1.8. Occupancy Sensor Zone Control:

25.1.7.1-25.1.8.1. Provide occupancy sensor HVAC zone control in areas subject to extended unoccupied periods during normal building occupied hours

25.1.7.1.1-25.1.8.1.1. Refer to the table in section IV-E-3-a for specific locations where HVAC integration is recommended.

25.1.7.1.2-25.1.8.1.2. Occupancy sensors shall be designed to provide full coverage of the area and shall have an output to the Building Automation System (BAS) for use in the temperature and ventilation control sequences.

25.1.7.2-25.1.8.2. Refer to section IV-E-3-a design guidelines on sensor locations.

25.1.7.3-25.1.8.3. Design system to allow airflow to ramp down to the supply and return fan minimum speeds.

25.1.7.4-25.1.8.4. Space temperature deadbands shall be as follows. Refer to Lab Systems for temperature deadbands in laboratory spaces.

Occupancy Mode	Description of Mode	HVAC Status	Temperature Deadband (°F)	
			Occupancy Sensor Occupied	Occupancy Sensor Unoccupied
Primary Occupancy	Standard Occupancy Hours	ON	+/- 1	+/- 3
Secondary Occupancy	Not standard occupancy hours, but the building is available to occupants	ON	+/- 1	+/- 6
Unoccupied	Building is unoccupied - HVAC is scheduled off	OFF	+/- 8	+/- 8

25.1.8-25.1.9. CO2 Ventilation Control:

25.1.8.1-25.1.9.1. CO2 sensor-driven Demand Control Ventilation strategies shall not be used without prior approval.

25.1.8.2-25.1.9.2. CO2 sensors shall not be installed in zones if not controlling ventilation air volumes to the space.

25.1.8.3-25.1.9.3. Locate sensors to allow for easy calibration or replacement on a regular maintenance schedule. Do not locate sensors in inaccessible shafts or above hard-lid ceilings.

25.1.8.4-25.1.9.4. Sensor Accuracy: +/-2%

~~25.1.8.5~~-~~25.1.9.5~~. Measuring Range: 0-2000 ppm

~~25.1.8.6~~-~~25.1.9.6~~. Reliability: Three (3) years of reliable calibration

~~25.1.8.7~~-~~25.1.9.7~~. Acceptable manufacturers: Johnson Controls, Kele, Schneider

~~25.1.9~~-~~25.1.10~~. Zone controls shall be determined based on one (1) room/occupied area per zone to allow the room occupancy sensor to control the occupied/unoccupied mode of each zone controller to maximize energy conservation.

~~25.1.10~~-~~25.1.11~~. BACnet Integration:

~~25.1.10.1~~-~~25.1.11.1~~. Design Professional shall require direct communication with the manufacturer's highest level of customer support and may need to converse with the manufacturer's BACnet development team during project design, and implementation to make sure that the BACnet controller is capable of accomplishing one hundred (100%) of the Sequence of Operation.

~~25.1.10.2~~-~~25.1.11.2~~. Design Professional shall be responsible to ensure that third party BACnet controllers are able to adhere to the same point capabilities as the building automation system.

~~25.1.10.3~~-~~25.1.11.3~~. BACnet conformance disputes that may arise with the equipment manufacturers with BACnet devices will be resolved by the project Design Professional working directly with equipment manufacturer.

25.2. Controls

25.2.1. Constructor shall furnish and install all equipment, accessories, wiring, piping, and instrumentation required for a complete and functional system.

25.2.1.1. Provide all hardware and software, including all relays, sensors, power supplies, etc., required to perform the sequences intended.

25.2.2. Manufacturers shall be Johnson Controls or Schneider EcoStruxure (EBO)Controls.

25.2.3. All components shall have been thoroughly tested and proven in actual use.

25.2.3.1. The DDC system shall possess a modular architecture, permitting future expansion through additional DDC panels, sensors, actuators and/or operator terminals.

25.2.3.2. The DDC system shall monitor and control the equipment with respect to the indicated Sequences of Operation and Points List.

25.2.3.3. Provide sufficient input/output units as determined by specific applications.

25.2.3.4. Existing DDC system shall be extended to meet the requirements, as indicated by the Drawings and Specifications associated with this project.

25.2.4. For UIHC:

25.2.4.1. A majority of the existing temperature control systems within the facility are currently based upon the Johnson Controls Metasys system.

25.2.4.1.1. Johnson Controls ~~and Siemens are now~~ is an approved TCCs at the Hospital.

25.2.4.1.2. There are locations where the required new systems of one TCC would work better with the existing equipment than others.

25.2.4.1.3. The Design Professional shall review such areas with the Owner.

25.2.4.2. The Design Professional shall coordinate all new temperature control work with existing systems.

25.2.4.3. Temperature Control System Electrical wiring:

25.2.4.3.1. All 24-volt wiring shall be installed by the TCC.

25.2.4.3.2. This wiring shall be installed either in conduit or on J hooks.

25.2.4.3.3. In mechanical equipment rooms and in-patient rooms, the use of conduit is required.

25.2.4.3.4. Routings shall be above corridor ceilings.

25.2.4.3.5. All 120-volt wiring for temperature control work (such as to control panels and for terminal air box controls) shall be installed by the TCC.

25.2.4.3.6. This wiring shall be installed in conduit.

25.2.4.4. Areas requiring special control systems

25.2.4.4.1. Isolation rooms shall have volume matching ~~terminal-Venturi terminal~~ air valve boxes valve with the ability to measure air flow and uses a damper vs. plunger to regulate flow; CRC basis of design. on the supply and the return or exhaust for that room.

25.2.4.4.2. The current standard for control monitors on isolation rooms is the TSI model Pressura RPC 30.

25.2.4.4.3. The TCC shall be specified to provide both monitoring and control of all exhaust fans for isolation rooms.

25.2.4.4.4. Telecom rooms shall be designed with their own thermostats which shall control a terminal air box, fan coil or other cooling device.

~~For UIHC:~~

25.2.4.4.5. The current standard for control monitors on isolation rooms is Setra Monitors.

~~25.2.4.4.4-25.2.4.4.6.~~ Room monitors shall only be for monitoring, control through BAS.

25.2.4.5. Equipment which requires standardized control or monitoring systems.

25.2.4.5.1. AHUs shall be monitored for:

- 25.2.4.5.1.1. Return Air temperature
- 25.2.4.5.1.2. Return Air Humidity
- 25.2.4.5.1.3. Mixed Air temperature
- 25.2.4.5.1.4. Supply air temperature
- 25.2.4.5.1.5. Discharge air humidity
- 25.2.4.5.1.6. Outside air damper position
- 25.2.4.5.1.7. Return air damper position
- 25.2.4.5.1.8. Relief air damper position
- 25.2.4.5.1.9. Heating valve position
- 25.2.4.5.1.10. Cooling valve position
- 25.2.4.5.1.11. Supply heating water temperature
- 25.2.4.5.1.12. Chilled water supply temperature
- 25.2.4.5.1.13. Supply Air static
- 25.2.4.5.1.14. Return air static
- 25.2.4.5.1.15. Supply air CFM
- 25.2.4.5.1.16. Return Air CFM
- 25.2.4.5.1.17. Supply fan status, [per fan](#)
- 25.2.4.5.1.18. Return fan status, [per fan](#)
- 25.2.4.5.2. Terminal Air Boxes (TABs) shall be specified with a discharge air sensor.
- 25.2.4.5.3. ~~Fire/smoke dampers shall have end switches and actuators mounted by the damper manufacturer.~~ [Fire Dampers shall have a switch to prove open and close status. The switches should be shown on the BAS.](#)
- 25.2.4.5.4. Actuators shall be 120V.
- 25.2.4.5.5. The temperature control system shall monitor entering water temperature, leaving water temperature, and valve position.
- 25.2.4.5.6. All return and exhaust fans shall be monitored.
- 25.2.4.5.7. HVAC circulating pumps shall be monitored and controlled.
- 25.2.4.5.8. Monitoring by either circuit transformers or differential pressure switches are acceptable.

- 25.2.4.5.9. Status monitoring shall be provided for all exhaust fans.
- 25.2.4.5.10. Sewage ejectors shall be monitored for high level alarm and pump failure status.
- 25.2.4.5.11. Sump pumps shall be monitored for high level alarm and for pump status.
- 25.2.4.5.12. Emergency generators shall be monitored for run status. This monitoring is separate from the monitoring provided by the generator remote panels.
- 25.2.4.5.13. Steam mains downstream of each service entrance (from the U of I campus steam distribution system) monitoring points shall include points for steam pressure and temperature, both upstream and downstream of the PRV.
- 25.2.4.5.14. Monitoring of the condensate pump status and level alarms.
- 25.2.4.5.15. Monitoring of the end sections of major steam grids is desirable.
- 25.2.4.5.16. Service entrances (from the campus chilled water system) shall include points for supply temperature, return temperature, supply pressure, and return temperature.
- 25.2.4.5.17. The main building distribution system shall include points for supply temperature (one per building), return temperature, supply pressure, return pressure, flow into the building system, and pressure at the hydraulically most remote point in the building.

25.2.4.6. Work to be specified for the Contractor to provide:

- 25.2.4.6.1. Provide and install all valves, pressure taps, and connections for steam water, drain and overflow connections.
- 25.2.4.6.2. Provide and install all piping connections required for valve position indicators, flow devices, etc.
- 25.2.4.6.3. Provide and install any necessary access panels to allow service access to all control devices and equipment.
- 25.2.4.6.4. Provide and install any necessary multiple section dampers and interconnecting linkages.
- 25.2.4.6.5. Install any automatic dampers and automatic control valves that are to be furnished by the TCC.
- 25.2.4.6.6. Install any separable wells that are to be furnished by the TCC.

25.2.5. BACnet Integration:

- 25.2.5.1. All BACnet devices shall be BACnet Testing Lab certified.
- 25.2.5.2. BACnet instance numbers shall be coordinated with the Owner.

- 25.2.5.3. Assigned numbers shall be physically entered by the equipment manufacturer at the BACnet device.
- 25.2.6. Installing Constructor shall specialize in systems and products and have a minimum of five (5) years documented experience.
- 25.2.7. The control system shall be installed by experienced control electricians and fitters regularly engaged in control installations.
- 25.2.8. Installing controls electricians and fitters shall have a minimum of two (2) years of documented field experience with extensive understanding and knowledge of the operation of the system installed.
- 25.2.9. Installers shall:
 - 25.2.9.1. Verify that all field controllers are properly addressed and communicating with the master controller.
 - 25.2.9.2. Jumper configurations.
 - 25.2.9.3. Be onsite to make corrections during point-to-point controls verification.
 - 25.2.9.4. Coordinate with Owner to determine device and sensor locations.
- 25.2.10. Warranty:
 - 25.2.10.1. All actuators shall have a minimum two (2) year Manufacturer's Warranty.

25.3. Scopes of Work:

25.3.1. Coordinate with UI Controls for projects using third party controls subcontractors.

25.3.2. The following responsibilities shall apply when UI Controls is providing project programming:

ACTIVITY	RESPONSIBLE PARTY	
	CONTROL CONSTRUCTOR	OWNER
Provide Control Components per Plans & Specifications	X	
Submittals	X	
Device/ System Installation	X	
Communication Bus Verification	X	
Determine Sensor Locations	X	X
Point to Point Verification/ Troubleshooting	X	X
Programming		X
Validating HVAC Systems		X
Commissioning Systems	X	X
Control System Startup		X
Build/ Install Graphics	X	
Record Drawings	X	

25.3.3. DDC Constructor shall:

25.3.3.1. Verify space requirements to insure proper service clearances.

25.3.3.2. Provide all required information, material and direction to the designated Constructor as required for device and accessory installation.

25.3.3.3. Address controllers

25.3.3.4. Configure jumpers

25.3.4. HVAC Constructor shall:

25.3.4.1. Install automatic valves, separable wells, flow switches, airflow monitoring stations, etc., supplied by the DDC Constructor.

25.3.4.2. Install all automatic control dampers.

25.3.4.3. Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.

25.3.4.4. Coordinate installation of variable air terminal units with control Constructor.

25.3.4.5. Install duct mounted reheat coils.

25.3.5. Electrical Constructor shall:

25.3.5.1. Provide all power wiring (120-volt or greater) to motors, electric dampers, smoke detectors, and DDC panels.

25.3.5.2. Assign and identify electrical circuits to control Constructor for dedicated controller wiring.

25.3.6. Controls Electrical Constructor shall:

25.3.6.1. Provide electric wiring and wiring connections required for the installation of the temperature control system, unless specifically shown on the electrical drawings or called for in the electrical specifications.

25.4. User Interface:

25.4.1. Graphics:

25.4.1.1. Dynamic Color Graphic Displays for floor plan displays, system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, terminal air boxes, and hot water systems, shall be provided as Screen Standards.

25.4.1.2. System Selection/Penetration:

25.4.1.2.1. Support user access to all system schematics and floor plans with a graphical penetration scheme, menu selection, or text-based commands.

25.4.1.3. Dynamic Data Displays:

25.4.1.3.1. Show dynamic temperature values, humidity values, flow values, and status indication in their actual respective locations.

25.4.1.3.2. Values shall automatically update to represent current conditions without operator intervention.

25.4.1.4. Windowing:

25.4.1.4.1. The windowing environment of the PC Operator Workstation shall allow the user to view several graphics simultaneously to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

25.4.1.5. Provide graphics screen with building floor plan showing actual locations of master controllers, system control panels, and Variable Frequency Drives.

25.4.1.5.1. Plans shall include routing of control communication bus and pneumatic piping.

25.4.1.6. Graphics Development Package:

25.4.1.6.1. Provide graphic generation software to allow the user to add, modify, or delete system graphic displays.

25.4.1.6.2. DDC Constructor shall provide libraries of pre-engineered screens and symbols depicting:

25.4.1.6.2.1. Standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.)

25.4.1.6.2.2. Complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.)

25.4.1.6.2.3. Electrical symbols

25.4.1.6.3. The graphic development packages shall allow user to perform the following:

25.4.1.6.3.1. Define symbols.

25.4.1.6.3.2. Position and size symbols.

25.4.1.6.3.3. Define background screens.

25.4.1.6.3.4. Define connecting lines and curves.

25.4.1.6.3.5. Locate, orient and size descriptive text.

25.4.1.6.3.6. Define and display color for all elements.

25.4.1.6.3.7. Establish correlation between symbols or text and associated system points or other displays.

25.4.1.6.4. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon:

25.4.1.6.4.1. Building function

25.4.1.6.4.2. Mechanical system

25.4.1.6.4.3. Building layout

25.4.1.6.4.4. Any other logical grouping of the facility

25.4.1.6.5. User shall be able to build graphic displays that include point data from multiple DDC panels, including MCP, sub panels, LCU's, or VAV terminal unit control.

25.4.1.7. Control Constructor shall coordinate with Control Engineering for campus graphic standard.

25.4.2. Local Interface:

25.4.2.1. Controllers shall support the connection of a portable interface device such as a laptop computer or vendor specific hand-held device.

25.4.2.2. Via this local interface, an operator shall:

25.4.2.2.1. Adjust application parameters.

25.4.2.2.2. Execute manual control of input and output points.

25.4.2.2.3. View dynamic data.

25.4.3. Alarms:

25.4.3.1. Route alarms directly from primary application nodes to specific workstations and servers.

25.4.3.2. The alarm management portion of the master controller software shall, at the minimum, provide the following functions:

25.4.3.2.1. Log date and time of alarm occurrence.

25.4.3.2.2. Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.

25.4.3.2.3. Allow user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

25.4.3.2.4. Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm.

25.4.3.2.4.1. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

25.4.3.2.5. Provide the ability to direct alarms to an e-mail address or text message.

25.4.3.2.6. Any attribute of any object in the system may be designated to report an alarm.

25.4.3.2.7. The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

25.4.3.3. Provide BAS alarm point for all flood protection valves.

25.4.4. Reports:

25.4.4.1. Reports shall be capable of being directed to each of the following:

25.4.4.1.1. User interface displays

25.4.4.1.2. Printers

25.4.4.1.3. Archives

25.4.4.2. The system shall provide the following reports:

25.4.4.2.1. All points in the BAS.

25.4.4.2.2. All points in each BAS application.

25.4.4.2.3. All points in a specific area network.

25.4.4.2.4. All points in a user-defined group of points.

25.4.4.2.5. All points currently in alarm in BAS application.

25.4.4.2.6. All points locked out in a BAS application.

25.4.4.2.7. All BAS schedules.

25.4.4.2.8. All user defined and adjustable variables, schedules, interlocks, etc.

25.4.4.2.9. BAS diagnostic and system status reports.

25.4.5. Schedules:

25.4.5.1. The system shall provide multiple input forms for automatic BAS time-of-day scheduling and operations override.

25.4.5.2. The following spreadsheet types shall be accommodated:

25.4.5.2.1. Weekly schedules.

25.4.5.2.2. Temporary override schedules.

25.4.5.2.3. Holiday schedules.

25.4.5.2.4. Monthly schedules.

25.4.5.3. Schedules shall be provided for each system or sub-system.

25.4.5.3.1. Each schedule shall include all user commanded points residing within the system.

25.4.5.3.2. Each point shall have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system.

25.4.5.3.3. Scheduling and rescheduling of points shall be accomplished via the system schedule spreadsheets.

25.4.5.4. Monthly calendars for a twelve (12) month period shall be provided to allow for scheduling of holidays and special days in advance.

25.4.6. Historical Trending and Data Collection:

25.4.6.1. Trend and store point history data for all BAS points and values as selected by the user.

25.4.6.2. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.

25.4.6.3. Provide the capability to perform the following statistical functions on the historical database:

25.4.6.3.1. Average

25.4.6.3.2. Arithmetic mean

25.4.6.3.3. Maximum/minimum values

25.4.6.3.4. Range – difference between minimum and maximum values

25.4.6.3.5. Standard deviation

25.4.6.3.6. Sum of all values

25.4.6.3.7. Variance.

25.4.6.3.7.1. Coordinate with UI Controls on trend specifics.

25.5. Sensors and Equipment:

25.5.1. Sensors and equipment shall be standard nonproprietary components regularly manufactured for this and/or other systems and not custom-designed specifically for this project.

25.5.2. For UI Housing:

25.5.2.1. Occupancy sensors in student sleeping rooms shall be connected to the fan coils controls, so that when the space is unoccupied, the space temperature readjusts to the setback and set up temperatures.

25.5.2.2. Coordinate final sequence with the Owner.

25.5.3. Nomenclature:

25.5.3.1. Label all system control points and devices.

25.5.3.2. Control point identifiers, descriptions and object names shall be per the Owner's equipment nomenclature standard.

25.5.3.3. The Owner's nomenclature standard shall apply to third-party BACnet controllers.

25.5.4. Sensors and equipment shall be of the electronic-type suitable for their intended purpose.

25.5.5. Inputs and Outputs:

25.5.5.1. The DDC System shall be capable of receiving the following input signals:

- 25.5.5.1.1. Analog Inputs (AI) shall monitor temperature, humidity, voltages, or any type of input signal from a 4 20 MA or 0-to-10-volt DC as selected by software.
- 25.5.5.1.2. Digital Inputs (DI shall accept dry contact closures.)
- 25.5.5.1.3. Pulse accumulators shall have the same characteristics as the DI except that, through software, the number of total pulses shall be counted.
 - 25.5.5.1.3.1. The pulse accumulator shall accept up to ten (10) pulses per second.
- 25.5.5.2. The DDC System shall be capable of providing the following output signals:
 - 25.5.5.2.1. Digital Outputs (DO) shall provide dry contact closures for momentary and maintained programmable operation of field devices.
 - 25.5.5.2.1.1. Closures will have a duration of 0.1 seconds to continuous.
 - 25.5.5.2.2. Analog Output (AO) shall provide variable outputs of four (4) 20 mA, 0-to-10-volt DC, or 0-to-20-volt DC, as selected by the software.
 - 25.5.5.2.3. Pulse Width Modulation (PWM) outputs are prohibited.
- 25.5.6. Accuracy shall be consistent with that specified below and as required to maintain end-to-end system accuracy.
 - 25.5.6.1. Temperature sensors shall be thermistor or RTD-type.
 - 25.5.6.2. Averaging sensors used as control points shall follow manufacturer recommended sensor coverage.
 - 25.5.6.2.1. Averaging sensors for monitoring only purposes, such as cooling coil temperature, face/bypass temperature, or return air temperature, may use a single averaging sensor.
 - 25.5.6.3. Energy recovering units shall have averaging temperature sensors at the inlets and outlets at the wheels.
 - 25.5.6.4. Humidity sensors shall be electronic with no moving or other parts requiring periodic service. Accuracy will be +3 percent of reading.
 - 25.5.6.5. Control relays shall be rated for the application with form c contacts with position indicator.
 - 25.5.6.6. Duct Static Pressure Probes:
 - 25.5.6.6.1. Probe shall be mounted as per manufacturer's recommendations.
 - 25.5.6.6.2. Duct static pressure control point or monitor point shall use the following probe in conjunction with an appropriately sized pressure transducer.
 - 25.5.6.6.2.1. Static Pressure Tip, ¼-inch Barb (Kele Part Number: A-302-K)

25.5.6.6.2.2. Mounting Flange for A-302-K (Kele Part Number: A-345-K)

25.5.6.7. Air flow status sensors for all supply, return, exhaust, and relief applications shall be differential pressure type.

25.5.6.7.1. Fan arrays (fan wall technology) shall be coordinated through control engineering.

25.5.6.7.2. Where Fan Wall Technology is utilized, an adjustable differential pressure switch shall be installed across the fan wall.

25.5.6.7.3. An additional current transducer at each motor shall be installed for alarming purposes.

25.5.6.8. Hydronic flow status sensors shall be differential pressure type and suitable for intended application.

25.5.6.8.1. No paddle switches. Provide external bleed ports in an H frame configuration.

25.5.6.9. Water Temperature Sensors shall be installed in separate immersion wells.

25.5.6.10. All relays and power supplies shall be mounted in an interface panel directly beside DDC panel and shall be clearly labeled as to their functions.

25.5.6.11. Current transducers shall be industrial type with separate zero and span adjustments.

25.5.7. Terminal Air Box (TAB) Controllers:

25.5.7.1. Standalone controllers capable of performing control functions related to variable air volume zone control for terminal air boxes independently from other controllers in the network.

25.5.7.2. Each TAB controller shall be capable of controlling the following configurations of variable air volume types:

25.5.7.2.1. Single Duct, cooling only.

25.5.7.2.2. Single Duct with Reheat.

25.5.7.2.3. Double Duct.

25.5.7.2.4. Fan-Powered, Parallel or Series Flow.

25.5.7.2.5. Remote Heating.

25.5.7.3. Controller shall support various digital and analog inputs and outputs as needed for damper control, control valves, electric coils, airflow sensors, remote heating, occupancy sensors, associated exhaust, discharge air temperature sensor, etc., and shall be capable of independent occupancy scheduling.

25.5.7.4. Systems set points, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming of the controller.

25.5.7.5. Valve actuators shall be proportional control 0-to-10-volt DC.

25.5.7.6. No spring return actuators with zone control devices.

25.5.8. Low Temperature Safety:

25.5.8.1. Low-limit switches shall have low point sensitive elements (not averaging type) installed to cover the entire duct/coil area.

25.5.8.2. These switches shall be 2-position manual reset type, wired to shut down the supply fan and send an alarm at the DDC system.

25.5.9. Building pressurization:

25.5.9.1. Volume tracking shall be used for these applications.

25.5.9.2. Building pressure shall be a monitored point only. [Adjust volume tracking to maintain building positive pressure.](#)

25.5.10. Building Utilities

25.5.10.1. Building steam pressure shall be monitored on the secondary side of all pressure reducing valves.

25.5.11. Humidity Control:

25.5.11.1. Units that have humidity control require the following:

25.5.11.1.1. Zone humidity

25.5.11.1.2. Return air humidity

25.5.11.1.3. Discharge air humidity:

25.5.11.2. Discharge high humidity limit switch shall be wired back as feedback to the DDC controls and hard wired to the humidity valve.

25.5.12. Air Handler Heating and Cooling Water Coils:

25.5.12.1. Per control valve, provide supply and return temperature sensors on coil header piping.

25.5.13. Air Handler and Exhaust Fans Safety Static Pressure Sensors:

25.5.13.1. Provide low static sensor on inlet side of all supply, return and exhaust fans. Mount sensor on unit.

25.5.13.2. Provide high static sensor on discharge side of supply fans before fire smoke dampers. Mount sensor on unit.

25.5.14. Hydronic Control Valves:

- 25.5.14.1. Provide factory fabricated electronic control valves of type, body material, and pressure class required for application
 - 25.5.14.2. Two-position valves shall be a minimum of line size with a maximum allowable pressure drop of 1 psi.
 - 25.5.14.3. Size two-way and three-way modulating valves to provide a pressure drop at full flow between 1 and 4 psi.
 - 25.5.14.4. Two-way valves shall be 100% tight closing.
 - 25.5.14.5. Three-way valves shall be 100% tight closing in both extreme positions.
 - 25.5.14.6. Modulating two-way valves shall have minimum shutoff classification (per ANSI/FCI 70-2) Class IV rating and shall have equal percentage flow characteristics.
 - 25.5.14.7. Modulating three-way valves shall have linear flow characteristics. Review use with Owner.
 - 25.5.14.8. Piping geometry correction factors for Cv ratings shall be used and stated for ball valves or non-characterized valves.
- 25.5.15. Heating Water Control Valves:
- 25.5.15.1. Globe ½-inch to 2-inches:
 - 25.5.15.1.1. Design Pressure: 250 psi
 - 25.5.15.1.2. Design Temperature: 212°F
 - 25.5.15.1.3. Design Flow Differential Pressure Rating: 35 psi
 - 25.5.15.1.4. Bronze or brass body, trim, and plug; nickel plated or stainless-steel stem; stainless steel or bronze seat; EPDM or PTFE packing; threaded ends.
 - 25.5.15.1.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.
 - 25.5.15.2. Globe 2 ½-inches to 6-inches:
 - 25.5.15.2.1. Design Pressure: 125 psi.
 - 25.5.15.2.2. Design Temperature: 250°F.
 - 25.5.15.2.3. Design Flow Differential Pressure Rating: 25 psi.
 - 25.5.15.2.4. Cast iron body, bronze or brass trim and plug; nickel plated or stainless-steel stem; bronze seat; EPDM or PTFE packing; flanged ends.
 - 25.5.15.2.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.
 - 25.5.15.3. Ball 2-inches and under:

25.5.15.3.1. Design Pressure: 400 psi.

25.5.15.3.2. Design Temperature: 212°F.

25.5.15.3.3. Design Flow Differential Pressure Rating: 35 psi.

25.5.15.3.4. Bronze or brass body, nickel plated brass or stainless-steel stem, chrome plated brass or stainless-steel ball, PTFE or RTFE seats and seals, screwed ends (solder ends are acceptable only if rated for soldering in line with 470°F melting point of 95-5 solder).

25.5.15.3.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.15.4. Ball 3-inches to 6-inches:

25.5.15.4.1. Design Pressure: 200 psi.

25.5.15.4.2. Design Temperature: 212°F.

25.5.15.4.3. Design Flow Differential Pressure Rating: 35 psi.

25.5.15.4.4. Cast iron body, stainless steel stem, stainless steel full port ball, PTFE or RTFE seats and seals, flanged ends.

25.5.15.4.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.16. Chilled Water Control Valves:

25.5.16.1. Globe 1-inch to 2-inches diameter (17 GPM or below):

25.5.16.1.1. Design Pressure: ASME Class 150.

25.5.16.1.2. Design Temperature: -20°F to 100°F.

25.5.16.1.3. Minimum Close-Off Differential Pressure: 150 psi.

25.5.16.1.4. Valve body of ASTM B62 Grade C83600, bonnet of ASTM B148, valve plug (soft seat) of ASTM A276 S31600 with PTFE insert, valve stem of ASTM A276 S31600.

25.5.16.1.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.16.2. Single V-Style Ball Control Valve: 1-inch to 12-inches diameter (Greater than 17 GPM):

25.5.16.2.1. Design Pressure: ASME Class 150.

25.5.16.2.2. Design Temperature: -20°F to 482°F.

25.5.16.2.3. Control Valve Range: 100:1 rangeability.

- 25.5.16.2.4. TFM seat providing Class VI shut-off. ANSI 150 carbon steel body with flanged ends with SS316 stainless steel ball and stem, and RPTFE/graphite gasket.
- 25.5.16.2.5. Control valve Cv shall be based on valve at 80% open.
- 25.5.16.2.6. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.
- 25.5.16.3. Provide valve size in accordance with specified maximum pressure drop across control valve.
- 25.5.16.4. Equip control valves with heavy-duty electronic actuators, with proper shutoff ratings.
- 25.5.16.5. Steam Service Valves shall have linear characteristics with range ability of 30 to 1150 psi pressure class, and maximum full flow pressure drop of 60% of inlet pressure for low-pressure systems.

25.5.17. Steam Control Valves:

25.5.17.1. General:

- 25.5.17.1.1. Two-position valves shall have a maximum pressure drop equal to ten percent (10%) of the inlet pressure.
- 25.5.17.1.2. Modulating control valves shall have modified linear characteristics.
- 25.5.17.1.3. The pressure drop through a modulating control valve with an inlet pressure less than or equal to 15 psig shall be equal to eighty percent (80%) of the inlet pressure.
- 25.5.17.1.4. In no case shall the inlet pressure of the equipment after the valve be less than 2 psig, except for integral face and bypass coils where the inlet pressure after the valve shall not be less than 5 psig.
- 25.5.17.1.5. The pressure drop through modulating control valves with inlet pressures greater than 15 psig shall be required to provide outlet pressure of 1 psi above the scheduled or specified inlet pressure of the equipment served.
- 25.5.17.1.6. Piping geometry correction factors for Cv ratings shall be used and stated for ball valves, butterfly valves, or non-characterized valves.

25.5.17.2. Two-Position (Low Pressure: 15 psi or below):

25.5.17.2.1. Globe ½-inch to 2-inches:

25.5.17.2.1.1. Design Pressure: 100 psi.

25.5.17.2.1.2. Design Temperature: 337°F.

25.5.17.2.1.3. Bronze body; stainless steel trim, plug, stem, and seat; EPDM or PTFE packing;

25.5.17.2.1.4. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.17.2.1.5. Threaded ends.

25.5.17.2.2. Globe 2 ½-inches to 6-inches:

25.5.17.2.2.1. Design Pressure: 100 psi.

25.5.17.2.2.2. Design Temperature: 337°F.

25.5.17.2.2.3. Cast iron body; stainless steel trim, plug, stem, and seat; EPDM or PTFE packing; flanged ends.

25.5.17.2.2.4. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.17.3. Modulating (Low Pressure: 15 psi and below):

25.5.17.3.1. Segmented ball 1-inch to 6-inches:

25.5.17.3.1.1. Design Pressure: 250 psi shutoff pressure with ANSI class 150 connections.

25.5.17.3.1.2. Design Temperature Range: 0 to 450°F.

25.5.17.3.1.3. Carbon steel body; stainless steel V-notch ball and shaft, Class VI seat tightness with soft seat seals manufactured from PTFE, modified PTFE (TFM), or RTFE.

25.5.17.3.1.4. Valves shall have 90° rotation, minimum 300:1 turndown range with equal percentage control characteristic.

25.5.17.3.1.5. Acceptable Manufacturers are Johnson Controls, Belimo, Bray or Owner approved equal.

25.5.18. Valve Actuators:

25.5.18.1. General:

25.5.18.1.1. Actuators shall be sized to operate the valve through its full range of motion and shall close against pump shutoff pressure without producing audible noise at any valve position.

25.5.18.1.2. Provide visual position indication.

25.5.18.1.3. Mount actuator directly on valve or provide linear motion assembly as required for valve type.

25.5.18.2. Valve Actuators - Electronic:

25.5.18.2.1. Actuator shall be UL listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage

due to over-rotation, and “V” bolt clamp with matching “V” toothed cradle (single bolt or setscrew fasteners not acceptable).

25.5.18.2.2. Actuators shall be rated for 60,000 full stroke cycles at rated torque.

25.5.18.2.2.1. Stall motor not acceptable.

25.5.18.2.3. Tri-state/floating actuators shall not be allowed on the project.

25.5.18.2.4. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.

25.5.18.2.5. Spring return actuators shall have an internal spring return mechanism. Non-mechanical forms of fail-safe operation are not acceptable.

25.5.18.2.6. Provide analog feedback signal for positive position indication as required by control diagrams.

25.5.19. Control Dampers:

25.5.19.1. General:

25.5.19.1.1. Damper shaft shall be exposed and mechanically marked (indicating damper position) for enabling easy access for maintenance, repair, and future replacement.

25.5.19.2. Standard Control Damper:

25.5.19.2.1. Shall be AMCA Certified Rating Seal.

25.5.19.2.2. Frame: Hat-shaped channel, minimum 12-gauge extruded aluminum, and minimum 4” deep.

25.5.19.2.3. Blades: Minimum 12-gauge extruded aluminum airfoil design, minimum 6-inches wide, overlapping blades and blade seals.

25.5.19.2.4. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.

25.5.19.2.5. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft.

25.5.19.2.6. Maximum Leakage: 4 cfm/ft² at 1-inch w.c. pressure differential.

25.5.19.3. Thermally Insulated Control Damper:

25.5.19.3.1. Shall be AMCA Certified Rating Seal.

25.5.19.3.2. Frame: Thermally broken, extruded aluminum, minimum 4-inches deep, 0.080” minimum thickness.

25.5.19.3.2.1. Insulate frame with extruded polystyrene.

25.5.19.3.3. Blades: Minimum 12-gauge extruded aluminum airfoil design, minimum 6-inches wide, internally insulated with expanded polyurethane foam and thermally broken, with overlapping blades and blade seals.

25.5.19.3.4. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.

25.5.19.3.5. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft.

25.5.19.3.6. Maximum Leakage: 4 cfm/ft² at 1-inch w.c. pressure differential.

25.5.19.4. Control Dampers (Fume Hoods):

25.5.19.4.1. Control dampers associated with fume hoods shall follow requirements of control dampers.

25.5.19.4.2. Shall be constructed of stainless-steel with high quality bearings for service in a corrosive environment

25.5.19.5. Control Damper Actuators:

25.5.19.5.1. Size each motor to operate dampers or valves with sufficient reserve power to provide smooth modulating action.

25.5.19.5.2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator.

25.5.19.5.2.1. Mechanical end switches to deactivate the actuator at the end of rotation are not acceptable.

25.5.19.5.3. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator.

25.5.19.5.4. Non-mechanical forms of fail-safe operation are not acceptable.

25.5.19.5.5. Proportional actuators shall accept a 0-to-10-volt DC.

25.5.19.5.6. All actuators shall provide a 0-to-10-volt DC position feedback signal.

25.5.19.5.7. All 24-volt AC/DC actuators shall operate on Class-2 wiring and shall not require more than 14 VA for AC or more than 8 watts for DC applications.

25.5.19.5.8. Actuators operating on 120-volt AC power shall not require more than 10 VA.

25.5.19.5.9. Non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

25.5.19.5.9.1. Spring return actuators with more than 60-inches/pound torque capacity shall have a manual crank to allow manual positioning of the damper when the actuator is not powered.

25.5.19.5.9.2. Actuators shall be sized for proper speed of response at the velocity and pressure conditions to which the control damper is subject.

25.5.19.5.9.3. Shall produce sufficient torque to close off against the maximum system pressures encountered.

25.5.19.5.9.4. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque. Manufacturer shall be ISO9001 certified.

25.5.19.5.9.5. Approved Manufacturers are Johnson Controls and Belimo.

25.5.20. Combination Air Flow and Temperature Measurement Station (AFMS):

25.5.20.1. General:

25.5.20.1.1. CSC shall provide thermal dispersion-type, combination airflow and air temperature measurement devices as indicated on the drawings and/or control sequences.

25.5.20.1.2. Each measuring device shall consist of multi-point sensor nodes in one (1) or more probe assemblies with a maximum of sixteen (16) sensor nodes per location, and a single remotely mounted 32-bit microprocessor-based transmitter for each measurement location.

25.5.20.1.3. Airflow and temperature measuring devices shall be UL Listed as an entire assembly.

25.5.20.1.4. Devices in UL labeled enclosures are not equivalent and shall not be used without a UL Listing for Standard 873.

25.5.20.1.5. Design and installation shall use duct-mounted devices in filtered airstreams and adequate access shall be provided for maintenance.

25.5.20.1.6. Fan inlet sensors shall not be substituted for duct or plenum sensor probes.

25.5.20.1.7. Where fan inlet mountings are accepted, mounting styles shall be indicated on the plans as either "face-mounting" or "throat-mounting."

25.5.20.1.8. Face mounting shall have no mechanical fastening in the throat or on the surface of the inlet cone

25.5.20.1.9. Face mounting shall be used on all performance-sensitive plenum-type or plug fans.

25.5.20.1.10. The device selected shall be capable of reading accurately throughout the full, intended range of airflow.

25.5.20.1.11. Basis of Design shall be EBTRON, Inc., Gold Series

25.5.20.2. Transmitter:

25.5.20.2.1. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature.

25.5.20.2.2. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units.

25.5.20.2.3. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.

25.5.20.2.4. All integrated ~~circuitry~~circuitries shall be industrial grade temperature rated.

25.5.21. Air Flow Monitoring Stations:

25.5.21.1. Device shall be capable of reading accurately throughout the full, intended range of airflow.

25.5.21.2. Basis of design shall be Air Monitor Corporation, VOLU-probe, or VOLU-probe/FI.

25.5.22. Miscellaneous Devices:

25.5.22.1. Provide all the necessary switches, relays, transformers, etc., to make a complete and operable system.

25.5.22.2. Locate devices in local interface panel, unless otherwise specified.

25.5.22.3. All buildings shall have a building static pressure sensor which has been field verified with Owner.

25.6. Installation:

25.6.1. Install all equipment in accordance with equipment manufacturer's published instructions. Furnish printed copies of these instructions to the Owner prior to installation.

25.6.2. Identification:

25.6.2.1. All equipment, including valves, dampers, etc., shall be identified by a unique equipment number and the equipment tagged after installation.

25.6.3. DDC Panels:

25.6.3.1. High and low pressure safety switch mounted at panel.

~~25.6.3.1.~~25.6.3.2. Neatly train wiring inside Panduit wire management system.

~~25.6.3.2.~~25.6.3.3. Mount relays and devices on din rail.

~~25.6.3.3.~~25.6.3.4. Control wiring cable sheath shall be stripped backed no more than 6 inches from control terminations.

~~25.6.3.4.~~25.6.3.5. Label electrical circuit number inside DDC panel door.

25.6.4. Wiring:

- 25.6.4.1. Wiring, including low voltage wiring, shall comply with the requirements of the Electrical Sections of the specifications.
- 25.6.4.2. Wiring methods shall be in accordance with the requirements of applicable codes.
- 25.6.4.3. Install control wiring in conduit when exposed within the space, mechanical rooms, exterior locations, etc.
- 25.6.4.4. Low voltage control cable installed per the NEC within a concealed location.
- 25.6.4.5. Control network communication cable and AC power wiring greater than 24-volts shall not share the same conduit nor shall they occupy the same enclosure unless an appropriate grounded metallic barrier is installed between these wiring types.
- 25.6.4.6. Wiring from remote equipment shall be to terminal blocks.
 - 25.6.4.6.1. The terminal blocks shall be permanently marked for identification.
 - 25.6.4.6.2. Wire nut connections are not allowed in control panel wiring.
- 25.6.4.7. Label each field wire at each end.
- 25.6.4.8. All relays and transformers in panels shall be labeled.
- 25.6.4.9. Splices shall not be made in shielded wiring except where specifically required.
- 25.6.4.10. Splices shall be made on terminal blocks in approved junction boxes.
- 25.6.4.11. Outlet boxes shall not be used for splices.
- 25.6.4.12. If the DDC system is controlling a piece of equipment that is on emergency power, the DDC panel shall be connected to the same source of emergency power.
- 25.6.4.13. Powering for DDC control devices shall originate from dedicated control power circuits.
- 25.6.4.14. DDC Constructor will identify on submittal riser diagram the devices power by each circuit.

25.7. Air Flow Matrix:

- 25.7.1. Design Professional shall provide an Air Flow Matrix for the Constructor using the Air Flow Matrix Detail below.
- 25.7.2. VAV box flow shall be selected within the readable range of the selected product.

25.7.3. When using differential pressure style airflow stations in VAV boxes, the minimum airflows shall not be less than:

VAV Size	Min. CFM	VAV Size	Min. CFM
5-inch	53 cfm	14-inch	410 cfm
6-inch	75 cfm	16-inch	537 cfm
7-inch	102 cfm	18-inch	680 cfm
8-inch	135 cfm	20-inch	840 cfm
9-inch	170 cfm	22-inch	1016 cfm
10-inch	210 cfm	24-inch	1210 cfm
12-inch	302 cfm		

25.7.4. Air Changes Per Hour (ACPH):

25.7.4.1. For positive rooms, the ACPH shall be based on the minimum supply airflow.

25.7.4.2. For negative rooms, the ACPH shall be based on the minimum exhaust/return airflow.

AIR FLOW MATRIX

Note: The Air Flow Matrix above is intended to be displayed horizontally as a header starting with the Room Number column on the top left and ending with the Notes column on the top right. Matrix shall be located with the HVAC Mechanical Schedules.

Room Number	Room Type	Supply VAV ID	Associated AHU	Supply VAV Inlet Size	Supply VAV AREA	Inlet FPM at Lowest Min CFM	Occ Supply CLG Max CFM	Occ Supply HTG Max CFM	Occ Supply HTG/CLG Min CFM	Unoc Supply CLG Max CFM	Unoc Supply HTG Max CFM	Unoc Supply HTG/CLG Min CFM
Example # 1	Lab	LSV 1	LAHU 1	8"	0.349	400	635	635	250	525	525	140

Exhaust VAV ID	Associated EF	Exhaust VAV Inlet Size	Exhaust VAV AREA	Inlet FPM at Lowest Min CFM	Occ Exhaust Max CFM	Occ Exhaust Min CFM	Unoc Exhaust Max CFM	Unoc Exhaust Min CFM
LEV 1	LEF 1	8"	0.349	500	670	285	560	175

Fume Hood VAV ID	Associated EF	Fume Hood VAV Size	Fume Hood Area	Inlet FPM at Lowest Min CFM	Fume Hood Max CFM	Fume Hood Min CFM
FHV 1	LEF 1	8"	0.349	472	550	165

Room Bias CFM (pos/neg)	Room Pressure	Room Volume Ft 3	Occ ACPH	Unoc ACPH	Notes:
neg 200	neg 0.01"	4,500	2.20	2.20	

25.8. Testing:

25.8.1. BACnet Testing:

25.8.1.1. Conduct on-site device testing using the BACnet Manufacturers Association / BACnet Testing Laboratories (BMA/BTL) Virtual Test Shell 3.5.0 (VTS) program.

24) **RESERVED FOR FUTURE EXPANSION**

25) **NOT APPLICABLE**

26) ELECTRICAL

1. General:

- 1.1. New building main power supplies and distribution panels shall be oversized for future requirements.
 - 1.1.1. A minimum of twenty percent (20%) spare capacity shall be provided within each breaker panel board.
 - 1.1.2. Spare capacity is defined as twenty percent (20%) space feeder capacity and twenty percent (20%) spare poles within the panel.
- 1.2. Only UL or equivalent approved appliances and equipment shall be specified.
- 1.3. When installing or changing electrical equipment, the Design Professional shall evaluate available fault currents and size the ampere interruption capacity accordingly.
- 1.4. Provide separate demolition and construction drawings.
- 1.5. Show conduit sizes, routings, number, and sizes of conductors for all feeder and homerun circuits.
- 1.6. Show lighting and power circuits on the drawings. Identify the panel terminal point for each circuit.
- 1.7. Provide a schematic wiring diagram of power and lighting related control circuits on the construction drawings.
- 1.8. New buildings or building additions may require ground fault zone interlocking. Review options with Owner regarding project needs.
- 1.9. Provide a riser diagram for each system covered under Division 26.
- 1.10. Show electrical schedules for panel boards, distribution boards, motor control centers and related items on the drawings. Indicate connected demand load.
- 1.11. Electrical distribution equipment shall not ~~be located in~~ be in stairwells.
- 1.12. The design for buildings that house sensitive laboratory or data processing equipment shall clearly address the power quality requirements and location for the equipment.
 - 1.12.1. Separate neutrals, oversized neutrals and isolated grounds shall be installed where necessary.
 - 1.12.2. ~~Power circuits shall not share neutrals.~~
 - ~~1.12.1.1.12.3.~~
- 1.13. Electrically heated snow/ice melting systems are not allowed.
- 1.14. The Design Professional shall evaluate anticipated building loads for potential harmonic design requirements.
 - 1.15. ~~Power circuits shall not share neutrals.~~

~~1.16.1.15.~~ Provide lighting and GFCI receptacles in all accessible pipe spaces, pipe shafts, duct shafts, attic spaces, tunnels, and mechanical equipment rooms.

~~1.17.1.16.~~ Fire alarm and miscellaneous signals shall be in conduit.

~~1.18.1.17.~~ Lighting and receptacles in electrical and generator rooms shall be primarily on emergency power.

~~1.19.1.18.~~ Lightning protection shall be included for the building and roof.

~~1.20.1.19.~~ Buildings may incorporate future cellular distribution antenna system (DAS) networks.

~~1.20.1.1.19.1.~~ When required, provide rough-in for only conduits and raceways from roof (assumed antenna location) to networking equipment located inside the building.

~~1.21.1.20.~~ For UI Housing:

~~1.21.1.1.20.1.~~ All electrical, lighting, camera, fire, and card access system controllers shall be designed and specified to have 20% minimum spare inputs/outputs per controller for future expansion.

2. Identification:

2.1. The Design Professional shall clearly indicate the required wording of all labels.

2.2. All switching, protective devices and metering on main distribution panels shall be identified with labels.

2.3. Equipment labels shall be adhesive-backed vinyl or plastic with ½-inch letters.

2.4. Identification labels are required for all distribution equipment from the service through branch circuit panelboards and motor control centers. Label shall include equipment name and circuit origin as well as what it feeds/serves.

2.5. Label types:

2.5.1. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables:

2.5.1.1. Self-adhesive vinyl tape not less than 3 mils thick by 1-inch to 2-inches in width.

2.5.2. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification:

2.5.2.1. Flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

2.5.3. Wire/Cable Designation Tape Markers:

2.5.3.1. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

2.5.4. Cable Ties:

- 2.5.4.1. Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application.
- 2.5.4.2. Provide ties in specified colors when used for color coding.
- 2.5.4.3. Cable ties shall be listed and identified for the application, securement, and support.
- 2.5.5. Underground Plastic Markers:
 - 2.5.5.1. Bright colored continuously printed plastic ribbon tape of not less than 6-inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service.
 - 2.5.5.2. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- 2.5.6. Aluminum, Wraparound Marker Bands:
 - 2.5.6.1. 1-inch width, 0.014 (5 mm) inch thick aluminum bands with stamped or embossed legend and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- 2.5.7. Brass or Aluminum Tags:
 - 2.5.7.1. 2-inches (50 mm) by 2-inches (50 mm) by .05-inch metal tags with stamped legend, punched for fastener.
- 2.5.8. Indoor/Outdoor Number and Letters:
 - 2.5.8.1. Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- 2.5.9. Baked-Enamel Signs for interior Use:
 - 2.5.9.1. Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application.
 - 2.5.9.2. Mounting ¼-inch grommets in corners.
- 2.5.10. Exterior, Metal-Backed, Butyrate Signs:
 - 2.5.10.1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing and with colors, legend, and size required for application.
 - 2.5.10.2. Mounting ¼-inch grommets in corners.
- 2.5.11. Safety Signs:
 - 2.5.11.1. Comply with 29 CFR, Chapter XVII, Part 1910.145.
- 2.5.12. Fasteners for Plastic-Laminated Signs:

2.5.12.1. Self-tapping stainless-steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.6. Provide label on the inside of the panel door in public spaces.

2.6.1. Refer to Arc Flash requirements, below, for additional information.

2.7. Provide label on the outside of equipment in Mechanical, Electrical, and non-public spaces.

2.8. Label inside cover of all safety switches with location of device, fuse size, type, current limiting ability, and devices controlled.

2.9. Label all receptacles on the cover plate with self-adhesive labels.

2.10. For UIHC:

2.10.1. Receptacle covers shall be etched.

2.10.2. Label shall indicate panel ~~room~~ number, ~~Owner's designated Preventative Maintenance number or~~ designated panel name, and circuit number.

2.11. All light fixtures shall be labeled with the panel number and circuit number from which they are fed.

2.11.1. Place label out of public view.

2.11.2. Coordinate label location with the Owner.

2.12. All junction box covers shall be labeled with the panel ~~room~~ number, Owner's designated panel number, ~~and~~ circuit numbers contained in the junction box, ~~and voltage~~.

2.12.1. Exposed boxes in finished areas shall be labeled on inside of cover.

2.12.2. Exposed boxes in unfinished areas shall be labeled on outside of cover.

2.12.3. Concealed boxes above accessible ceilings shall be labeled on outside of cover. J-box covers should be painted to match conduit color.

2.13. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

2.14. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

2.15. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect.

2.16. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.

2.17. Install metal-backed butyrate signs for outdoor items.

2.18. Conduit Identification:

2.18.1. Pre-printed, flexible, self-adhesive vinyl labels with legend at 20-foot intervals to identify all conduits run exposed or located above accessible ceilings.

2.18.2. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3-feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors.

2.18.3. Labels for multiple conduits shall be aligned.

3. Arc Flash:

3.1. Constructor shall provide as-installed equipment and feeder data to Design Professional for use in completing the Record Arc Flash Assessment.

3.2. Equipment Labeling:

3.2.1. All new and modified equipment, as identified in NFPA 70E, Current Edition, shall be labeled.

3.2.2. Label shall include, at a minimum, the information identified in NFPA 70E.

3.2.3. Apply labels to the face of the equipment enclosure so that they will be visible without opening a door, panel, or enclosure plate.

3.2.4. Arc flash labels shall be a permanently attached, non-aging material with waterproof, abrasion resistant lettering.

4. Grounding:

4.1. Buried loop is the preferred method for establishing grounding. In new construction, establish grounding through use of concrete reinforcing steel.

4.2. Driven grounds shall not be specified where soil conditions consist of rock. In such conditions, use a counterpoise system or another approved alternative.

4.3. Building steel shall not be used for grounding unless specifically designed and tested for this application.

4.4. Building columns, roof steel, and steel reinforcing shall be made electrically continuous for grounding purposes.

4.5. Water lines, building steel, and a grounding conductor from existing building shall be bonded together.

4.6. Grounding electrode shall have a resistance to ground between 2-to-5-ohms.

4.7. Ground systems shall be connected to the primary power system ground mat serving the facility.

4.8. All grounding system conductors shall be copper.

4.9. Provide a separate grounding conductor with all circuits.

4.10. All grounding electrodes shall be tested to the recorded resistance value specified by the Design Professional.

4.10.1. Provide electronic copy of testing reports to the Owner.

4.11. For UIHC:

- 4.11.1. All equipment, lighting, devices, and metallic conduit systems shall be grounded per NEC 250, NEC 517, and NFPA 99.
- 4.11.2. Maximum resistance of main service grounds shall be 3-ohms.
- 4.11.3. In new service applications, the main electrical service ground shall be connected to the incoming water service, a new grounding grid, building steel, and steel rebar in the foundations.
- 4.11.4. The grounding grid shall consist of ground rods spaced 10-feet apart, connected with exothermic welds, in addition to conductors installed in the transformer vault walls.
 - 4.11.4.1. Coordinate main grounding with the Utility Operator.
- 4.11.5. In the existing portions of the facility, a separate grounding conductor is not always present in feeders and branch circuits.
 - 4.11.5.1. In remodel projects where existing panels are reused, proper grounding of that panel shall be obtained by either:
 - 4.11.5.1.1. Bonding the feeder conduit serving the panel at the panel, all pull boxes, and the source panel;
 - 4.11.5.1.2. Or re-pulling a new feeder with a separate grounding conductor if the panel will serve sensitive electronic or diagnostic equipment.
 - 4.11.5.2. Branch circuit wiring with no grounding conductor shall not be reused for new circuits.
- 4.11.6. Where new panels are added, the feeders to the source panel shall contain a grounding conductor.
 - 4.11.6.1. The source panel shall be properly grounded back to the main electrical service if proper grounding does not currently exist.
 - 4.11.6.2. A grounding electrode conductor shall be extended to all step-down transformers from the main electrical service ground bar. This shall be used to ground the secondary neutral. The equipment grounding conductor is NOT the grounding electrode.
- 4.11.7. Isolated ground panels shall be used in areas with sensitive equipment such as electronics, hospital diagnostic equipment, and computer equipment.
 - 4.11.7.1. A separate isolated grounding conductor (green with a yellow stripe) shall be installed in the panel feeder and all branch circuits.
 - 4.11.7.2. A green grounding conductor shall also be installed to bond the panel enclosure.
- 4.11.8. Sensitive electronic and imaging equipment often require a very "clean" grounding connection.

- 4.11.8.1. Provide a dedicated grounding conductor to main electrical service grounding point and provide for monitoring of ground noise prior to connection of equipment.
- 4.11.9. Operating Rooms and similar rooms with an isolated power source (IPS) shall have isolated power systems with equi-potential grounding.
 - [4.11.9.1.](#) This includes an isolated power panel with isolation transformer and monitoring/indication, receptacles, and low leakage conductors. Refer to NEC 517.
 - [4.11.9.1-4.11.9.2.](#) Isolated power systems shall be tested and commissioned per ###.
- 4.11.10. Ground rods shall be 10-feet long by ¾-inch diameter, copper, or copper clad steel.
 - 4.11.10.1. All grounding conductors, ground bars, etc. shall be copper.
- 4.11.11. Ground bars in standard electrical rooms (rooms with panels totaling less than 800 amps) shall be a minimum of ¼-inch thick, 4-inches tall and 24-inches long.
- 4.11.12. Ground bars in the main electrical rooms (rooms with panels totaling 800 amps or more) shall be a minimum of ¼-inch thick, 4-inches tall, and 48-inches long.
- 4.11.13. For remodeling projects, the Design Professional shall confirm there are existing grounding bars and space available for new or modified panels or equipment.
- 4.11.14. Ground bars in telecommunications rooms shall be a minimum of ¼-inch thick, 4-inches tall, and 10-inches long. Refer to the Telecommunications Design Reference Manual, prepared by Communications Technology Services, for more information on grounding for telecommunications equipment.
- 4.11.15. A green grounding conductor shall be installed throughout the entire new or modified portion of the electrical distribution system.
 - 4.11.15.1. Relying on the raceway for the sole source of grounding is not acceptable except in remaining panels which will be reused as noted above.
 - 4.11.15.2. A separate grounding bar shall be installed in each electrical room and telecommunications room, connected to the main electrical room grounding bar with a #4/0 grounding conductor.
 - 4.11.15.3. Conductor shall be in conduit with listed bushings when leaving the raceway.
- 4.11.16. Grounding bar conductors shall not contain splices.

5. Lightning Protection:

5.1. For UIHC:

- 5.1.1. Lightning protection systems shall conform to NFPA 780 and UL 96A.
- 5.1.2. The system shall be installed by, or under the direct supervision of a firm actively engaged in the installation of UL approved Master Labeled Lightning Protection systems. The firm shall be listed by UL.

- 5.1.3. Any new structure shall have a lightning risk assessment done per NFPA 780.
- 5.1.4. For building additions, the lightning protection system shall be installed as determined by the lightning risk assessment.
- 5.1.5. Air terminals shall be ½-inch by 24-inches solid round, nickel-plated copper points to extend to at least 10-inches above the roof or parapet with heavy duty bronze cases.
- 5.1.6. Ground terminals shall be copper clad steel or copper ground rods, ¾-inch in diameter driven vertically into the earth to a depth of at least 10-feet.
 - 5.1.6.1. The ground rods shall be connected to the conductor by heavy duty, 2-bolt bronze clamps.
- 5.1.7. Roof and down conductors shall be stranded copper cable with twenty-eight (28) strands of 14-gauge wire and weigh at least 375 pounds per 1,000 feet.
- 5.1.8. Down conductors shall be completely concealed and protected with PVC conduit.
- 5.1.9. One (1) down lead shall be interconnected to the water pipe system.
- 5.1.10. All down conductors shall be directly connected to the ground rods.
- 5.1.11. Conductors shall be interconnected to provide at least two (2) electric paths to ground.
- 5.1.12. Upward direction for lateral conductors interconnecting air terminals shall be avoided.
- 5.1.13. Conductor bends shall have a radius of at least 8-inches at an angle not less than 90-degrees.
- 5.1.14. Bond metal components of the building into the lightning protection system.
- 5.1.15. Structural steel shall be grounded with 25- feet of #2/0 bare copper conductor 2-inches below the bottom of each column footing pad.
 - 5.1.15.1. Systems shall be tested so there are no loose connections.

6. Medium-Voltage (601 Volts – 69k Volts) Electrical Distribution:

6.1. General:

- 6.1.1. Medium voltage switchgear, transformers, metering, and cabling by Owner.
- 6.1.2. For UI Housing:
 - 6.1.2.1. Provide minimum one (1) power meter for each major activity group building zone(s) listed below:
 - 6.1.2.1.1. Kitchen / server and dining zone
 - 6.1.2.1.2. Sleeping Floors zone

6.2. Raceways:

- 6.2.1. Constructor shall furnish a minimum 1-inch rigid metal raceway from primary building electric meters to the utility network cabinet.
- 6.2.2. Refer to UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL in Appendices.
- 6.3. Cabling:
 - 6.3.1. All wire and cable for power, lighting, control, and signal circuits shall have copper conductors and shall be insulated to 600 volts.
 - 6.3.2. Conductor sizes #12 AWG and smaller shall be solid; conductor sizes #10 AWG and larger shall be stranded.
 - 6.3.3. All standard building wiring shall be THWN/THHN.
 - 6.3.4. Aluminum conductors are not allowed.
 - 6.3.5. In-line splices and taps for conductor sizes #8 AWG and smaller, shall use vinyl insulated spring connectors.
 - 6.3.6. Connectors for conductors, sizes #6 and larger, shall be compression lug types.
 - 6.3.7. Conductor identification-all circuits originating from 20-amp circuit breakers shall have the grounded conductor identified by a colored tracer of the same color as the ungrounded conductor.
 - 6.3.8. Color code conductors as follows:
 - 6.3.8.1. 120/208V, 3PH, 4W: Phase A – Black; Phase B – Red; Phase C – Blue; Neutral – White; Ground – Green.
 - 6.3.8.2. 277/480V, 3PH, 4W: Phase A – Brown; Phase B – Orange; Phase C – Yellow; Neutral – Grey; Ground – Green.
 - 6.3.8.3. Grounded conductors require colored tracer that is the same color as the phase conductor.
 - 6.3.9. For UIHC:**
 - 6.3.9.1. Minimum size wiring for power applications shall be #12 unless the distance is greater than 100-feet, then it shall be #10 Stranded, or larger to compensate for voltage drop.
 - 6.3.9.2. 120/208-volt normal, 120/208-volt emergency, 277/480-volt normal, 277/480-volt emergency, communications, and Fire Alarm wiring shall not occupy the same raceway, junction box or pull box.
 - 6.3.9.3. For high harmonic branch circuits such as those serving lighting and electronic equipment, provide a shared #10 neutral conductor for three phase conductors.
 - 6.3.9.4. For sensitive electronic and diagnostic equipment, provide a separate #12 neutral conductor for each phase conductor.

- 6.3.9.5. For branch circuit panels serving high harmonic loads, provide double-sized neutral conductor.
- 6.3.9.6. Type AC (armored cable) and type MC (metal clad cable) shall not be specified.
- 6.3.9.7. All cable for major feeders shall be continuous from origin to termination.
 - 6.3.9.7.1. Splices in branch circuit wires shall be made only in accessible junction boxes.
 - 6.3.9.7.2. Keep conductor splices to a minimum.
- 6.3.9.8. All power feeder cable shall be pulled with the use of approved pulling compound or powder.
 - 6.3.9.8.1. Pull all conductors into raceway at the same time.
- 6.3.9.9. Neatly arrange, label, and tie-wrap all wiring inside all cabinets, panelboards, boxes, and other enclosures.

7. Low-Voltage Electrical Distribution:

7.1. Equipment:

7.1.1. Design:

- 7.1.1.1. Load centers shall be used only when a few circuits are required for a specific purpose, such as the dedicated panel in an elevator machine room.
- 7.1.1.2. Service entrance switchboards, panelboards or switchgear shall have a main circuit breaker. [Where cross ties are installed use main tie; tie main configuration.](#)
- 7.1.1.3. Phase, neutral and ground buss shall be copper.
- 7.1.1.4. The phase arrangement on 3-phase buss shall be A-B-C from left to right, top to bottom, front to back as viewed from the front of the switchboard.
- 7.1.1.5. Provide a minimum twenty percent (20%) spare, usable space in new switchboards, panelboards, and motor control centers.
- 7.1.1.6. In existing buildings, new switchboards, panelboards, motor control centers, enclosed switches, circuit breakers and VFD shall match existing. [If already mixed, confirm with owner before matching existing.](#)
- 7.1.1.7. Provide nominal 3 ½-inch high housekeeping pads for floor mounted equipment. Pads shall extend 4 inches beyond the equipment. [Pad edges shall be painted yellow.](#)
- 7.1.1.8. Exterior and interior surfaces of electrical equipment enclosures shall be wiped or cleaned with a vacuum immediately prior to final acceptance.

7.1.1.9. Scratches on painted surfaces shall be touched up with equipment manufacturer's standard paint of matching color.

7.1.1.10. Provide five (5) spare ¾-inch conduit stubs from flush panels into suspended ceiling space or other accessible space.

7.1.1.11. Provide each panel with a clear, plastic covered, typed circuit schedule.

7.1.1.11.1. The schedule shall identify circuits by room number and location in room using final room numbers provided by the Owner. Please no duplicate circuits.

~~7.1.1.11.1.~~ 7.1.1.11.2. Provide an electronic copy of the schedule within the O&M manual.

7.1.1.12. Provide branch circuit electrical panels in General Education Buildings with Best 5E Series ¾-inch Utility Cylinder. Key to MK EB and EB1.

7.1.1.13. **For UIHC:**

7.1.1.13.1. Switchboards, motor control centers, automatic transfer switches and transformers shall be installed on concrete pads minimum 3 ½-inches high with the outside and the top 3 ½-inches of edges painted safety yellow

7.1.1.13.2. Provide nameplates for all distribution equipment.

7.1.1.13.2.1. Refer to UIHC ELECTRICAL EQUIPMENT LABELING IN Appendices.

7.1.1.13.3. Disconnect switches used with motor-driven appliances, and motors and controllers shall be installed within sight of controller position.

7.1.1.13.4. Where installed on the load side of a VFD, the disconnect switch shall be labeled stating the location of the VFD, and it shall contain a normally open interlock which is connected to the VFD.

7.1.1.13.4.1. This interlock wiring must be in a separate raceway.

7.1.1.13.4.2. The interlock engages before the phase conductors are disconnected and the VFD knows to shut down before the motor is disconnected from it.

7.1.1.13.5. Transformers shall be installed on vibration mounts and connected with liquid-tight flexible conduit (24-inch minimum length).

7.1.1.13.5.1. No ceiling hung transformers are allowed.

7.1.1.13.6. Provide grounding connections to assure permanent and effective ground for transformers.

7.1.1.13.7. Perform voltage drop calculations on all feeders.

7.1.1.13.7.1. Increase conductor sizes where necessary.

7.1.1.13.8. Perform short circuit calculations on the new or upgraded portions of the electrical distribution system.

7.1.2. Transient Voltage Surge Suppression:

7.1.2.1. Locate suppression equipment in the enclosure of the equipment being served.

7.1.2.2. Provide a disconnecting means to isolate the suppression equipment.

7.1.2.3. For UI Housing:

7.1.2.3.1. Provide minimum TVSS equipment at main switchboard(s), motor control centers, distribution panelboards that feed lighting and appliance panelboards and 480/277 3 phase panels.

7.1.3. Switchboards:

7.1.3.1. Provide continuous ground bus the full length of the switchboard.

7.1.3.2. All switchboards shall have separate neutral and grounding busses.

7.1.3.3. Covers to consist of full-length hinge, door within a door.

7.1.3.4. Approved manufacturers include Square D, General Electric and Cutler-Hammer.

7.1.3.5. **For UIHC:**

7.1.3.5.1. Switchboards shall be factory assembled, dead-front, metal enclosed with copper bussing and copper ground bar.

7.1.3.5.2. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the switchboard.

7.1.3.5.3. Utilize Square D Power Logic to match the existing monitoring system.

7.1.3.5.4. Switchboards shall be listed for service entrance where applicable.

7.1.3.5.5. The basis of design shall be Square D I-Line Series and shall have main breakers.

7.1.4. Panelboards:

7.1.4.1. Provide continuous ground bus the full length of the panelboard.

7.1.4.2. All panelboards shall have separate neutral and grounding busses

7.1.4.3. Circuit breakers on branch circuit panelboards shall be bolt-on type.

7.1.4.4. Approved manufacturers include Square D I-Line, GE Spectra Series, and Cutler-Hammer.

7.1.4.5. **For UIHC:**

- 7.1.4.5.1. Distribution panelboards shall be factory assembled, dead-front, metal enclosed with copper bussing and copper ground bar.
 - 7.1.4.5.1.1. Provisions for additional circuit breakers shall be such that field addition to connectors or mounting hardware will not be required to add circuit breakers to the panelboards.
 - 7.1.4.5.1.2. Fronts shall include hinged doors and have flush, stainless steel, cylinder tumbler-type locks with catches and spring- loaded door pulls and shall have main breakers.
 - 7.1.4.5.1.3. The basis of design shall be Square D I-Line Series.
- 7.1.4.5.2. Isolated Power Panels shall be provided In-patient care areas determined by the Owner to be “wet locations” during times when patients are present.
 - 7.1.4.5.2.1. Inside the room a line isolation monitor (LIM) shall be provided [with remote annunciator panel](#).
 - 7.1.4.5.2.2. These panels supply uninterrupted power in the event of a line-to-ground fault, while eliminating the danger of electrical shock.
 - 7.1.4.5.2.3. All panels shall have a main breaker.
 - 7.1.4.5.2.4. The basis of design shall be Square D.
- 7.1.4.5.3. Lighting and Appliance panelboards shall be factory assembled, dead-front, metal enclosed with copper bussing and copper ground bar.
 - 7.1.4.5.3.1. Provisions for additional circuit breakers shall be such that field addition to connectors or mounting hardware will not be required to add circuit breakers to the panelboards.
 - 7.1.4.5.3.2. Fronts shall include hinged doors and have flush, stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls.
 - 7.1.4.5.3.3. All panelboard locks shall be keyed alike.
 - 7.1.4.5.3.4. A circuitry directory frame and card with a clear plastic covering shall be provided on the inside of the door [and an electronic copy should be provided as well.-](#)
 - 7.1.4.5.3.5. All multi-section panels shall be the same dimensions.
 - 7.1.4.5.3.6. Provide panelboards with two hundred percent (200%) rated neutral and two hundred percent (200%) rated neutral conductor where they serve high harmonic loads such as computer rooms.
 - 7.1.4.5.3.7. Load centers are not allowed.

7.1.4.5.3.8. The basis of design shall be Square D I-Line Series (277/480 volt) and Square D NQOD Series (120/208 volt), door on door covers, and shall have main breakers along with snap on main breakers.

~~7.1.4.5.3.9.~~ All circuits serving fire alarm devices shall have a red handle and circuit breaker label and lock.

~~7.1.4.5.3.10.~~ 7.1.4.5.3.9. EClips ELOCK-FA or Owner approved equal.

7.1.5. Motor Control Center:

7.1.5.1. Starters shall have fusible disconnects rather than circuit breakers.

7.1.5.2. Control circuit voltage shall be 120-volts or less.

7.1.5.3. Provide a minimum of two (2) additional auxiliary contacts (1 N.O. and 1 N.C.) in magnetic starters.

7.1.5.4. Design each motor control center section so starter units may be rearranged, removed, or added.

7.1.5.5. Approved manufacturers include Square D, General Electric and Cutler-Hammer.

7.1.5.6. **For UIHC:**

~~7.1.5.6.1. Motor control centers not preferred. shall be dead front multi-unit type, consisting of an assembly of vertical stacks with each stack containing cubicles to provide equipment, including space.~~

~~7.1.5.6.2. Horizontal copper 600 amp minimum bussing across top and 300 amp minimum vertical copper bussing down each stack.~~

~~7.1.5.6.3. Include copper ground bus entire length.~~

~~7.1.5.6.4. Vertical sections designed so matching sections can be added later.~~

~~7.1.5.6.5. Motor Starters:~~

~~7.1.5.6.5.1. Two speed motor starters shall not be used.~~

~~7.1.5.6.5.2. Utilize standard motor with VFD.~~

~~7.1.5.6.5.3. Operating handle for fusible disconnect switch mechanism shall indicate and control switch position with enclosure door open or closed; capable of being locked in the off position and mechanically interlocked to prevent opening unless switch within the enclosure is open.~~

~~7.1.5.6.5.4. Magnetic Starters:~~

~~7.1.5.6.5.4.1. Starters shall have thermal overload relays sized per manufacturer's recommendations for protection of the motor;~~

~~7.1.5.6.5.4.2. Electrical interlocks, as required for the control sequences, control transformer within each enclosure where required to provide control voltage, manual reset, off auto-selector switch, and pilot lights (green for stopped and red for running).~~

~~7.1.5.6.5.4.3. The BAS usually controls HVAC motors.~~

~~7.1.5.6.5.5. Combination Starters:~~

~~7.1.5.6.5.5.1. Starter shall have same features as magnetic starters.~~

~~7.1.5.6.5.6. AC Fractional Horsepower Manual Starters:~~

~~7.1.5.6.5.6.1. Starters shall have thermal overload relay of the melting alloy type for protection of 120 VAC motors of ½ Horsepower and less, quick make quick break trip free toggle mechanisms, pilot light, and toggle operated handle with handle lock-off.~~

~~7.1.5.6.5.7. Solid State Reduced Voltage Starters:~~

~~7.1.5.6.5.7.1. Starters shall utilize silicon-controlled rectifiers (SCRs).~~

~~7.1.5.6.5.7.2. Each starter shall have a circuit breaker, closed-loop feedback system to maintain motor acceleration at constant rate, and shorting contactor to bypass SCRs at one hundred percent (100%) output.~~

7.1.6. Breakers, Fuses and Safety Switches:

7.1.6.1. Renewable fuses shall not be used.

7.1.6.2. Equipment shall be specified with fuse holders that accept fuses dimensionally the same as Class H fuses.

7.1.6.3. Safety switches intended for use on circuits where current limiting fuses are required shall be specified with rejection clips designed to permit installation of Class R fuses only.

7.1.6.4. Locate equipment disconnects adjacent to equipment served. If not feasible, locate per NEC.

7.1.6.5. Tandem branch circuit breakers shall not be used.

7.1.6.6. Each project shall supply one (1) set of three (3) spare fuses for each type and size fuse installed.

7.1.6.7. Provide spare fuse storage cabinet of metal Construction.

- 7.1.6.7.1. Cabinet shall be labeled and mounted as directed by Owner.
- 7.1.6.8. Safety switches shall be heavy duty.
- 7.1.6.9. Safety switches in mechanical rooms shall have minimum NEMA 3R enclosures.
- 7.1.6.10. All safety switches shall have a grounding bar.
- 7.1.6.11. Approved manufacturers include Square D, General Electric and Cutler-Hammer.
- 7.1.6.12. **For UIHC:**

- 7.1.6.12.1. Main Feeders and Branch Circuit Equipment Feeders:

- 7.1.6.12.1.1. For switch rating over 600 amps, use Hi-Cap, Type KRPO-C with interrupting rating of 200,000 amps RMS.
- 7.1.6.12.1.2. For switch rating of 600 amps or less, use Low peak current limiting fuses, Type LPN(S)-R, with interrupting rating of 200,000 amps RMS.

- 7.1.6.12.2. Motors Above 1-Horsepower:

- 7.1.6.12.2.1. For fuse rating 600 amps or less, dual element time delay, Type FRN(S)-R, with interrupting rating of 200,000 amps RMS.
- 7.1.6.12.2.2. Size fuses per Article 430 of the NEC.

- 7.1.6.12.3. Circuit Breakers:

- 7.1.6.12.3.1. Lighting and Appliance Panelboards:

- 7.1.6.12.3.1.1. Circuit breakers shall be plug-on type toggle action with quick-make, quick-break mechanism, with visi-trip.
- 7.1.6.12.3.1.2. Single pole 15- and 20-ampere circuit breakers shall be UL listed as switching breakers at 120/277-volt AC and carry the SWD marking.
- 7.1.6.12.3.1.3. Tandem or "piggyback" breakers providing two (2) circuits from one (1) pole space are prohibited.

- 7.1.6.12.3.2. Distribution Panelboards or Switchboards:

- 7.1.6.12.3.2.1. Circuit breakers shall have over center, trip-free toggle-type operating mechanisms with quick-make, quick-break action, and positive handle indication.
- 7.1.6.12.3.2.2. Unless specified as adjustable trip for selective coordination, each circuit breaker shall have a

permanent trip unit containing individual trip elements in each pole.

7.1.6.12.3.2.3. Operating handles shall assume a center position when tripped.

7.1.6.12.3.2.4. Breakers rated 250 amps and above shall be solid state type, and breakers rated below 250 amps shall be thermal- magnetic.

7.1.6.12.3.3. All circuit breakers shall be labeled with nameplates or as part of a typewritten panel directory.

7.1.6.12.3.3.1. Each panelboard directory shall be typewritten to identify the location, and load fed by each circuit.

7.1.6.12.3.3.2. Spare breakers and circuits to be left blank with circuit breaker in off position.

7.1.6.12.3.3.3. Spare breakers shall be labeled Spare in the directory.

7.1.6.12.3.3.4. Blanks shall be labeled Space in the directory.

7.1.6.12.3.3.5. Directories will be checked for accuracy. If errors are identified, contractor will be required to fix and recheck project for accuracy.

7.1.6.12.3.4. Breaker serving the fire alarm panel shall be identified with a red mark.

7.1.6.12.4. Disconnect Switches

7.1.6.12.4.1. All disconnect switches shall be heavy duty type and shall be fused.

7.1.6.12.4.2. Disconnect switches for fractional horsepower motors, ½-horsepower and smaller, and less than 125-volts shall be Bussman SSY type or Owner approved equal.

7.1.6.12.4.3. Disconnect switches installed indoors shall have NEMA 1 enclosures.

7.1.6.12.4.4. Disconnect switches installed outdoors or in wet locations shall have raintight NEMA 3R enclosures, however, NEMA 4X stainless steel type shall be considered for each project based on the environment

7.1.7. Variable Frequency Drive (VFD):

7.1.7.1. Provide analysis of VFD input current harmonics on the distribution system.

- 7.1.7.2. Authorized VFD manufacturers for installation are the following: ABB, Yaskawa, and Eaton.
- 7.1.7.3. VFD shall be properly sized per the individual connected load requirements.
- 7.1.7.4. All VFD's supplied shall be paired with a manufacturer compliant line reactor with a minimum impedance factor of 3%.
- 7.1.7.5. VFD's must have manufactures programmable control keypad device accessible from the exterior of the device.
- 7.1.7.6. Third-party interface cards are not allowed for communication integration with Building Automation System.
- 7.1.7.7. All VFD's shall be supplied with a component specific onsite manufacturer representative startup technician procedure to perform all internal parameter setups, inspection of installation wiring, and verification of performance required by the connected equipment.
- 7.1.7.8. Design note in specifications and schedules shall require all VFD pricing to be broken out by device to promote competitive pricing during the bid. VFD's shall not be bundled within other major electrical product like gear and panels.
- 7.1.7.9. Operating Ambient: 32°F to 40°F (0°C to 4.4°C) ~~0°C to 40°F~~.
- 7.1.7.10. Speed Limit: VFD size shall be selected for operation at or below 60Hz output speed. Operation above 60Hz output speeds shall be considered spare capacity.
- 7.1.7.11. Pulse Width Modulated (PWM) Variable Frequency Drives:
- 7.1.7.11.1. Converter shall be of a diode bridge design with a sine weighted PWM inverter section.
- 7.1.7.11.2. Main semi-conductors in the inverter section of controller shall be IGBT transistors capable of a carrier switching frequency of up to 8 kHz.
- 7.1.7.11.3. If derating of the inverter is necessary to run at 8 kHz, then the unit's derated currents must equal or exceed the motor full load currents listed in NEC Table 430-150.
- 7.1.7.11.4. All controllers supplied with semi-conductors capable of switching at less than 8,000 Hertz shall be supplied with a motor acoustic noise reduction filter.
- 7.1.7.11.5. Pulse width modulated (PWM) drives shall be supplied with drive input harmonic filter to reduce the total harmonic distortion to less than the IEEE519-1992 limits at the utility service entrance.
- 7.1.7.11.6. Drives that are located beyond the manufacturer's recommended maximum distance from the motor shall be provided with dV/dt (long lead) filters.

- 7.1.7.12. Motors controlled by VFDs shall have shaft grounding installed.
- 7.1.7.13. Bypass shall not be provided.
- 7.1.7.14. VFDs shall be mounted independently. Refer to Variable Frequency Drive Mounting Detail in Appendices.
- 7.1.7.15. Keypad (operator interface) will be mounted outside on the front of the enclosure)
- 7.1.7.16. Drive status will come from a current transformer (CT) not the VFD contacts.
- 7.1.7.17. Critical applications shall require a spare VFD as identified by the Owner.
- 7.1.7.18. A VFD shall not serve more than one (1) piece of equipment.
- 7.1.7.19. Provide startup services by a Factory-Certified Service Representative
- 7.1.7.20. Provide a minimum of four (4) hours of Owner training.
- 7.1.7.21. **For UIHC:**
 - 7.1.7.21.1. Approved Manufacturers are Toshiba and ABB. Must be ultra-low harmonic drives.
- 7.1.7.22. For UI Housing:
 - 7.1.7.22.1. All VFDs shall have bypass with safety and shall be controlled by 0-10 vdc. Devices.
- 7.1.7.23. Refer to *VARIABLE Frequency DRIVE MOUNTING DETAILS* in Appendices.

7.2. Devices:

- 7.2.1. Receptacles shall be provided on all floors of all stairwells and in all elevator lobbies.
- 7.2.2. Locate floor maintenance receptacles so that all areas are accessible with a 25-foot cord.
- 7.2.3. GFCI receptacles shall be used in lieu of GFCI breakers.
 - ~~7.2.3.~~7.2.3.1. GFCI ArcFault combination breakers in lieu of receptacles only in behavioral health patient areas.
- 7.2.4. Receptacles shall be provided at all entryways.
- 7.2.5. Receptacles and switches shall be heavy-duty, minimum specification grade, minimum 20-amp rating.
- 7.2.6. Receptacles and switches shall be side and back wiring type.
- 7.2.7. All wire connections shall be screw clamp or wire nut type.
- 7.2.8. Install switches at 48-inches above finished floor.

7.2.9. Install receptacles at 18-inches above finished floor.

7.2.10. Install 120-volt receptacles with the ground up.

7.2.11. Approved Manufacturers:

7.2.11.1. Switches shall be Hubbell, Leviton 1221, or Pass and Seymour

7.2.11.2. Receptacles shall be Hubbell 5362, Leviton 5362A, or Pass and Seymour.

7.2.12. Isolated Ground Duplex Receptacles shall be Hubbell, Leviton, or Pass and Seymour IG5362.

7.2.12.1. Plugmold shall be Wiremold V24GB306.

7.2.12.2. Plugmold Pigtail shall be Pass and Seymour S266-X 12/3 type SJOW cord.

7.2.13. For UIHC:

7.2.13.1. All switches and receptacles shall be Hospital-grade, with modular plug tail. Verify switch types with Owner in other areas for each project.

7.2.13.2. Color of Normal power switches and receptacles shall be white.

7.2.13.3. Color of Emergency power receptacles shall be red. UPS receptacles shall have blue bodies.

7.2.13.4. Wall switches shall be as follows:

7.2.13.4.1. Standard toggle light switches – 20-amp, 120-277 volt rated, all switches serving emergency circuits shall have "red" handles.

7.2.13.4.2. Wireless switching is not permitted.

7.2.13.5. Receptacles shall be as follows:

7.2.13.5.1. Duplex Receptacles:

7.2.13.5.1.1. Two (2) pole, three (3) wire grounding type, 20-amp, 125-volt rated, NEMA 5-20R configuration, iGFI receptacles shall be duplex receptacles with integral test and reset button.

~~7.2.13.5.1.2. All receptacles connected to emergency circuits shall have "red" bodies.~~

7.2.13.5.1.2. 120/208-volt receptacles shall be similar in construction to NEMA 5-20R except shall be simplex type [one (1) receptacle per mounting strap] and shall have NEMA configuration to match the plug.

7.2.13.5.1.3. Require the following for nurse station areas, waiting rooms, and at least one in each inpatient room: NEMA 5-20R Plug Tail Receptacle with USB Charger. 125-volt, 20-amp, hospital grade tamper resistant, 3 wire grounding

type with impact resistant thermoplastic face. USB charging rated 5VDC 2.1A with (1) Type-A port and (1) Type-C port. Mounted in a double gang backbox. Device shall be compatible with all major cell phone and device manufacturers.

7.2.13.6. Tamper resistant receptacles shall be installed in all Patient Rooms, Public Corridors/Lounge, Waiting Rooms, Common Areas, Exam Rooms, Nourishment Rooms, (if accessible to the public), Dining Areas, and Psych Units.

7.2.13.7. Housekeeping outlets shall be spaced 30-to-40-feet apart in all corridors.

7.2.13.7.1. Outlets shall be 110-volt duplex, {fed by two circuits,} with a 110-volt single labeled for Floor Machine on a separate 20-amp breaker, {for three circuits total}.

7.2.13.8. Circuits for outlets in main corridors to be alternated on at least three (3) different circuits, so that at least three (3) adjacent outlets are on different circuits.

7.2.13.9. Cover Plates:

7.2.13.9.1. Stainless steel, smooth metal, Type 302.

7.2.13.9.2. Plate types for different utilities (dimmers, switches, receptacles, voice/data, etc.) shall match.

7.2.13.9.3. All covers shall be etched with circuit and panel. Coordinate numbering with Owner.

7.2.13.9.4. Normal Power:

7.2.13.9.4.1. Stainless Steel wall plate (0.035-inch- (1-mm-) thick, satin-finished Type 302/304 Non-Magnetic stainless steel) with etched/engraved (Metal) or Hot Stamped (Thermoplastic) black lettering.

7.2.13.9.4.2. Text to be Arial/Kartika font (or approved similar) at 3/16- inch high and shall identify the panelboard and circuit number.

7.2.13.9.5. Emergency Power:

7.2.13.9.5.1. Stainless Steel wall plate (0.035-inch- (1-mm-) thick, satin-finished Type 302/304 Non-Magnetic stainless steel) with etched/engraved (Metal) or Hot Stamped (Thermoplastic) red lettering.

7.2.13.9.5.2. Text to be Arial/Kartika font (or approved similar) at 3/16-inch high and shall identify the panelboard and circuit number.

~~7.2.13.9.5.3. Approved manufacturers are: Marking Services Incorporated or Owner approved equal.~~

- 7.2.13.10. Outlets used during construction for negative air machines shall be on normal power, plugged into GFCI outlets.
- 7.2.13.11. In masonry walls, switches and receptacle heights shall be adjusted as required so outlets are at nearest mortar joint to specified height.
- 7.2.13.12. Dimmers shall be installed such that derating is not required.
 - 7.2.13.12.1. No fins shall be removed when dimmers are ganged together.
- 7.2.13.13. A separate neutral shall be installed for all circuits which supply lighting is controlled by dimmers.
- 7.2.13.14. Receptacles shall be installed so the ground prong is up.
- 7.2.13.15. Feeding of receptacles down stream of GFI receptacles for protection is not allowed.
- 7.2.13.16. GFI type receptacles shall be specified in damp or wet locations, near any source of water, above counter tops that have a sink, kitchens, restrooms, and other locations per NEC.
- 7.2.13.17. Test each receptacle device for proper polarity, grounding, and retention force per NFPA. Provide documentation of testing to the Owner.

7.3. Raceways, Boxes, and Supports:

7.3.1. General:

- 7.3.1.1. All systems shall be installed in conduit.
- 7.3.1.2. Flexible wiring systems shall not be used.
- 7.3.1.3. For Feeders, conduit shall be sized at least one (1) size above the NEC requirement of wire being installed or anticipated being installed, with minimum size of 1-inch.
- 7.3.1.4. A red plastic tracer tape shall be buried 18-inches above all underground cable or conduit installations.
- 7.3.1.5. PVC conduit for Blue Cap phones and parking gates shall be sized a minimum of 1-inch.
- 7.3.1.6. To reduce sound transmission, wall outlet boxes shall not be installed back-to-back in a partition stud space.
- 7.3.1.7. Maintain a 6-inch minimum from top of ceiling tile support grid to any raceway.
 - 7.3.1.7.1. Raceway and Boxes – OUTLINE SPECIFICATIONS AND DETAILS:
- 7.3.1.8. For Branch Circuits, the minimum conduit size shall be ¾-inch.
- 7.3.1.9. For flexible metal conduit, minimum size shall be ½-inch.
- 7.3.1.10. The use of flexible metal conduit shall be limited to recessed lighting fixtures. Maximum length shall be 6-feet.

7.3.1.11. **For UIHC:**

7.3.1.11.1. Flexible metal conduit cannot be used to daisy chain light fixtures.

7.3.1.12. Liquid-tight flexible metal conduit shall be used to connect rotating, vibrating or moveable equipment.

7.3.1.13. Conduit shall be supported from the building structure.

7.3.1.13.1. Attachment to other pipes, conduits, ductwork, etc., shall not be allowed.

7.3.1.14. At the points where conduit penetrates concrete that is in contact with soil, that conduit shall be Schedule-80 PVC bedded in sand.

7.3.1.15. If the PVC is a bend of greater than 45-degrees, the bend shall be completely encased in concrete.

7.3.1.16. All metallic fittings shall be compression-type rated for ground connection.

7.3.1.17. All fittings shall be galvanized steel or malleable iron.

7.3.1.18. EMT shall not be used outdoors, in wet locations, in floor crawl spaces, or within 5-feet of finished grade.

7.3.1.19. Empty conduits shall have nylon pull cords installed with temporary caps or plugs.

7.3.2. Non-Metallic Conduit or Boxes:

7.3.2.1. Shall be used only in wet locations.

7.3.2.2. May be used for underground electric circuits less than 600-volts which are:

7.3.2.2.1. Under paved areas and areas scheduled to be paved.

7.3.2.2.2. Next to permanent buildings, under formal planting beds and in extremely high areas that would be difficult to excavate due to regular heavy use.

7.3.2.2.3. Shall be Schedule-40 minimum weight and to be designed for electric application with all connection's solvent-welded.

7.3.2.2.4. Conduit 2-inches and smaller shall be a minimum of Schedule 80.

7.3.2.2.5. Schedule 80 PVC conduit shall be utilized anywhere non-metallic conduit emerges from concrete or where conduit may receive physical abuse.

7.3.2.3. Maintain a 6-inch minimum from top of ceiling tile support grid to any raceway.

7.3.2.4. Raceways, boxes, and their supports shall be compatible with the atmosphere of the area in which they are installed.

7.3.3. Hangers and Supports ([attached to structure, not other conduits, duct](#)):

7.3.3.1. Lead, fiber, wood, and powder actuated anchors are prohibited.

7.3.3.2. Bolted conduit clamps are prohibited less than 8-feet above finished floor in public areas.

7.3.4. Types of Conduit:

7.3.4.1. All rigid conduit shall be identified at each connector and coupling.

7.3.4.2. **For UIHC:**

7.3.4.2.1. Minimum size conduit for power, fire alarm, sound, control, and lighting conduits shall be ¾-inch.

7.3.4.2.2. Minimum size conduit for telecommunications systems, ~~including nurse call,~~ shall be 1-1/4 inch. Nurse Call conduit shall be 1-inch. Refer to Communications section, below.

7.3.4.2.3. Conduits for power feeders over 2-inches in size shall be galvanized rigid steel or intermediate metal conduit or EMT with Engineering Services' approval.

7.3.4.2.4. Conduits over 2-inches in size shall have a grounding bushing.

7.3.4.2.5. Conduit fill – Branch circuit fill shall be limited to a maximum of three (3) grounded, three (3) ungrounded and one (1) equipment grounding conductor.

7.3.4.2.6. All conduits shall be factory colored by Allied EZ-Pull, Republic, or Wheatland (EMT/Ridged) as follows:

7.3.4.2.6.1. Normal power – Blue

7.3.4.2.6.2. Critical power – Yellow

7.3.4.2.6.3. Life Safety power – Green

7.3.4.2.6.4. Equipment emergency power – Orange

7.3.4.2.6.5. Fire Alarm – Red

7.3.4.2.6.6. Communications – Black

7.3.4.2.6.7. ~~UPS~~Fire doors – Brown

7.3.4.2.6.8. Building Controls – White

7.3.4.2.6.9. Undesignated Emergency – Purple

~~7.3.4.2.6.10. Central UPS Power – shall follow designation of the panel (Normal=Blue, Critical=Yellow)~~

~~7.3.4.2.6.11.~~7.3.4.2.6.10. Conduit may be painted by the contractor if done off site (not on university property).

7.3.4.3. Electrical Metal Tubing (EMT):

- 7.3.4.3.1. Use for installations in stud walls, masonry walls, above suspended ceilings and where exposed.
- 7.3.4.3.2. Fittings shall be compression type, malleable iron or steel, water, and concrete type.
- 7.3.4.3.3. Set screw or indenter type fittings shall not be used.
- 7.3.4.4. Flexible Metal Conduit (FMC):
 - 7.3.4.4.1. Use for final connections from junction boxes to lighting fixtures in accessible ceiling, and for wiring within casework and millwork.
 - 7.3.4.4.2. Fittings shall be squeeze or screw type galvanized malleable iron or steel with nylon insulated throats.
 - 7.3.4.4.3. The maximum length shall be 6-feet.
 - ~~7.3.4.4.4. One (1) trade size larger than standard size if used for communications infrastructure.~~
- 7.3.4.5. Liquid-tight Flexible Metal Conduit (LFMC):
 - 7.3.4.5.1. Use for final connections to all motor operated equipment such as unit heaters, fans, air handling units, and pumps; and equipment located in wet areas.
 - 7.3.4.5.2. Fittings shall be galvanized malleable iron or steel, with watertight gaskets, "O" ring and retainer, and nylon insulated throats.
 - 7.3.4.5.3. The maximum length shall be 6-feet.
- 7.3.4.6. Galvanized Rigid Steel Conduit (GRS):
 - 7.3.4.6.1. Fittings shall be threaded, galvanized malleable iron or heavy steel, water and concrete tight.
- 7.3.4.7. Intermediate Metal Conduit (IMC):
 - 7.3.4.7.1. May be used where rigid conduit is specified.
 - 7.3.4.7.2. Shall not be used for conduit buried in earth fill.
 - 7.3.4.7.3. Fittings shall be threaded, galvanized malleable iron or heavy steel, water and concrete tight.
- 7.3.4.8. Rigid Aluminum Conduit:
 - 7.3.4.8.1. Fittings shall be threaded aluminum alloy type.
- 7.3.4.9. Rigid PVC Conduit (PVC):
 - 7.3.4.9.1. Heavy wall Schedule 40 PVC conduit, sunlight resistant and impact resistant.

- 7.3.4.10. All horizontal runs of branch circuit conduit shall be installed in ceiling plenum or within walls for short distances.
- 7.3.4.11. Conduit for convenience outlets, wall mounted fixtures and other wall outlets shall be routed overhead and dropped through wall to the outlet.
- 7.3.4.12. All circuits within a room must have an accessible "J" box within the room, above the ceiling. No J-boxes above hard ceilings unless access panel is present.-.
- 7.3.4.13. Branch circuit conduit shall not be installed in concrete floor slabs except where conditions will not permit the conduit to be installed overhead.
- 7.3.4.14. Major motor or panel feeders may be installed in concrete floor slabs.
- 7.3.4.15. Exposed conduit and conduit concealed in ceiling space shall be routed in lines parallel to building construction.
- 7.3.4.16. Do not install more than three (3) 90-degree ~~{or a total of 270-degrees}~~ bends (includes offsets or any other bend) between panelboards, enclosures, junction boxes, or pull boxes.
- 7.3.4.17. All junction or pull boxes shall be identified with the voltage, the source feed, and circuit within.
- 7.3.4.18. Support conduit raceway systems in accordance with requirements as set forth in the National Electric Code.
- 7.3.4.19. Conduit shall not be attached to ceiling support wires.
- 7.3.4.20. Compression fittings shall be used. Set screw connectors are prohibited.
- 7.3.4.21. EMT conduit shall be used for all branch circuit power, lighting, fire alarm, sound, nurse call, and control conduit.
- 7.3.4.22. GRS or IMC conduit shall be used in exterior above grade applications and below paving.
- 7.3.4.23. PVC conduit may be used below grade where there is no paving.
- 7.3.4.24. Aluminum conduit shall be used in all magnetic imaging facilities where non-ferrous material must be used. Do not use in other applications.

7.3.5. Cable Trays

7.3.5.1. For UIHC:

- 7.3.5.1.1. Cable trays shall not be used to distribute 120/208-volt or 277/480-volt feeders or branch circuit wiring.
- 7.3.5.1.2. Utilize cable tray for horizontal and backbone pathways serving communications cabling.

- 7.3.5.1.3. Only welded steel wire mesh basket type cable trays shall be specified for communications raceway.
- 7.3.5.1.4. Acceptable manufacturers are Cablofil, Flextray or Owner approved equal.
- 7.3.5.1.5. Standard size of cable tray shall be 12-inches wide by 4-inches diameter.
- 7.3.5.1.6. Edges of tray shall be made smooth.
- 7.3.5.1.7. Cable tray shall be used where there are large quantities of low voltage cabling, such as for sound systems or nurse call systems.
- 7.3.5.1.8. Cable tray shall be installed in the main corridors for distribution of telecommunications cabling, nurse call cabling, and sound system cabling.
- 7.3.5.1.9. Locate cable tray so there is adequate room above and to each side of it for access.
 - 7.3.5.1.9.1. Do not install cable tray more than 24-inches above an acoustical tile ceiling.
- 7.3.5.1.10. Cable tray shall have a minimum of 12-inches of headroom above the tray and 18- inches available on the side of the tray for access.
- 7.3.5.1.11. Stop cable tray at fire-rated walls and install conduit sleeves through wall.
- 7.3.5.1.12. Ground and bond the cable tray so it is electrically continuous.

7.3.6. Electrical Boxes:

7.3.6.1. **For UIHC:**

7.3.6.1.1. Pull Boxes:

7.3.6.1.1.1. Pull and junction boxes shall be fabricated of heavy gauge galvanized steel with screw or hinged covers and equipped with corrosion resistant screws and hardware.

7.3.6.1.1.2. Pull and junction boxes for outdoor installation shall be rain tight.

7.3.6.1.2. Extension Rings:

7.3.6.1.2.1. Extension rings shall not have knockouts removed.

7.3.6.1.2.2. Devices, fixture whips, or raceways shall not be connected to extension rings.

7.3.6.1.3. Outlet Boxes:

7.3.6.1.3.1. In Stud Walls:

7.3.6.1.3.1.1. For single or double outlet, use a 4-inch square by minimum 1 ½-inch or deeper/larger deep box.

7.3.6.1.3.1.2. Boxes to be provided with raised covers of depth as required for thickness of wall materials.

7.3.6.1.3.1.3. Back-to-back or through-wall type boxes shall not be used.

7.3.6.1.3.1.4. Boxes shall be staggered on opposite sides of sound and fire rated walls.

7.3.6.1.3.1.5. Multiple boxes in the same room shall be fed from a common box located in accessible area above the ceiling in the same room.

7.3.6.1.3.2. In Masonry and Poured Concrete Walls:

7.3.6.1.3.2.1. Use a 3 ¾-inch high by 2 ½-inch and/or 3 ½-inch deep masonry box.

7.3.6.1.3.3. Surface Mounted Wall Outlets:

7.3.6.1.3.3.1. Use 4-inch square by 1 ½-inch deep box with raised cover in rough areas.

7.3.6.1.3.3.2. Use wire mold box in finished areas.

7.3.6.1.3.4. Outlets installed outdoors or in wet locations:

7.3.6.1.3.4.1. Use cast weatherproof aluminum outlet boxes with cast aluminum "in use" covers.

7.3.6.1.4. Floor Boxes:

7.3.6.1.4.1. Provide cast iron waterproof, fully adjustable floor boxes, with thread-conduit entrance ends, and vertical adjusting rings, gaskets, floor plates and flush screw-on covers.

7.3.6.1.4.2. Floor boxes shall be provided with barrier to separate high and low potential voltages.

7.3.6.1.4.3. Floor boxes shall not be fed from conduit poured into the floor slab without written approval of the Owner.

7.3.6.1.5. Poke-through Assemblies:

7.3.6.1.5.1. Provide flush mounted, fire-rated, poke-through with separate high and low potential voltages.

7.3.6.1.5.2. Fire rating shall be accomplished with intumescent type material.

7.4. Wire and Cable:

7.4.1. No WAGO type wire connectors except inside the light fixture; Twist type connectors only.

~~7.4.1.~~7.4.2. Neutral conductors shall be a minimum of full size. Neutral conductor capacity shall be increased as necessary for harmonics.

~~7.4.2.~~7.4.3. Conductors and buss shall be copper. Aluminum conductors or buss shall not be used.

~~7.4.3. Normal, emergency, life safety, 120/208, and 277/480 shall not occupy the same raceways except where normal and emergency conductors of the same voltage are in G4000 wiremold.~~

7.4.4. Conductors carrying more than 150v to ground shall not be installed in conduits with conductors carrying less than 150v to ground.

7.4.5. Stranded #Number 10 AWG shall be used when length of wire serving floor maintenance receptacles exceeds 100 feet.

7.4.6. Provide dedicated neutral and ground for each isolated ground device.

7.4.7. The minimum wire size for lighting and power branch circuits is #12 AWG.

7.4.8. The minimum wire size for Class 1 control circuits is #14 AWG.

7.4.9. Any conductors installed in flexible conduit at terminal connections of rotating, vibrating or moveable equipment shall be of stranded wire.

7.4.10. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

208/120 VOLTS	PHASE	480/277 VOLTS
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	White or Gray <u>For UIHC:</u> Gray
Green	Ground	Green

7.5. Metering and Switchgear:

7.5.1. Metering:

- 7.5.1.1. Additional electric kilowatt-hour meters may be needed to properly account for other customer electric power usage.
- 7.5.1.2. Place a disconnect means ahead of meter.
- 7.5.1.3. Meter sockets/boxes for self-contained meter sites shall be provided by University's Utility Operator and shall be installed and wired by the Constructor.
 - 7.5.1.3.1. All cabling shall be clearly labeled.
 - 7.5.1.3.2. Meters shall be provided and installed by the Utility Operator.
 - 7.5.1.3.3. CTs and PTs shall be provided by the Utility Operator and installed by Constructor.
 - 7.5.1.3.4. CT and PT wiring to meters shall be by the Owner or Utility Operator.

7.5.2. Metering Raceways:

- 7.5.2.1. Constructor shall provide a 1-inch minimum raceway from utilities network cabinet to socket based electrical meters.
- 7.5.2.2. Rigid metal if outside, EMT acceptable if inside.
- 7.5.2.3. For multiple electric meters in one location, Constructor shall provide and install a 12-inch by-12 inch by 4-inch junction box.

- 7.5.2.3.1. Junction box shall have with backplane and be centrally located near electric meters.
- 7.5.2.3.2. Provide raceways to each meter from junction box and from junction box to utility network cabinet.
- 7.5.2.4. Refer to *UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL* in Appendices.
- 7.5.2.5. Wire and Cable for Metering:
 - 7.5.2.5.1. University's Utility Operator will provide, pull, and terminate all cabling.
- 7.5.3. Switchgear:
 - 7.5.3.1. Secondary utility disconnect switchgear shall be furnished and installed by Owner.
- 7.5.4. Low-Voltage Transformer:
 - 7.5.4.1. Step-down Dry-type Transformers:
 - 7.5.4.1.1. Transformers shall be factory-assembled, general-purpose, air-cooled, dry-type distribution transformers of sizes, characteristics, and rate capacities indicated.
 - 7.5.4.1.2. Primary windings shall have six (6) taps; two (2) at 2½% increments above full-rated voltage and four (4) at 2½% increments below full-rated voltage.
 - 7.5.4.1.3. Insulation shall be rated at 220-degrees.
 - 7.5.4.1.4. Temperature rise shall be rated at 80-degrees.
 - 7.5.4.1.5. Windings shall be aluminum.
 - 7.5.4.1.6. Transformers shall have fully enclosed sheet steel enclosures, NEMA 1 rated for standard interior installations.
 - 7.5.4.1.7. Provide NEMA 3R enclosure with weather shields for wet location installations.
 - 7.5.4.2. K-rated transformers for high harmonic load applications shall have an electrostatic shield, additional coil capacity and double size neutral terminals.
 - 7.5.4.3. No transformers greater than 75Kva shall be allowed without Owner approval.
- 7.5.5. Bus Duct:
 - 7.5.5.1. Bus duct shall be NEMA 3R AND low impedance, copper bus, with insulated ground bus and full size neutral (where a neutral is required).
 - 7.5.5.2. Joints shall be single bolt type with silver plated contact surface.
 - 7.5.5.3. Circuit breakers in new panelboards and switchboards shall not take up more than

7.5.5.4. Seventy-five percent (75%) of the available bus space (Twenty-five percent (25%) shall be for future use).

7.5.5.5. Utilize surface mounted panelboards or integrated power centers in dedicated electrical rooms.

7.5.5.5.1. Where flush branch circuit panels are used in finished spaces, stub five (5) ¼-inch and one (1) 1 ¼-inch empty conduit out of panel to above an accessible ceiling area.

7.5.5.6. Use K-rated transformers where they serve high harmonic loads such as computer rooms.

7.5.5.7. Utilize expansion fittings on bus ducts, conduits, and cable trays where they cross building expansion joints.

8. Emergency and Backup Power Systems:

8.1. Non-Life Safety Backup Power:

8.1.1. Non-life safety backup power shall be served by natural gas engine generators.

8.1.2. Diesel engine generators require an approved Deviation Request.

8.1.3. Packaged Generator Assemblies:

8.1.3.1. If a diesel engine generator is installed:

8.1.3.2. Fuel day tanks in generator rooms shall be 660-gallon maximum, provided with spill containment and leak detection.

8.1.3.3. All fuel piping shall exit the top of the tank.

8.1.3.4. Total on-site fuel storage shall provide for a minimum of eight (8)-hours of run time.

8.2. Load Shedding Generation:

8.2.1. If load shedding is desired, requirements shall be determined via discussion with the Owner.

8.3. Generator Environmental and Code Compliance:

8.3.1. Generators shall comply with New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and other applicable environmental regulations.

8.3.2. Refer to ENVIRONMENTAL COMPLIANCE for general air emissions compliance requirements.

8.3.3. Engine shall be certified to emission standards and certificate provided to the Owner.

8.3.4. NSPS requires installation of a non-resettable hour meter.

8.3.4.1. Review with Owner for monitoring and communications requirements.

8.3.5. The generator fuel system shall be arranged to automatically shut down upon a fire or detected leak.

8.3.6. For UIHC:

~~8.3.5-8.3.6.1.~~ 8.3.6.1. The generator fuel system shall NOT be arranged to automatically shut down upon a fire or detected leak.

~~8.3.6-8.3.7.~~ 8.3.7. For UI Housing:

~~8.3.6.1-8.3.7.1.~~ 8.3.7.1. Generators shall use natural gas fuel only.

~~8.3.6.2-8.3.7.2.~~ 8.3.7.2. Flues for generators shall extend up through the building to the highest roof level.

~~8.3.6.3-8.3.7.3.~~ 8.3.7.3. Generators are preferred to be located on the highest roof top level not visible for student rooms.

~~8.3.6.4-8.3.7.4.~~ 8.3.7.4. Generators shall not be located on mid-level roof tops visible from student rooms from above.

~~8.3.6.5-8.3.7.5.~~ 8.3.7.5. Generator(s) and flues shall be screened from view and noise and vibration shall be mitigated to not impact student sleeping floors.

~~8.3.6.6-8.3.7.6.~~ 8.3.7.6. Dining facility kitchen(s) shall have a minimum of six (6) power receptacles on an emergency power generator circuit. Coordinate locations with Owner.

~~8.3.6.7-8.3.7.7.~~ 8.3.7.7. Review with the Owner for generator air construction permit requirements.

~~8.3.6.8-8.3.7.8.~~ 8.3.7.8. Owner shall file permit and registration application and complete air dispersion modeling.

~~8.3.6.8.1-8.3.7.8.1.~~ 8.3.7.8.1. Engines having maximum capacity greater than or equal to 400 brake horsepower (bhp) require that an air construction permit is received prior to commencing construction of the unit.

~~8.3.6.8.2-8.3.7.8.2.~~ 8.3.7.8.2. Engines having maximum capacity less than 400 bhp require a registration with the Iowa Department of Natural Resources.

~~8.3.6.9-8.3.7.9.~~ 8.3.7.9. Generator sets shall be located to disperse exhaust fumes (vertical exhausts with flapper-style rain caps), vibration and noise without affecting the normal functions of the building and surrounding site.

~~8.3.6.10-8.3.7.10.~~ 8.3.7.10. Stack height requirements shall be determined by the Owner based on dispersion modeling to meet ambient air quality standards.

~~8.3.7-8.3.8.~~ 8.3.8. Refer to ENVIRONMENTAL COMPLIANCE for Spill Prevention Control and Countermeasures (SPCC) requirements.

~~8.3.7.1-8.3.8.1.~~ 8.3.8.1. SPCC requirements apply to gear boxes and fuel tanks.

~~8.3.8-8.3.9.~~ Dewatering wells, if required for flood mitigation, shall be on separate emergency generator and not tied into the building system generator.

8.4. Monitoring and Data Transmission:

8.4.1. UPS condition shall be monitored.

8.4.2. Generators shall be continuously monitored to provide, at a minimum:

8.4.2.1. Engine run hours

8.4.2.2. Engine power produced (kWh)

8.4.2.3. Engine fuel consumption

8.4.3. Engines shall be connected to the Utility Network or building automation system for purposes of collecting and sharing the monitoring data.

8.4.4. Review connection types with the Owner.

8.5. Transfer Switches:

8.5.1. ATs shall have loading shedding capability with ASCO relay 30B.

~~8.5.1-8.5.2.~~ Closed transition transfer switches shall be installed for all generators and fail to emergency power. ATS will fail to E-Power when failure to synchronize occurs.

~~8.5.2-8.5.3.~~ Provide a minimum of two (2) sets of auxiliary Form-C contacts for normal and emergency transfer switch positions.

8.6. UIHC Emergency Power:

8.6.1. Existing loading of the generator and each emergency branch shall be obtained and figured with the proposed new loads in sizing calculations.

8.6.2. Emergency power distribution branches shall be segregated into the Life Safety branch, the Critical branch, and the Equipment branch.

8.6.2.1. The Equipment branch may have separate transfer switches for automatic and non-automatic transfers.

8.6.2.1.1. Lighting equipment and devices shall be placed on the different branches according to NEC 517.

8.6.2.2. Life Safety Branch serves:

8.6.2.2.1. Exit lighting,

8.6.2.2.2. Emergency path of egress lighting,

8.6.2.2.3. Alarm systems,

8.6.2.2.4. Communications systems,

- 8.6.2.2.5. Select loads at the generator location, elevator cab and control equipment (not the motor), and automatic doors.
- 8.6.2.3. The Critical Branch serves:
 - 8.6.2.3.1. Task illumination, equipment, and power receptacles in critical care areas, patient care areas, and additional areas needed for effective hospital operation.
- 8.6.2.4. The Equipment branch (delayed automatic) serves:
 - 8.6.2.4.1. Equipment such as central suction systems, sump pumps, compress air systems, smoke control systems, and kitchen hood exhaust.
- 8.6.2.5. The Equipment Branch (delayed automatic or non-automatic) serves:
 - 8.6.2.5.1. Heating equipment for critical care or patient care areas, jockey pump, elevators, and HVAC in some critical care areas.
- 8.6.2.6. Refer to NEC 517 for complete list and discuss with the Owner any other items that need to be put on one of the emergency power branches.
- 8.6.3. Review requirements for department/area-specific transfer switches (served by a single generator) with Owner.
- 8.6.4. Sprinkler system fire pumps shall have their own transfer switch.
 - 8.6.4.1. The normal source shall come from the main electrical service panel and the main generator distribution switchboard with disconnecting means on both sources.
 - 8.6.4.2. Refer to NEC 695 and 700.
- 8.6.5. Each bank of elevators shall be served from a separate transfer switch and a separate elevator distribution panel.
 - 8.6.5.1. Upon a loss of power, the elevators shall return to the designated floor and stop.
 - 8.6.5.2. One (1) elevator shall remain operational for emergency use.
- 8.6.6. An emergency power generator shall feed a generator distribution switchboard.
 - 8.6.6.1. This switchboard is used to distribute power to the transfer switches for all the branches of emergency power, fire pumps, and remote generator radiator fans.
 - 8.6.6.2. Each branch of emergency power shall have a main distribution panel on the load side of the transfer switch for distribution to the separate emergency branch panels located on each floor with main tie tie main crosstie to another GDP.
- 8.6.7. No area of the facility shall be served by 100% normal power or 100% emergency power.
- 8.6.8. Emergency generators and the main distribution of emergency power shall be at 277/480-volt power on site or; EPGF is 13,8000 volt off site.- Once on site all distribution gear shall be 480/277.

8.6.8.1. This power shall be stepped down to 120/208-volt on each floor with local step-down transformers.

8.6.9. Any new generators shall have their generator distribution switchboard tied together with the two (2) nearest separate generator distribution switchboards.

8.6.10. Generator distribution switchboards shall have a main tie tie main configuration for redundant connection to other generator distribution switchboards.

8.6.10.1. Solid state metering and controls shall be provided in a separate metering section

8.6.11. Generators shall be diesel, EPGF 13,800 277/480-volt, 3-phase, four (4) wire, with a remote multi-fan radiator, critical silencer, engine control panel, and remote annunciator.

8.6.12. Automatic transfer switches shall be closed transition, bypass-isolation type, ASCO 7000-7A series.

8.6.12.1. Approved manufacturers shall be ASCO and RUSS Electric~~ASCO and Zenith~~.

8.6.13. Non-automatic transfer switches shall be open transition type, ASCO 7000-7N series.

8.6.13.1. Approved manufacturers shall be ASCO and RUSS Electric~~Zenith~~ and shall be equipped with PM 8000 meters.

8.6.14. Each branch of the emergency power system shall be installed in raceway separate from the other branches, normal power, and any other system wiring.

8.6.15. Generators and main emergency distribution equipment shall be installed in rooms separate from other equipment.

8.6.16. Testing shall include both factory and on-site testing. EMERGENCY AND BACKUP POWER SYSTEMS

8.7. Life Safety Backup Power:

8.7.1. Life safety backup power shall be by an Uninterruptible Power Supply (UPS). Generators require an approved Deviation Request.

8.7.2. Uninterruptible Power Supplies (UPS):

8.7.2.1. Provide cooling, ventilation, and maintenance access space in battery rooms and battery cabinets.

8.7.2.2. Provide containment systems in battery rooms.

8.7.3. For UIHC:

8.7.3.1. Life safety backup power shall not be by an Uninterruptible Power Supply (UPS). Generators require an approved Deviation Request.

~~8.7.2.2.~~

~~8.7.3.~~8.7.4. Packaged Generator Assemblies:

~~8.7.3.1~~-~~8.7.4.1~~. Provide startup services and training for Owner's personnel by a Factory-Certified Service Representative.

~~8.7.3.2~~-~~8.7.4.2~~. Submit a completed manufacturer's start-up checklist.

~~8.7.3.3~~-~~8.7.4.3~~. Fuel piping and venting from outside of the building for day tank filling shall be hard piped.

~~8.7.3.4~~-~~8.7.4.4~~. A high liquid level device shall be provided for day tank overflow protection.

~~8.7.3.5~~-~~8.7.4.5~~. Manufacturer shall have a service center within a 100-mile radius of The University of Iowa and have the ability to provide 24-hour service response time.

~~8.7.3.6~~-~~8.7.4.6~~. The engine's New Source Performance Standard (NSPS) compliance certificate shall be submitted to the Owner.

~~8.7.3.7~~-~~8.7.4.7~~. Diesel fuel for generators shall be limited to a maximum sulfur content of 15 ppm and a minimum cetane index of 40 or a maximum aromatic content of 35% by volume.

~~8.7.3.8~~-~~8.7.4.8~~. The engine-generator set shall be the product of a United States of American manufacturer, regularly engaged in the manufacture of generator plants

~~8.7.3.9~~-~~8.7.4.9~~. The set and controls shall be built and tested by the engine manufacturer precluding divided responsibility

~~8.7.3.10~~-~~8.7.4.10~~. The set shall be tested by the manufacturer of the set

~~8.7.3.11~~-~~8.7.4.11~~. Certified test reports of the complete assembly shall be available from the engine manufacturer showing the plant's power rating, voltage and frequency regulation, and other pertinent data.

~~8.7.3.12~~-~~8.7.4.12~~. The Continuously Rated for Standby Use output of the set shall mean the set's full continuous derated output for the following ambient conditions:

~~8.7.3.12.1~~-~~8.7.4.12.1~~. Altitude: 750-feet above sea level

~~8.7.3.12.2~~-~~8.7.4.12.2~~. Engine Room Temperature: 120° F

~~8.7.4~~-~~8.7.5~~. Diesel Engine:

~~8.7.4.1~~-~~8.7.5.1~~. Engine Features:

~~8.7.4.1.1~~-~~8.7.5.1.1~~. The diesel engine shall be:

~~8.7.4.1.1.1~~-~~8.7.5.1.1.1~~. Heavy duty,

~~8.7.4.1.1.2~~-~~8.7.5.1.1.2~~. Compression ignition,

~~8.7.4.1.1.3~~-~~8.7.5.1.1.3~~. Water cooled,

~~8.7.4.1.1.4~~-~~8.7.5.1.1.4~~. Multi-cylinder,

~~8.7.4.1.1.5~~-~~8.7.5.1.1.5~~. _____ 4-stroke,

~~8.7.4.1.1.6~~-~~8.7.5.1.1.6~~. _____ Designed for cold quick start,

~~8.7.4.1.1.7~~-~~8.7.5.1.1.7~~. _____ Capable of delivering full load output in not more than ten (10) seconds.

~~8.7.4.1.2~~-~~8.7.5.1.2~~. _____ Speed may be either 1200 rpm or 1800 rpm.

~~8.7.4.1.3~~-~~8.7.5.1.3~~. _____ The engine shall have replaceable cylinder liners of the wet sleeve type, and replaceable valve seat inserts.

~~8.7.4.1.4~~-~~8.7.5.1.4~~. _____ Exhaust manifolds shall be water cooled.

~~8.7.4.2~~-~~8.7.5.2~~. _____ Starting System:

~~8.7.4.2.1~~-~~8.7.5.2.1~~. _____ The engine starting shall be by means of 24-volt starting motors.

~~8.7.4.2.2~~-~~8.7.5.2.2~~. _____ Crank termination switch shall be provided.

~~8.7.4.2.3~~-~~8.7.5.2.3~~. _____ Batteries of sufficient capacity for five (5) 15-second consecutive crank periods shall be furnished.

~~8.7.4.2.3.1~~-~~8.7.5.2.3.1~~. _____ The battery voltage shall be 24-volt DC.

~~8.7.4.2.3.2~~-~~8.7.5.2.3.2~~. _____ Batteries shall be maintenance free, lead-acid type.

~~8.7.4.2.3.3~~-~~8.7.5.2.3.3~~. _____ Battery charger with sufficiently high charge rate shall be furnished.

~~8.7.4.2.3.4~~-~~8.7.5.2.3.4~~. _____ 115-volt AC power shall be available for the battery charger.

~~8.7.4.2.3.5~~-~~8.7.5.2.3.5~~. _____ A battery rack shall be furnished.

~~8.7.4.3~~-~~8.7.5.3~~. _____ Cooling System:

~~8.7.4.3.1~~-~~8.7.5.3.1~~. _____ The cooling system shall insure that the maximum cooling water temperature is safely within the normal working temperature range when the set is operating continuously at full load at maximum ambient temperature when the air intake temperature of the engine room may rise to 120° F.

~~8.7.4.3.2~~-~~8.7.5.3.2~~. _____ The engine outlet water temperature under such conditions shall not exceed 200° F.

~~8.7.4.3.3~~-~~8.7.5.3.3~~. _____ Cooling shall be provided by a remotely installed radiator unit of the vertical discharge style.

8.7.4.4-8.7.5.4. Lubrication System:

8.7.4.4.1-8.7.5.4.1. A pressure type lubricating system with gear type oil pump and a full flow filter shall be fitted to the engine.

8.7.4.5-8.7.5.5. Filters:

8.7.4.5.1-8.7.5.5.1. Fuel Oil Systems:

8.7.4.5.1.1-8.7.5.5.1.1. The system shall have a filter before the fuel injection pumps.

8.7.4.5.1.2-8.7.5.5.1.2. This filter shall be of ample capacity to prevent passage of all particles of 10-micron size or larger.

8.7.4.5.2-8.7.5.5.2. Lubricating Oil System:

8.7.4.5.2.1-8.7.5.5.2.1. System should have full flow filters of sufficient capacity.

8.7.4.6-8.7.5.6. Intake and Exhaust System:

8.7.4.6.1-8.7.5.6.1. Air is to be induced to the engine manifold through an air cleaner with dry-type elements.

8.7.4.6.2-8.7.5.6.2. The engine exhaust line shall be fitted with expansion bellows and a critical-type silencer to give efficient silencing with maximum tolerable back pressure.

8.7.4.6.3-8.7.5.6.3. The exhaust system shall be comprised of a side entry critical silencing muffler.

8.7.4.6.4-8.7.5.6.4. The length and configuration of the exhaust piping shall be determined based on the Air Dispersion Modeling.

8.7.4.7-8.7.5.7. Governing System:

8.7.4.7.1-8.7.5.7.1. The engine shall run steadily at any load within its rating at its rated speed, and the changes in speed at a steady load shall not exceed 0.5% when all transients have decayed.

8.7.4.7.2-8.7.5.7.2. The maximum speed variation upon applying a fifty percent (50%), 0.8 power factor load change shall not exceed five percent (5%).

8.7.4.7.3-8.7.5.7.3. The governor shall have provisions for adjustment of speed.

8.7.4.7.4-8.7.5.7.4. The governor actuator shall be of the electronic type, as manufactured by Woodward or Barber Colman, used as the governor speed control mechanism.

8.7.4.8-8.7.5.8. Fuel Transfer Pump:

~~8.7.4.8.1-8.7.5.8.1.~~ For fuel oil transfer from the day tank, an automatically controlled electric driven fuel transfer pump shall be supplied on the set.

~~8.7.4.8.2-8.7.5.8.2.~~ A suitable hand operated transfer pump shall be supplied and installed as a standby to the automatic pump, shall be complete with piping.

~~8.7.4.9-8.7.5.9.~~ Safety Switches:

~~8.7.4.9.1-8.7.5.9.1.~~ The engine shall be equipped with automatic safety switches to stop the engine in the following cases:

~~8.7.4.9.1.1-8.7.5.9.1.1.~~ Water temperature exceeds a preset safe working limit.

~~8.7.4.9.1.2-8.7.5.9.1.2.~~ Lubricating oil pressure lower than a preset safe working limit.

~~8.7.4.9.1.3-8.7.5.9.1.3.~~ Speeds exceeding one hundred ten percent (110%).

~~8.7.4.9.1.4-8.7.5.9.1.4.~~ Over cranking.

~~8.7.4.10-8.7.5.10.~~ Engine Instrument Panel:

~~8.7.4.10.1-8.7.5.10.1.~~ Furnish an engine-mounted instrument panel that includes:

~~8.7.4.10.1.1-8.7.5.10.1.1.~~ water temperature gauge,

~~8.7.4.10.1.2-8.7.5.10.1.2.~~ oil pressure gauge,

~~8.7.4.10.1.3-8.7.5.10.1.3.~~ fuel pressure gauge,

~~8.7.4.10.1.4-8.7.5.10.1.4.~~ oil temperature gauge.

~~8.7.4.11-8.7.5.11.~~ Engine-Generator Monitoring System:

~~8.7.4.11.1-8.7.5.11.1.~~ An engine-generator monitoring system shall be provided complete with sensors to monitor the following:

~~8.7.4.11.1.1-8.7.5.11.1.1.~~ Low engine temperature.

~~8.7.4.11.1.2-8.7.5.11.1.2.~~ High water temperature.

~~8.7.4.11.1.3-8.7.5.11.1.3.~~ Low oil pressure.

~~8.7.4.11.1.4-8.7.5.11.1.4.~~ High oil temperature.

~~8.7.4.11.1.5~~-~~8.7.5.11.1.5~~. Over crank.

~~8.7.4.11.1.6~~-~~8.7.5.11.1.6~~. Overspeed.

~~8.7.4.11.1.7~~-~~8.7.5.11.1.7~~. Low battery voltage.

~~8.7.4.11.1.8~~-~~8.7.5.11.1.8~~. High battery voltage.

~~8.7.4.11.1.9~~-~~8.7.5.11.1.9~~. Low fuel supply.

~~8.7.4.12~~-~~8.7.5.12~~. Sub-Base:

~~8.7.4.12.1~~-~~8.7.5.12.1~~. The engine generator unit shall be mounted on a full sub-base fabricated of structural steel with heavy cross members suitable for lifting.

~~8.7.4.12.2~~-~~8.7.5.12.2~~. Supply spring type vibration isolators of the type and quality recommended by the manufacturer

~~8.7.4.12.3~~-~~8.7.5.12.3~~. Mounting holes for the isolators shall be located in the sub-base by the engine manufacturer to insure equal distribution of weight on the isolators.

~~8.7.4.12.4~~-~~8.7.5.12.4~~. Maximum vibration transmission not to exceed six percent (6%).

~~8.7.4.12.5~~-~~8.7.5.12.5~~. All service connections, fuel, water, electric, etc. to the engine shall be through flexible connection devices.

~~8.7.4.13~~-~~8.7.5.13~~. 8.7.4.13.1-8.7.5.13.1 Alternator and Exciter:

~~8.7.4.13.1~~-~~8.7.5.13.1~~. 8.7.4.13.1-8.7.5.13.1 The alternator shall maintain continuously its specified fully derated output at 0.8 power factor under the worst conditions stated in these specifications without exceeding 130° C temperature rise over listed engine room maximum ambient temperature.

~~8.7.4.13.2~~-~~8.7.5.13.2~~. 8.7.4.13.2-8.7.5.13.2 The windings of the alternator and exciter shall be insulated with Class F insulation suited for high humidity environment.

~~8.7.4.13.3~~-~~8.7.5.13.3~~. 8.7.4.13.3-8.7.5.13.3 The exciter shall be brushless direct connected type with shaft mounted diodes and built-in permanent magnets eliminating field flashing.

~~8.7.4.13.4~~-~~8.7.5.13.4~~. 8.7.4.13.4-8.7.5.13.4 The alternator shall be a multi-pole revolving field type with rotating brushless exciter and solid-state regulator.

~~8.7.4.13.5~~-~~8.7.5.13.5~~. 8.7.4.13.5-8.7.5.13.5 The number of poles shall be compatible with 1200 or 1800 rpm to provide a 60 Hertz output.

~~8.7.4.13.6~~-~~8.7.5.13.6~~. 8.7.4.13.6-8.7.5.13.6 The alternator shall be directly connected to the engine flywheel housing and driven by means of a multiple disc coupling from the flywheel.

~~8.7.4.13.7~~-~~8.7.5.13.7~~. 8.7.4.13.7-8.7.5.13.7 Voltage regulator shall be SCR static type with voltage adjustment rheostat and automatic sub synchronous speed protection.

~~8.7.4.13.8~~-~~8.7.5.13.8~~. 8.7.4.13.8-8.7.5.13.8 Voltage regulation shall be within $\pm 1\%$ of rated voltage, from no load to full load.

~~8.7.4.13.9~~-~~8.7.5.13.9~~. 8.7.4.13.9-8.7.5.13.9 The transient voltage dip shall not be greater than twenty-five percent (25%) of rated voltage when full load at rated power factor is applied to the alternator.

~~8.7.4.14~~-~~8.7.5.14~~. 8.7.4.14.1-8.7.5.14.1 Battery Charger:

~~8.7.4.14.1~~-~~8.7.5.14.1~~. 8.7.4.14.1-8.7.5.14.1 A battery charger shall be furnished.

~~8.7.4.14.2~~-~~8.7.5.14.2~~. 8.7.4.14.2-8.7.5.14.2 The charger shall employ a transistor controlled magnetic amplifier circuit to provide continuous taper charging and shall maintain rated output voltage with an A.C. line fluctuation of $\pm 10\%$.

~~8.7.4.14.3~~-~~8.7.5.14.3~~. 8.7.4.14.3-8.7.5.14.3 The charger shall have:

~~8.7.4.14.3.1~~-~~8.7.5.14.3.1~~. 8.7.4.14.3.1-8.7.5.14.3.1 2 ranges – Float at 2.17 V.P.C. and equalize at 2.33 V.P.C.

~~8.7.4.14.3.2~~-~~8.7.5.14.3.2~~. 8.7.4.14.3.2-8.7.5.14.3.2 Automatic A.C. line compensation.

~~8.7.4.14.3.3~~-~~8.7.5.14.3.3~~. 8.7.4.14.3.3-8.7.5.14.3.3 Automatic overload protection.

~~8.7.4.14.3.4~~-~~8.7.5.14.3.4~~. 8.7.4.14.3.4-8.7.5.14.3.4 Silicone diode full-wave rectifier.

~~8.7.4.14.3.5~~-~~8.7.5.14.3.5~~. Automatic surge suppressors.

~~8.7.4.14.3.6~~-~~8.7.5.14.3.6~~. D.C. ammeter and voltmeter.

~~8.7.4.14.3.7~~-~~8.7.5.14.3.7~~. Fused A.C. input and D.C. output.

~~8.7.4.14.3.8~~-~~8.7.5.14.3.8~~. Low D.C. voltage alarm relay.

~~8.7.4.14.3.9~~-~~8.7.5.14.3.9~~. High D.C. voltage alarm relay

~~8.7.4.15~~-~~8.7.5.15~~. Control Panel and Switchgear:

~~8.7.4.15.1~~-~~8.7.5.15.1~~. A free-standing control panel shall be furnished.

~~8.7.4.15.2~~-~~8.7.5.15.2~~. Control panel shall include (not necessarily limited to) the following:

~~8.7.4.15.2.1~~-~~8.7.5.15.2.1~~. Metering:

~~8.7.4.15.2.1.1~~-~~8.7.5.15.2.1.1~~. Ammeter – two percent (2%) of full-scale accuracy.

~~8.7.4.15.2.1.2~~-~~8.7.5.15.2.1.2~~. Ammeter Selector Switch, 4-position, to measure current flow in all phases.

~~8.7.4.15.2.1.3~~-~~8.7.5.15.2.1.3~~. Voltmeter – two percent (2%) of full-scale accuracy.

~~8.7.4.15.2.1.4~~-~~8.7.5.15.2.1.4~~. Voltmeter Selector Switch to measure all phase voltages.

~~8.7.4.15.2.1.5~~-~~8.7.5.15.2.1.5~~. KW and KWH Meters.

~~8.7.4.15.2.1.6~~-~~8.7.5.15.2.1.6~~. Frequency Dial.

~~8.7.4.15.2.1.7~~-~~8.7.5.15.2.1.7~~. Running Time Meter.

~~8.7.4.15.2.2~~-~~8.7.5.15.2.2~~. Control:

~~8.7.4.15.2.2.1~~-~~8.7.5.15.2.2.1~~. Start-Stop control.

~~8.7.4.15.2.2.2~~-~~8.7.5.15.2.2.2~~. 3-position switch (Off-Auto-Test).

~~8.7.4.15.2.2.3~~-~~8.7.5.15.2.2.3~~. Engine cool down timer.

~~8.7.4.15.2.2.4~~-~~8.7.5.15.2.2.4~~. Over crank timer.

~~8.7.4.15.2.2.5~~-~~8.7.5.15.2.2.5~~. Immediate Engine Safety Shut Down
Lights and Relays for:

~~8.7.4.15.2.2.5.1~~-~~8.7.5.15.2.2.5.1~~. _____ Over crank.

~~8.7.4.15.2.2.5.2~~-~~8.7.5.15.2.2.5.2~~. _____ Overspeed.

~~8.7.4.15.2.2.5.3~~-~~8.7.5.15.2.2.5.3~~. _____ Low Oil
Pressure.

~~8.7.4.15.2.2.5.4~~-~~8.7.5.15.2.2.5.4~~. _____ High Engine
Temperature.

~~8.7.4.15.2.2.6~~-~~8.7.5.15.2.2.6~~. Pre-alarm Warning Lights and Relays for:

~~8.7.4.15.2.2.6.1~~-~~8.7.5.15.2.2.6.1~~. _____ Low Oil
Pressure.

~~8.7.4.15.2.2.6.2~~-~~8.7.5.15.2.2.6.2~~. _____ High Engine
Temperature.

~~8.7.4.15.2.2.6.3~~-~~8.7.5.15.2.2.6.3~~. _____ Radiator Fan
Power Failure.

~~8.7.4.15.2.2.7~~-~~8.7.5.15.2.2.7~~. Warning Light for low engine
temperature.

~~8.7.4.15.2.2.8~~-~~8.7.5.15.2.2.8~~. Voltage Regulator with associated
control.

~~8.7.4.15.2.2.9~~-~~8.7.5.15.2.2.9~~. Engine speed adjuster.

~~8.7.4.15.2.2.10~~-~~8.7.5.15.2.2.10~~. _____ Running Indicator Lamp for
radiator fan:

~~8.7.4.15.2.2.10.1~~-~~8.7.5.15.2.2.10.1~~. _____ Fan Cycle On.

~~8.7.4.15.2.2.10.2~~-~~8.7.5.15.2.2.10.2~~. _____ Fan Cycle Off.

~~8.7.4.15.2.3~~-~~8.7.5.15.2.3~~. _____ Switchgear:

~~8.7.4.15.2.3.1~~-~~8.7.5.15.2.3.1~~. Main Circuit Breaker:

~~8.7.4.15.2.3.1.1~~-~~8.7.5.15.2.3.1.1~~. _____ Amperage,
volt, phase shall be based on specific

~~generator.1600 ampere, 480-volt, 3-phase.~~

~~8.7.4.15.2.3.1.2-8.7.5.15.2.3.1.2.~~ Molded Case Type – U.L. listed interrupting rating = 50,000 RMS symmetrical amperes.

~~8.7.4.15.2.3.1.3-8.7.5.15.2.3.1.3.~~ 24-volt D.C. shunt trip.

~~8.7.4.15.2.3.2-8.7.5.15.2.3.2.~~ Feeder Circuit Breakers:

~~8.7.4.15.2.3.2.1-8.7.5.15.2.3.2.1.~~ Molded Case Type – U.L. listed interrupting rating = 30,000 RMS symmetrical amperes.

~~8.7.4.15.2.3.2.2-8.7.5.15.2.3.2.2.~~ One (1) 450-amp, 3-phase; one (1) 225 amp, 3-phase; one (1) 125 amp, 3-phase; and space with bus for three (3) 450-amp, 3-phase, as future breakers.

~~8.7.4.15.2.4-8.7.5.15.2.4.~~ Accessories:

~~8.7.4.15.2.4.1-8.7.5.15.2.4.1.~~ Potential Transformers required – instrument quality.

~~8.7.4.15.2.4.2-8.7.5.15.2.4.2.~~ Current Transformers required – instrument quality.

~~8.7.4.15.2.4.3-8.7.5.15.2.4.3.~~ Control Switches – switchboard type.

~~8.7.4.15.2.4.4-8.7.5.15.2.4.4.~~ Lamp Test Switch.

~~8.7.4.15.2.4.5-8.7.5.15.2.4.5.~~ Terminal Boards for all wiring:

~~8.7.4.15.2.4.5.1-8.7.5.15.2.4.5.1.~~ All wires shall be marked at both ends with markings the same as shown on the control wiring diagrams.

~~8.7.4.15.2.4.6-8.7.5.15.2.4.6.~~ All wiring bundled and wrapped and secured in place with clips. Plastic wiring duct may be used at contractor's option.

~~8.7.4.15.2.4.7~~-~~8.7.5.15.2.4.7~~. All panel components identified and marked in accordance with the control drawings. Markings shall be permanent type and securely fastened to or adjacent to the device.

~~8.7.4.15.2.4.8~~-~~8.7.5.15.2.4.8~~. All relays shall be of the enclosed, dust-tight, and plug-in type and shall be mounted on a swing-out panel for rear access.

~~8.7.4.15.2.4.9~~-~~8.7.5.15.2.4.9~~. Motor Control circuit Relays, as needed, shall be provided to control:

~~8.7.4.15.2.4.9.1~~-~~8.7.5.15.2.4.9.1~~. _____ Radiator fan starter.

~~8.7.4.15.2.4.9.2~~-~~8.7.5.15.2.4.9.2~~. _____ Fuel pump starter.

~~8.7.4.15.2.4.9.3~~-~~8.7.5.15.2.4.9.3~~. _____ Space ventilation equipment starters.

~~8.7.4.15.2.4.10~~-~~8.7.5.15.2.4.10~~. _____ Audible alarm with silencing switch to alarm when any one or more of the immediate shut down or pre-alarm conditions exist.

~~8.7.4.15.2.4.11~~-~~8.7.5.15.2.4.11~~. _____ Control system shall be protected by a circuit breaker.

~~8.7.4.15.2.5~~-~~8.7.5.15.2.5~~. _____ Miscellaneous:

~~8.7.4.15.2.5.1~~-~~8.7.5.15.2.5.1~~. Switchgear bus shall be silver plated copper.

~~8.7.4.15.2.5.2~~-~~8.7.5.15.2.5.2~~. Neutral shall be full capacity.

~~8.7.4.15.2.5.3~~-~~8.7.5.15.2.5.3~~. Switchgear bus shall be full capacity (1600 amp) to all sections.

~~8.7.4.15.2.5.4~~-~~8.7.5.15.2.5.4~~. A 24-volt D.C. panel and switchgear display light shall be provided in the event of a total power failure.

~~8.7.4.15.2.5.5~~-~~8.7.5.15.2.5.5~~. Lifting angles shall be provided running the full length of the switchgear and bolted on the top.

~~8.7.4.16~~-~~8.7.5.16~~. _____ Remote Annunciator Panel:

~~8.7.4.16.1~~-~~8.7.5.16.1~~. A remote annunciator panel, powered from the batteries, shall be provided.

~~8.7.4.16.2~~-~~8.7.5.16.2~~. The annunciator panel shall indicate alarm conditions of the emergency generator set as follows:

~~8.7.4.16.2.1.1~~-~~8.7.5.16.2.1.1~~. Individual Visual Lights shall indicate:

~~8.7.4.16.2.1.1.1~~-~~8.7.5.16.2.1.1.1~~. Emergency generator operating to supply power to load.

~~8.7.4.16.2.1.1.2~~-~~8.7.5.16.2.1.1.2~~. Battery Charger malfunctioning:

~~8.7.4.16.2.1.1.3~~-~~8.7.5.16.2.1.1.3~~. Low battery voltage.

~~8.7.4.16.2.1.2~~-~~8.7.5.16.2.1.2~~. Individual Visual Lights plus common alarm shall indicate:

~~8.7.4.16.2.1.2.1~~-~~8.7.5.16.2.1.2.1~~. Low oil pressure.

~~8.7.4.16.2.1.2.2~~-~~8.7.5.16.2.1.2.2~~. Low water temperature.

~~8.7.4.16.2.1.2.3~~-~~8.7.5.16.2.1.2.3~~. High water temperature.

~~8.7.4.16.2.1.2.4~~-~~8.7.5.16.2.1.2.4~~. Over crank (failure to start).

~~8.7.4.16.2.1.2.5~~-~~8.7.5.16.2.1.2.5~~. Overspeed.

~~8.7.4.16.2.1.2.6~~-~~8.7.5.16.2.1.2.6~~. Low fuel supply.

~~8.7.4.16.2.1.3~~-~~8.7.5.16.2.1.3~~. Lamp Test Switch.

~~8.7.4.17~~-~~8.7.5.17~~. Remote Radiator

~~8.7.4.17.1~~-~~8.7.5.17.1~~. If required, a remote radiator, of the quiet type, shall be provided as follows:

~~8.7.4.17.1.1.1~~-~~8.7.5.17.1.1.1~~. Welded and bolted steel frame suitable for 100 mph wind load.

~~8.7.4.17.1.1.2~~-~~8.7.5.17.1.1.2~~. Plenum Chamber.

~~8.7.4.17.1.1.3~~8.7.5.17.1.1.3. Fan Ring.

~~8.7.4.17.1.1.4~~8.7.5.17.1.1.4. Lifting Lugs.

~~8.7.4.17.1.1.5~~8.7.5.17.1.1.5. Core Guard.

~~8.7.4.17.1.1.6~~8.7.5.17.1.1.6. OSHA Fan Guard and fan drive supported from channels integral with frame.

~~8.7.4.17.1.1.7~~8.7.5.17.1.1.7. Horizontal core for vertical air discharge with copper plat fins solder bonded to flat brass tubes.

~~8.7.4.17.1.1.8~~8.7.5.17.1.1.8. Removable manifold tanks to permit access to tube ends for inspection and cleaning.

~~8.7.4.17.1.1.9~~8.7.5.17.1.1.9. Thermal expansion and contraction differential provision between core and frame supports.

~~8.7.4.17.1.1.10~~8.7.5.17.1.1.10. Core shall be pitched and have drainage connections to permit complete drainage of unit.

~~8.7.4.17.1.1.11~~8.7.5.17.1.1.11. Fan shall be fixed center, airfoil type, belt driven by totally enclosed fan cooled motor, 480-volt, 3-phase.

~~8.7.4.17.1.1.12~~8.7.5.17.1.1.12. Fan shall have a maximum tip speed of 11,000 feet per minute.

~~8.7.4.17.1.1.13~~8.7.5.17.1.1.13. Radiator shall be equipped with a surge tank.

~~8.7.4.17.1.1.14~~8.7.5.17.1.1.14. Radiator shall be stainless flexible connections for all piping connections.

~~8.7.4.17.1.1.15~~8.7.5.17.1.1.15. Radiator shall be provided with spring type vibration isolators.

~~8.7.4.17.1.1.16~~8.7.5.17.1.1.16. Radiator shall be sized to provide adequate engine cooling when the ambient temperature is 105° F and with the radiator located approximately 8-feet above the engine-generator set.

~~8.7.4.17.1.1.17-8.7.5.17.1.1.17.~~ Radiator shall be provided with a water temperature sensing thermostat to control and cycle the fan motor starter.

~~8.7.4.17.2-8.7.5.17.2.~~ Remote indicating lamp, alarm horn and silencing switch to indicate when the engine generator set is running.

9. Lighting

9.1. General:

- 9.1.1. Conform to IES recommended foot-candle levels.
- 9.1.2. All new buildings, additions, and major remodels shall utilize the services of a Professional Lighting Designer, Lighting Certified (LC) by the National Council on Qualifications for the Lighting Professions (NCQLP).
- 9.1.3. Lighting quality shall be considered in the design of all artificial and natural lighting systems.
- 9.1.4. Lighting design shall conform to IES DG-18-08 Light + Design: A Guide to Designing Quality Lighting for People and Buildings.
- 9.1.5. Energy efficiency and lighting quality shall be equal and balanced considerations when designing the lighting, selecting the products, and determining the architectural and interior finishes for a project.
- 9.1.6. Arrange lighting throughout all critical areas (including egress areas, assembly occupancies, health care facilities, and public safety operations) so that failure of any single element of the system, such as a lamp, ballast, switch, circuit breaker, or conductor, does not leave any portion of a critical area in darkness or illuminated at less than the levels required by code.

9.1.7. Lighting selection shall be approved by the Owner.

Fixture Installation:

~~All light fixtures shall be accessible without scaffolding.~~

~~Lighting fixtures shall not be installed above stair treads.~~

~~Lighting fixtures at landings shall meet ADA requirements for mounting heights.~~

~~Luminaires installed in occupancies such as laboratories and workshops shall be oriented parallel to benches and centered over the edge of the working surface.~~

~~Space luminaires to maintain a maximum uniformity ratio of 2:1.~~

~~Luminaires located in suspended ceilings shall be connected with a maximum 6 foot length of flexible metal conduit.~~

~~Use number 12 AWG (min) light fixture whips.~~

~~Luminaires shall be fitted with swivels or otherwise adjusted so they hang plumb and true.~~

~~Fixtures in finished spaces shall not be chain hung.~~

~~Housing, trim, and lens frame shall be true, straight, and parallel to each adjacent fixtures and features.~~

~~Fixtures shall not be supported by ceiling acoustical panels.~~

~~Troffer, recessed and semi recessed fixtures shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, located near each corner of each fixture.~~

~~Ceiling grid clips shall not be allowed as an alternative to independently supported light fixtures.~~

~~Round fixtures or fixtures smaller than the ceiling grid shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, per fixture, spaced equidistant around the fixture.~~

~~Round fixtures or fixtures smaller than the ceiling grid shall have at least two (2) ¼ inch (19 mm) metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.~~

~~9.1.7.~~

9.1.8. For UIHC:

- 9.1.8.1. Lamp types shall be LED.
- 9.1.8.2. Incandescent / fluorescent lighting shall not be used for general area lighting and shall be used only for special applications or where approved by the Owner.
- 9.1.8.3. High Intensity Discharge lighting shall not be used.
- 9.1.8.4. In General Hospital and South Wing, 120-volt lighting is the most commonly used voltage for both normal power and all of the emergency branches lighting.
- 9.1.8.5. In the remainder of the facility, 277-volt lighting is typically available and shall be utilized for both normal power and all of the emergency branch lighting.
- 9.1.8.6. Verify the voltage for each project.
- 9.1.8.7. The Contractor shall replace all lamps within the construction area with new lamps prior to Substantial Completion. Review with Owner.
- 9.1.8.8. Hanging fixtures, such as pendant lighting, shall be specified to be hung at heights that are out of reach of staff and patients.

9.1.8.9. Constructors are responsible for the removal of lamps and Owner shall provide lamp recycle bins for disposal.

9.1.9. For UI Housing:

9.1.9.1. Glass material as part of a light fixture is not allowed.

9.1.9.2. LED lighting is preferred.

~~Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box.~~

~~Length shall be a maximum of 6-foot.~~

~~Fixtures shall not be daisy chained with flexible conduit.~~

~~Recessed fixtures in non-removable, fire-rated ceilings shall be enclosed in a fire-rated enclosure.~~

~~A fixture that can remove the heat it produces in this situation must be used.~~

~~Where fixture housings are connected, use 90-degree C wire for branch circuit feed through fixture channels.~~

~~Fixtures recessed in furred ceiling shall be installed so they can be removed from below the ceiling.~~

~~Fixtures installed in plastered or acoustical tile shall not be supported directly on the ceiling material.~~

~~Support fixtures with metal bar hangers or strut channels attached to the ceiling support system.~~

~~Suspended fixtures shall be supported to the building structure.~~

~~Emergency powered light fixtures connected to the critical branch shall be provided in mechanical rooms, electrical rooms, elevator equipment rooms, telecommunications closets, medicine rooms, pharmacies, ICUs, operating rooms, and larger waiting rooms.~~

~~Refer to NEC 517 for requirements.~~

9.1.9.2. Lighting fixtures at landings shall meet ADA requirements for mounting heights. UIHC requests to be a max of 8 feet above the landing.

9.2. Warranties:

9.2.1. Constructor shall be capable of being onsite within 4 (four) hours for all warranty calls during the warranty period.

9.2.2. All LED fixtures shall carry a five (5) year manufacturer's warranty.

9.2.2.1. Warranty shall include LED board/chip set, driver and all other components involved with the performance of the LED product.

9.2.2.2. Warranty shall include color shift of less than three (3) Macadam Ellipses and lumen depreciation faster than the manufacturer's published L70 rating.

9.3. Submittals and Shop Drawings:

9.3.1. Submit dimensioned drawings of lighting fixtures.

9.3.2. Submit a separate sheet for each light fixture, lamp, and ballast, assembled in order of luminaire "type" designation.

9.3.2.1. Clearly indicate fixture type, manufacturer, model number, and accessories for each item.

9.3.3. Submit a "Lamp and Ballast Schedule" noting fixture type, lamp designation, lamp manufacturer, and local supplier for each fixture.

9.3.4. LED fixture submittals shall include photometric reports per IES LM-79 guidelines.

9.3.4.1. Report shall be for the latest generation system being furnished, including independent testing laboratory name, report number, date, luminaire model number, input wattage, delivered lumens and driver specifications.

9.3.4.2. Provide manufacturer of origin for the LED chipset included in the fixture.

9.4. Interior Lighting:

9.4.1. Fixture Installation:

9.4.1.1. All light fixtures shall be accessible without scaffolding.

9.4.1.2. Lighting fixtures shall not be installed above stair treads.

9.4.1.3. Lighting fixtures at landings shall meet ADA requirements for mounting heights.

9.4.1.4. Luminaires installed in occupancies such as laboratories and workshops shall be oriented parallel to benches and centered over the edge of the working surface.

9.4.1.5. Space luminaires to maintain a maximum uniformity ratio of 2:1.

9.4.1.6. Luminaires located in suspended ceilings shall be connected with a maximum 6-foot length of flexible metal conduit.

9.4.1.7. Use number 12 AWG (min) light fixture whips.

9.4.1.8. Luminaires shall be fitted with swivels or otherwise adjusted so they hang plumb and true.

9.4.1.9. Fixtures in finished spaces shall not be chain hung.

9.4.1.10. Housing, trim, and lens frame shall be true, straight, and parallel to each adjacent fixtures and features.

9.4.1.11. Fixtures shall not be supported by ceiling acoustical panels.

9.4.1.12. Troffer, recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, located near each corner of each fixture.

9.4.1.13. Ceiling grid clips shall not be allowed as an alternative to independently supported light fixtures.

9.4.1.14. Round fixtures or fixtures smaller than the ceiling grid shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, per fixture, spaced equidistant around the fixture.

9.4.1.15. Round fixtures or fixtures smaller than the ceiling grid shall have at least two (2) ¾-inch (19 mm) metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.

9.4.1.16. For UIHC:

9.4.1.16.1. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box.

9.4.1.1.1. Length shall be a maximum of 6-foot.

9.4.1.16.2. _____

9.4.1.1.1.1. Fixtures shall not be daisy chained with flexible conduit.

9.4.1.16.2.1. _____

9.4.1.1.1.2. Recessed fixtures in non-removable, fire-rated ceilings shall be enclosed in a fire-rated enclosure.

9.4.1.16.2.2. _____

9.4.1.1.1.3. A fixture that can remove the heat it produces in this situation must be used.

9.4.1.16.2.3. _____

9.4.1.1.1.4. Where fixture housings are connected, use 90-degree C wire for branch circuit feed through fixture channels.

9.4.1.16.2.4. _____

9.4.1.1.1.5. Fixtures recessed in furred ceiling shall be installed so they can be removed from below the ceiling.

9.4.1.16.2.5.

9.4.1.1.1.6. Fixtures installed in plastered or acoustical tile shall not be supported directly on the ceiling material.

9.4.1.16.2.6.

9.4.1.1.1.7. Support fixtures with metal bar hangers or strut channels attached to the ceiling support system.

9.4.1.16.2.7.

9.4.1.1.1.8. Suspended fixtures shall be supported to the building structure.

9.4.1.16.2.8.

9.4.1.1.1.9. Lighting fixtures at landings shall meet ADA requirements for mounting heights.

9.4.2. Design

9.4.2.1. The lighting design shall maximize the use of recessed and volumetric 2-foot by 4-foot luminaires using linear fluorescent or LED fixtures.

9.4.2.2. Interior light sources shall be fluorescent or LED, except as follows:

9.4.2.2.1. When installed in high ceiling spaces (over 12-feet) in finished areas, interior light sources shall be LED fixtures.

9.4.2.2.2. When installed in high ceiling spaces (over 12-feet) in unfinished areas, such as warehouses and workshops, interior light sources shall be LED or T5 fluorescent.

9.4.2.2.3. Three (3) and four (4) lamp fluorescent fixtures shall not be used.

9.4.2.3. Coordinate luminaire locations with architectural features and adjacent structural and mechanical elements.

9.4.2.4. Wholly indirect lighting systems are not acceptable.

9.4.2.5. In rooms where video display terminals are used, fixtures shall have a minimum 0.7 visual comfort probability (VCP) value.

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~~1.1.1.6-9.4.2.6. For UIHC:~~

~~1.1.1.6.1-9.4.2.6.1. LED lights shall be used unless approved by the Owner in writing. They shall be 3500-k, with drivers accessible from below the ceiling.~~

~~1.1.1.6.2-9.4.2.6.2. Fluorescent Ballasts and Lamps shall only be used where approved by the Owner.~~

~~1.1.1.6.2.1-9.4.2.6.2.1. Ballasts shall be low harmonic (<10%), electronic, sound rated A or better, minimum 0.95 power factor, minimum 0.85 ballast factor, maximum 1.7 crest factor, operating at >20k Hz, with a written five (5) year warranty.~~

~~1.1.1.6.2.2-9.4.2.6.2.2. Ballasts shall be by Advance, Lutron, Robertson, General Electric (Magnatek) or Universal.~~

~~1.1.1.6.3-9.4.2.6.3. Fixtures shall be placed at heights and locations to allow for easy access for maintenance.~~

~~1.1.1.6.3.1-9.4.2.6.3.1. Two (2) lamp fixtures are acceptable in corridors, storage rooms, or other areas where lower light levels are desired.~~

~~1.1.1.6.4-9.4.2.6.4. Offices and Work Areas:~~

~~1.1.1.6.4.1-9.4.2.6.4.1. Utilize 2-foot by 2-foot recessed LED with 1 1/2-inch by 1 1/2-inch by 3/4-inch aluminum parabolic louver.~~

~~1.1.1.6.4.2-9.4.2.6.4.2. The use of occupancy sensors, daylight sensors (where there are exterior windows), and two-level switching shall comply with energy code.~~

~~1.1.1.6.5-9.4.2.6.5. Conference Rooms:~~

~~1.1.1.6.5.1~~9.4.2.6.5.1. Utilize Dimmable LED lighting.

~~1.1.1.6.6~~9.4.2.6.6. Mechanical, Electrical, and Telecommunications Rooms:

~~1.1.1.6.6.1~~9.4.2.6.6.1. Utilize 4-foot industrial strip fixtures.

~~1.1.1.6.7~~9.4.2.6.7. Exam Rooms:

~~1.1.1.6.7.1~~9.4.2.6.7.1. Utilize ~~2-foot by 2-foot or 2-foot by 4-foot~~-lensed troffers. ~~2X4 LED with replaceable LED strip and drivers located outside the operating room.~~

~~1.1.1.6.8~~9.4.2.6.8. Operating Rooms ~~or~~ (where anesthesia is administered) ~~color temp shall be 4000k:~~

~~1.1.1.6.8.1~~9.4.2.6.8.1. ~~2X4 LED with replaceable LED strip and drivers located outside the operating room.~~ Utilize ~~2-foot by 4-foot~~ ~~lensed surgical troffers.~~

~~1.1.1.6.8.2~~9.4.2.6.8.2. One (1) shall be fed from an emergency battery inverter located remotely in an accessible area below ceiling.

~~1.1.1.6.8.2.1~~9.4.2.6.8.2.1. Inverter shall have a keyed test switch, Leviton 1221- 2KL.

~~1.1.1.6.8.2.2~~9.4.2.6.8.2.2. Test switch shall interrupt the power feeding inverter.

~~9.4.2.6.8.2.3.~~ Review switch location with Owner.

~~1.1.1.6.8.2.3~~9.4.2.6.8.3. ~~color temp shall be 4000k~~

~~1.1.1.6.9~~9.4.2.6.9. Patient Rooms:

~~1.1.1.6.9.1~~9.4.2.6.9.1. Utilize a combination of fixtures to accomplish lighting for the varying tasks in the room.

~~1.1.1.6.9.2~~9.4.2.6.9.2. Fixtures above the bed shall be compatible with patient bed controls.

~~1.1.1.6.9.3~~9.4.2.6.9.3. Nightlights shall be recessed in wall with an LED light source.

~~1.1.1.6.9.4~~9.4.2.6.9.4. Provide under counter fixtures where there are countertops with cabinets above.

~~1.1.1.6.10~~9.4.2.6.10. Restrooms:

~~1.1.1.6.10.1~~9.4.2.6.10.1. Utilize 2x2 ceiling fixtures.

~~1.1.1.6.11~~9.4.2.6.11. Specialty:

~~1.1.1.6.11.1~~~~9.4.2.6.11.1~~. Utilize fixtures constructed specifically for special types of rooms (example: non-ferrous fixtures in MRI rooms).

~~1.1.1.6.12~~~~9.4.2.6.12~~. Task Lighting:

~~1.1.1.6.12.1~~~~9.4.2.6.12.1~~. Fixtures shall be LED and have an opaque task lens.

~~1.1.1.6.12.2~~~~9.4.2.6.12.2~~. Utilize task lighting where appropriate e.g., offices, labs, patient rooms, treatment rooms, exam rooms, work rooms, nurse stations, and conference rooms.

~~1.1.1.6.13~~~~9.4.2.6.13~~. Signage and Art Lighting:

~~1.1.1.6.13.1~~~~9.4.2.6.13.1~~. Utilize LED track lighting.

~~1.1.1.6.13.2~~~~9.4.2.6.13.2~~. These fixtures shall be controlled separately with a dimmer.

~~1.1.1.6.13.3~~~~9.4.2.6.13.3~~. Track and heads shall be selected by the Design Professional.

~~1.1.1.7~~~~9.4.2.7~~. For UI Housing:

~~1.1.1.7.1~~~~9.4.2.7.1~~. Rooms with electronic displays shall have a dimming lighting system.

~~1.1.1.8~~~~9.4.2.8~~. Restrooms:

~~1.1.1.8.1~~~~9.4.2.8.1~~. Lighting shall be accessible from a ladder for maintenance and cleaning.

~~1.1.1.8.2~~~~9.4.2.8.2~~. Fixture covers shall not be located above or behind water closets or counters.

~~1.1.1.9~~~~9.4.2.9~~. Interior lighting systems shall operate at either 277-volt or 120-volt.

~~1.1.1.10~~~~9.4.2.10~~. Lighting Designer shall work with the architect and/or Interior Designer to specify high reflectivity interior finishes achieving the following minimum reflectance values:

~~1.1.1.10.1~~~~9.4.2.10.1~~. Ceilings: ninety percent (90%)

~~1.1.1.10.2~~~~9.4.2.10.2~~. Walls: fifty percent (50%)

~~1.1.1.10.3~~~~9.4.2.10.3~~. Floors: twenty percent (20%)

~~1.1.1.11~~~~9.4.2.11~~. Efficacy:

~~1.1.1.11.1~~~~9.4.2.11.1~~. Non-LED type fixtures shall carry a Luminaire Efficacy Rating (LER) of fifty-five (55) or greater.

1.1.1.11.2-9.4.2.11.2. All LED products shall carry a Lighting Facts label listing the LPW for that product.

1.1.1.11.3-9.4.2.11.3. All LPW ratings shall be at the color temperature (CCT) used on the project

1.1.1.12-9.4.2.12. Efficiencies:

1.1.1.12.1-9.4.2.12.1. Non-LED type fixtures shall have the minimum following efficiencies:

1.1.1.12.1.1-9.4.2.12.1.1. Recessed linear fluorescent – eighty percent (80%)

1.1.1.12.1.2-9.4.2.12.1.2. Linear indirect/ direct – eighty-five percent (85%)

1.1.2-9.4.3. Daylighting:

1.1.2.1-9.4.3.1. Incorporate natural daylighting to the greatest extent possible to replace or supplement artificial lighting.

1.1.2.2-9.4.3.2. Use manual and/ or automatic control devices, such as blinds, diffusers, and light shelves to control distribution, brightness, and glare.

1.1.2.3-9.4.3.3. Design Professional shall ensure that the contribution from daylighting is included in HVAC loads.

1.1.2.3.1-9.4.3.3.1. One (1) system shall not be sacrificed for the benefit of another.

1.1.2.4-9.4.3.4. All daylighting shall be incorporated free of glare to the occupants.

1.1.2.5-9.4.3.5. Up lighting under skylights is prohibited.

1.1.2.6-9.4.3.6. Downlights in skylight wells or adjacent spaces shall be controlled thru automatic daylight dimming or switching.

1.1.2.7-9.4.3.7. Arrange interior lighting systems so appropriate areas can be switched or dimmed when adequate natural light is present.

1.1.2.8-9.4.3.8. Where applicable, provide control by the following means:

1.1.2.8.1-9.4.3.8.1. Wall switches placed for occupant convenience

1.1.2.8.2-9.4.3.8.2. Automated dimming controls, which may include multi-level stepping or switching

1.1.2.8.3-9.4.3.8.3. Photo sensors

1.1.2.8.4-9.4.3.8.4. Programmable central control systems

1.1.3.9.4.4. Lighting Fixtures (Luminaries):

1.1.3.1.9.4.4.1. Custom lighting fixtures shall not be used.

1.1.3.2.9.4.4.2. All recessed can lighting shall be LED.

1.1.3.3.9.4.4.3. Exposed fixture housing surfaces, trim frames, door frames, and lens frames shall be free of light leaks.

1.1.3.4.9.4.4.4. Lens doors shall close in a light tight manner.

1.1.3.5.9.4.4.5. Hinged door closure frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

1.1.3.6.9.4.4.6. Metal Finishes:

1.1.3.6.1.9.4.4.6.1. Interior light reflecting finishes shall be white with minimum eighty-five percent (85%) reflectance.

1.1.3.6.2.9.4.4.6.2. Exterior finishes shall be a baked, electrostatic powder coat.

1.1.3.7.9.4.4.7. Provide all lighting fixtures with a specific means for grounding their metallic wire-ways and housings to an equipment grounding conductor.

1.1.3.8.9.4.4.8. The manufacturer shall apply a standard finish over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt, and other deposits.

1.1.3.8.1.9.4.4.8.1. Edges of pre-finished sheet metal shall be finished in a similar corrosion-resistant manner to match the adjacent surface(s).

1.1.3.9.9.4.4.9. Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.

1.1.3.10.9.4.4.10. For UIHC:

9.4.4.10.1. Light fixtures need to be accessible for maintenance without extraordinary or costly measures. ~~Discuss with project team on best practices for each project.~~

9.4.4.10.2. All light fixtures shall be accessible to replace/repair with an Environmental Containment Unit (ECU). Wall wash fixtures must provide space along wall to allow ECU containment.

1.1.3.10.1.9.4.4.10.3. Lighting fixtures shall be manufactured by one (1) of the following manufactures:

1.1.3.10.1.1.9.4.4.10.3.1. Day Bright, Cooper (Halo), Hubble (Columbia), Lithonia or Metulux. LED fixtures to be Finelite, Lithonia, Hubble, Visa, Amico, Kirlin or approved equivalent.

1.1.3.10.2.9.4.4.10.4. Typical Fixtures (troffers, wraparounds, strips, etc.):

~~1.1.3.10.2.1-9.4.4.10.4.1.~~ In recessed troffers, lenses and louvers shall be standard size so replacements are readily available.

~~1.1.3.10.3-9.4.4.10.5.~~ Suspended Linear Direct/Indirect Fixtures:

~~1.1.3.10.3.1-9.4.4.10.5.1.~~ Housings shall be of steel or aluminum construction with endcaps.

~~1.1.3.10.3.2-9.4.4.10.5.2.~~ Fixtures shall be suspended with adjustable aircraft cable and fed with white coiled cords.

~~1.1.3.10.4-9.4.4.10.6.~~ Recessed Downlights:

~~1.1.3.10.4.1-9.4.4.10.6.1.~~ Rough-in kits shall have steel bar hangers with steel junction boxes.

~~1.1.3.10.4.2-9.4.4.10.6.2.~~ Reflectors shall be low iridescence Alzak type.

~~9.4.4.10.6.3.~~ Incandescent fixtures shall be thermally protected.

~~9.4.4.10.7.~~ For UIHC

~~9.4.1.1.1-10-9.4.4.10.7.1.~~ Recessed can light fixtures shall be 6-inch or larger

1.1.4.9.4.5. LED Lamps and Fixtures:

1.1.4.1.9.4.5.1. References to SSL and/or LED sources shall include the entire solid-state lighting system, including circuitry, LED boards, chip sets, power supplies, and drivers.

1.1.4.2.9.4.5.2. Interior LED fixtures shall have a minimum color rendering index (CRI) of eighty (80).

1.1.4.3.9.4.5.3. Exterior LED fixtures shall have a minimum color rendering index (CRI) of seventy (70).

1.1.4.4.9.4.5.4. Color temperature of the chip sets/light engines of both interior and exterior LED fixtures shall be 3500k4000k. OR color temp is 4000k and Exterior color temp is 5000k.

1.1.4.5.9.4.5.5. All LED fixtures shall have a maximum Correlated Color Temperature variance of +/- one hundred (100) degrees K.

1.1.4.5.1.9.4.5.5.1. Products installed in field with greater variance shall be replaced at no cost to Owner.

1.1.4.6.9.4.5.6. All LED fixtures, modules, or arrays, per type, shall be provided with the same date code of manufacture.

1.1.4.7.9.4.5.7. LED Drivers:

1.1.4.7.1.9.4.5.7.1. Solid state driver with integral heat sink.

1.1.4.7.2.9.4.5.7.2. Driver shall have over-heat, short-circuit, and overload protection, power factor 0.90 or above and maximum total harmonic distortion of {10%+ 20}%.

9.4.5.7.3. Driver shall have a voltage fluctuation tolerance of +/- 10%.

9.4.1.1.2. _____

1.1.4.7.3.9.4.5.7.4. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type.

1.1.4.7.4.9.4.5.7.5. Dimming shall control light output in a continuous curve from one hundred percent (100%) to ten percent (10%) unless noted otherwise.

1.1.4.7.5.9.4.5.7.6. Driver shall have a minimum of fifty thousand (50,000) hours rated life.

1.1.4.7.6.9.4.5.7.7. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor.

1.1.4.7.7.9.4.5.7.8. Driver start time shall be less than 0.5 seconds to ninety-eight percent (98%) of initial light output.

~~1.1.4.7.8-9.4.5.7.9.~~ Flicker should be less than thirty percent (30%) throughout the operating range.

~~1.1.4.7.9-9.4.5.7.10.~~ Driver shall be field replaceable without removal of the luminaire and accessible from below ceiling.

~~1.1.4.7.10-9.4.5.7.11.~~ Class A sound rating; inaudible in a 27 dBA ambient.

~~1.1.4.7.11.~~ ~~Demonstrate no visible change in light output with a variation of +/- 10% change in line voltage input.~~

~~1.1.4.8-9.4.5.8.~~ Submit driver data and dimmer compatibility list as provided by the manufacturer.

~~1.1.4.9-9.4.5.9.~~ Constructor shall furnish and install only dimmers listed as compatible with the specified LED lighting fixture.

~~1.1.4.10-9.4.5.10.~~ Constructor shall be responsible for verifying that installed dimming controls are compatible with and approved by the luminaire manufacturer prior to submittals to the Lighting Designer.

~~1.1.4.11-9.4.5.11.~~ LED fixtures shall be provided with a driver and light source as a modular system.

~~1.1.4.12-9.4.5.12.~~ All LED drivers shall carry a minimum life expectancy of fifty thousand (50,000) hours.

~~1.1.4.13-9.4.5.13.~~ LED fixtures shall use passive cooling (heat sinks) or active cooling (Synjet or heat pipe) to ensure LED operating temperature are within manufacturer's specifications.

~~1.1.4.13.1-9.4.5.13.1.~~ Active cooling systems involving fans or other maintainable mechanical parts are prohibited.

~~1.1.4.14-9.4.5.14.~~ Dynamic Tunable LED (DLED):

~~1.1.4.14.1-9.4.5.14.1.~~ Variable correlated color temperature LED systems shall offer a range of temperature control from [2700K through 6000K] [3000K through 5000K].

~~1.1.4.14.2-9.4.5.14.2.~~ Color rendering index shall be a minimum of [80] [90].

~~1.1.4.14.3-9.4.5.14.3.~~ Dimming control from one hundred percent (100%) to one percent (1%) shall offer compatibility with any LED dimming driver/controller including 0-10V, DALI, DMX, etc.

~~1.1.4.15-9.4.5.15.~~ Warm Dim LED (WLED):

~~1.1.4.15.1-9.4.5.15.1.~~ Variable warm dimming LED systems shall offer a range of temperature control from [2700K through 1800K] [3000K through 1800K].

~~1.1.4.15.2-9.4.5.15.2.~~ Color rendering index shall be a minimum of [80] [90].

~~1.1.4.15.3-9.4.5.15.3.~~ Dimming control from one hundred percent (100%) to one percent (1%) shall offer compatibility with any LED dimming driver/controller including 0-10V, DALI, DMX, etc.

~~1.1.5.9.4.6.~~ Emergency Egress Lighting Fixtures and Exit Signs:

~~1.1.5.1-9.4.6.1.~~ Emergency lighting and exit sign units shall not be mounted higher than 10-feet above finished floor.

~~1.1.5.2-9.4.6.2.~~ Emergency Egress Lighting Fixtures:

~~1.1.5.2.1-9.4.6.2.1.~~ Systems shall provide a minimum of ninety (90) minutes emergency use.

~~1.1.5.2.2-9.4.6.2.2.~~ Acceptable systems, in order of Owner preference

~~1.1.5.2.2.1-9.4.6.2.2.1.~~ Fixtures and signs connected to compliant building backup power system, such as a generator.

~~1.1.5.2.2.2-9.4.6.2.2.2.~~ Self-contained fixture or sign battery units.

~~1.1.5.2.2.3-9.4.6.2.2.3.~~ Central inverter-based systems require written approval from Owner.

~~1.1.5.2.3.~~ Fixture Installation:

~~1.1.5.2.3.1.~~ All light fixtures shall be accessible without scaffolding.

~~1.1.5.2.3.2.~~ Lighting fixtures shall not be installed above stair treads.

~~1.1.5.2.3.3.~~ Lighting fixtures at landings shall meet ADA requirements for mounting heights.

~~1.1.5.2.3.4.~~ Luminaires installed in occupancies such as laboratories and workshops shall be oriented parallel to benches and centered over the edge of the working surface.

~~1.1.5.2.3.5.~~ Space luminaires to maintain a maximum uniformity ratio of 2:1.

~~1.1.5.2.3.6.~~ Luminaires located in suspended ceilings shall be connected with a maximum 6-foot length of flexible metal conduit.

~~1.1.5.2.3.7.~~ Use number 12 AWG (min) light fixture whips.

~~1.1.5.2.3.8.~~ Luminaires shall be fitted with swivels or otherwise adjusted so they hang plumb and true.

~~1.1.5.2.3.9.~~ Fixtures in finished spaces shall not be chain hung.

~~1.1.5.2.3.10.~~ Housing, trim, and lens frame shall be true, straight, and parallel to each adjacent fixtures and features.

~~1.1.5.2.3.11. Fixtures shall not be supported by ceiling acoustical panels.~~

~~1.1.5.2.3.12. Troffer, recessed and semi recessed fixtures shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, located near each corner of each fixture.~~

~~1.1.5.2.3.13. Ceiling grid clips shall not be allowed as an alternative to independently supported light fixtures.~~

~~1.1.5.2.3.14. Round fixtures or fixtures smaller than the ceiling grid shall be independently supported from the building structure by a minimum of four (4) wires, straps, or rods, per fixture, spaced equidistant around the fixture.~~

~~1.1.5.2.3.15. Round fixtures or fixtures smaller than the ceiling grid shall have at least two (2) ¾ inch (19 mm) metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.~~

1.1.5.2.4.9.4.6.2.3. For UIHC:

~~1.1.5.2.4.1. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box.~~

~~1.1.5.2.4.2. Length shall be a maximum of 6 foot.~~

~~1.1.5.2.4.3. Fixtures shall not be daisy chained with flexible conduit.~~

~~1.1.5.2.4.4. Recessed fixtures in non-removable, fire-rated ceilings shall be enclosed in a fire-rated enclosure.~~

~~1.1.5.2.4.5. A fixture that can remove the heat it produces in this situation must be used.~~

~~1.1.5.2.4.6. Where fixture housings are connected, use 90-degree C wire for branch circuit feed through fixture channels.~~

~~1.1.5.2.4.7. Fixtures recessed in furred ceiling shall be installed so they can be removed from below the ceiling.~~

~~1.1.5.2.4.8. Fixtures installed in plastered or acoustical tile shall not be supported directly on the ceiling material.~~

~~1.1.5.2.4.8.1. Support fixtures with metal bar hangers or strut channels attached to the ceiling support system.~~

~~1.1.5.2.4.9. Suspended fixtures shall be supported to the building structure.~~

~~1.1.5.2.4.10-9.4.6.2.3.1.~~ Emergency powered light fixtures connected to the critical branch shall be provided in mechanical rooms, electrical rooms, elevator equipment rooms, telecommunications closets, medicine rooms, pharmacies, ICUs, operating rooms, and larger waiting rooms.

~~1.1.5.2.4.11-9.4.6.2.3.2.~~ Refer to NEC 517 for requirements.

~~1.1.5.3-9.4.6.3.~~ Exit Signs:

~~1.1.5.3.1-9.4.6.3.1.~~ Center exit signs on building elements, such as corridors and doorways.

~~1.1.5.3.2-9.4.6.3.2.~~ Signs shall be cast or stamped aluminum, minimum 0.090-inch (2.25 mm) thick, stenciled with 6-inch (150 mm) high letters, backed with red, color-stable plastic or fiberglass.

~~1.1.5.3.3-9.4.6.3.3.~~ Lamps shall be red or green LED, mounted in center of letters on red or green color-stable plastic or fiberglass.

~~1.1.5.3.4-9.4.6.3.4.~~ LED shall be rated minimum twenty-five (25) year life.

~~1.1.5.3.5-9.4.6.3.5.~~ LED exit light fixtures without diffuser panels shall be maximum of 3.5 watts for single-faced and 7-watts for double-faced.

~~1.1.5.3.6-9.4.6.3.6.~~ LED exit light fixtures with diffuser panels shall use 1 watt maximum per fixture for single-or double-faced.

~~1.1.5.3.7-9.4.6.3.7.~~ Fixtures shall be wired for universal 120 to 277-volt.

~~1.1.5.3.8-9.4.6.3.8.~~ EXIT signs shall comply with UL 924 and EPA Energy Star Specifications at the end of five (5) years of continual use.

~~1.1.5.3.8.1-9.4.6.3.8.1.~~ At the end of five (5) years of continual use (when measured at 0-degrees and 45-degree viewing angles), average luminance shall be greater than 15 candelas/meter, minimum luminance shall be greater than 8.6 candelas/meter, and maximum-to-minimum luminance ratio shall be less than 20:1.

~~1.1.5.3.8.2-9.4.6.3.8.2.~~ Letter illumination shall appear when viewed in a typical installation.

~~1.1.5.3.9-9.4.6.3.9.~~ There shall be no radioactive material used in the fixtures.

~~1.1.5.3.10-9.4.6.3.10.~~ For UIHC:

~~1.1.5.3.10.1-9.4.6.3.10.1.~~ Light source shall be [feed from life safety circuit, be](#) LED only without battery backup unless required by code.

~~1.1.5.3.10.2~~~~9.4.6.3.10.2~~. Exit signs manufacturer shall be Lithonia or Telesis pivot style with brushed aluminum, letter color red with mirror backing.

~~1.1.5.4.9.4.6.4~~. Emergency Fixtures:

~~1.1.5.4.1.9.4.6.4.1~~. System shall consist of an automatic power failure device and fully automatic solid-state charger in a self-contained power pack.

~~1.1.5.4.2.9.4.6.4.2~~. Charger shall be trickle, float, constant-current or constant-potential type, or a combination of these.

~~1.1.5.4.3.9.4.6.4.3~~. Battery shall operate unattended and require no maintenance, including no additional water, for a minimum of five (5) years.

~~1.1.5.5.9.4.6.5~~. Exit signs and emergency lighting equipment shall include self-testing module to perform the following functions:

~~1.1.5.5.1.9.4.6.5.1~~. Self-diagnostics shall monitor LED status, LED load transfer circuit, battery capacity and charger function and display any fault detection by means of a flashing code.

~~1.1.5.5.2.9.4.6.5.2~~. Self-test feature shall automatically run a 1-minute test once a month and an alternating 30 or 60-minute test once every six (6) months.

~~1.1.5.5.3.9.4.6.5.3~~. Multi-color LED on-board indicators shall provide visible fault detection and charging status.

~~1.1.5.5.4.9.4.6.5.4~~. Manual test switch to simulate a discharge test cycle.

~~1.1.5.5.5.9.4.6.5.5~~. Module shall have low voltage battery disconnect and brown-out protection circuit.

~~1.1.6.9.4.7~~. Quality Control:

~~1.1.6.1.9.4.7.1~~. Foot candle measurements shall be taken after lamps have been in service for one hundred (100) hours.

~~1.1.6.1.1.9.4.7.1.1~~. Obtain measurements during periods of darkness at a sufficient number of locations to demonstrate that the design criteria have been met.

~~1.1.6.1.2.9.4.7.1.2~~. Results shall be submitted to Owner.

~~1.1.6.2.9.4.7.2~~. Where ballast noise is audible above the ambient noise, use sound level meter (capable of measuring as low as 35 dB) to test ballast.

~~1.1.6.2.1.9.4.7.2.1~~. Replace all ballasts outside of specified range.

~~1.1.6.3.9.4.7.3~~. Test all emergency fixtures and exit signs under power failure conditions.

~~1.1.6.4.9.4.7.4.~~ Lighting Designer shall observe and direct Constructor in the field for final aiming of each adjustable fixture.

~~1.1.6.4.1.9.4.7.4.1.~~ Aiming shall occur after sunset, at a time designated by the Owner.

~~1.1.6.4.2.9.4.7.4.2.~~ All materials and labor necessary for the final aiming and adjusting shall be included in the Constructor's base bid.

~~1.1.6.5.9.4.7.5.~~ Include provisions for pre-construction meeting between manufacturer's representatives, Lighting Designer, Constructor and Owner to verify required devices, placement, intended operation, and wiring scenarios.

~~1.1.6.6.9.4.7.6.~~ Constructor shall verify that installation of controls is complete and correct per manufacturer provided drawings and specifications.

~~1.1.6.6.1.9.4.7.6.1.~~ Demonstrate fully operational system to the Owner prior to scheduling training.

~~1.1.6.7.9.4.7.7.~~ The Owner reserves the right to videotape each training session for use in future training programs.

~~1.1.6.8.9.4.7.8.~~ Training shall include:

~~1.1.6.8.1.9.4.7.8.1.~~ A combination of classroom and field venues (all typical room types).

~~1.1.6.8.2.9.4.7.8.2.~~ Complete overview of the entire system identifying specific features and operating descriptions.

~~1.1.6.8.3.9.4.7.8.3.~~ Provide specific instructions on how to turn lights on, off, dim lights, etc., allowing for hands-on participation.

~~1.1.6.8.3.1.9.4.7.8.3.1.~~ Review of each device that is part of the lighting system, including specific luminaires.

~~1.1.6.8.3.2.9.4.7.8.3.2.~~ Review shall include device purpose, how it is used, how the user interfaces with the device, etc.

~~1.1.6.8.3.3.9.4.7.8.3.3.~~ The Constructor shall bring minimum one (1) of each component to the training event so participants can "touch and hold" each device.

~~1.1.6.9.9.4.7.9.~~ If the system includes daylight-harvesting functionality, provide a complete description of how the daylight-harvesting system works.

~~1.1.6.10.9.4.7.10.~~ Provide detailed instructions and demonstrations on how to adjust, calibrate, program, troubleshoot, repair, and replace each sensor and major system component.

~~1.1.6.11-9.4.7.11.~~ Provide detailed instructions and demonstrations on how to repair and troubleshoot individual luminaires.

~~1.1.6.12-9.4.7.12.~~ For computerized systems, provide detailed system login, programming, reporting, and troubleshooting instructions.

~~1.2.9.5.~~ Interior Lighting Controls:

~~1.2.1.9.5.1.~~ General:

~~1.2.1.1-9.5.1.1.~~ Conform to ~~IECC~~ or ASHRAE 90.1 requirements for automated lighting controls based on project goals. Verify with Owner.

~~1.2.1.2-9.5.1.2.~~ All rooms require lighting controls. Rooms with more than one (1) entry shall have lighting controls reviewed with Owner.

~~1.2.1.3-9.5.1.3.~~ Develop Sequence of Operation with the Owner.

~~1.2.1.4-9.5.1.4.~~ Use daylighting strategies and occupancy sensors to control lighting in areas subject to extended unoccupied periods during normal hours of occupancy.

~~1.2.1.5-9.5.1.5.~~ Provide multi-level switching or dimming capabilities in areas where variable levels of illumination are required by users or for energy conservation.

~~1.2.1.5.1-9.5.1.5.1.~~ Such areas can include auditoriums, lecture halls, classrooms, gymnasiums, laboratories, offices, and workshops.

~~1.2.1.6-9.5.1.6.~~ Provide Sequence of Operation for each lighting control strategy and condition in the Documents.

~~1.2.1.7-9.5.1.7.~~ Manufacturer to retest controls within one (1) year after occupancy to ensure systems are operating as intended.

~~1.2.1.8-9.5.1.8.~~ Where dual-level or multi-level switching is provided, switches shall control the same lamp sets at each fixture.

~~1.2.1.9-9.5.1.9.~~ Project specific control layouts shall be included in the Manufacturer's submittals.

~~1.2.1.9.1-9.5.1.9.1.~~ Include Manufacturer's layout indicating coverage areas and sensor types.

~~1.2.1.10-9.5.1.10.~~ The control system shall be complete for all Sequences of Operation and include hardware, software, hand-held devices, panels, cables, etc., as required to test, troubleshoot, program, and operate the system.

~~1.2.1.11-9.5.1.11.~~ Provide complete programming and source code to Owner.

~~1.2.1.12-9.5.1.12.~~ Ceiling sensors shall be located minimum of 4-feet from supply air diffuser to avoid false activation.

~~1.2.1.13-9.5.1.13.~~ Control cabling shall be labeled at both ends.

1.2.1.14.9.5.1.14. **For UIHC:**

1.2.1.14.1.9.5.1.14.1. Occupancy sensors, not vacancy sensors, shall be ceiling mounted, dual-technology type in areas over 150-square foot.

1.2.1.14.2.9.5.1.14.2. Utilize wall mounted type in areas smaller than 150-square foot or for remodel projects where existing light switches can be replaced.

1.2.1.14.3.9.5.1.14.3. Photo sensors shall be ceiling mounted type to be used to switch on/off standard ballasts, not adjust dimming ballasts, unless approved by the Owner.

1.2.1.14.4.9.5.1.14.4. Controls shall be compatible with the facility BAS.

1.2.1.14.5.9.5.1.14.5. Coordinate with the Design Professional's mechanical engineer since occupancy sensors often also control the VAV boxes, terminal air boxes, fan coil units, and/or exhaust fans in the space.

1.2.1.14.6.9.5.1.14.6. In large, open areas, utilize a low voltage control system with a timer to over-ride the light switches.

1.2.1.14.7.9.5.1.14.7. Low voltage control wiring for the energy control systems shall be installed in conduit or trained along conduit and fixture whips they serve.

1.2.1.14.8.9.5.1.14.8. Where the lighting is connected to the BAS, relays and contactors shall be provided to switch the light fixtures.

1.2.1.14.9.9.5.1.14.9. Incandescent Dimmers shall be solid-state dimmer capable of controlling 120 VAC incandescent and quartz halogen lighting intensity over complete range from zero to full light intensity.

1.2.1.14.9.1.9.5.1.14.9.1. Unit shall contain filter to eliminate noise and RFI.

1.2.1.14.9.2.9.5.1.14.9.2. Dimmer shall have an integral on/off switch.

1.2.1.14.10.9.5.1.14.10. Low Voltage Dimmers shall be like incandescent dimmers but specifically made for low voltage lamps.

1.2.1.14.11.9.5.1.14.11. LED dimming shall use 0-10 V switches.

1.2.1.15.9.5.1.15. **For UI Housing:**

1.2.1.15.1.9.5.1.15.1. Use Lutron lighting control systems.

1.2.1.15.2.9.5.1.15.2. Provide ability reduce light levels by connecting non-emergency light fixtures to the lighting control system on student sleeping floor corridors.

1.2.1.16.9.5.1.16. **Control Scenarios:**

SPACE TYPE	CONTROL TYPE	DURATION	HVAC Integration	NOTES
Classroom	Vacancy Sensor	15 minutes	Yes	Teacher over-ride off, test mode on (1 hr.), dimming
Restroom	Occupancy Sensor	15 minutes	No	No manual over-ride.
Office	Vacancy Sensor	15 minutes	Yes	Manual on. Potential for dual level
Mechanical Room	Manual	N/A	No	Manual on/off only in mechanical areas
Conference	Vacancy Sensor and Dimming	15 minutes	Yes	Multi-zone preset control. Possible A/V interface.
Open Office, Auditoria, Corridor, Common Areas	Occupancy Sensor or Central System	15 minutes	Yes	
Storage	Vacancy Sensor	15 minutes	Yes	
Laboratory	Occupancy Sensor	15 minutes	Yes	
Telecommunication Room	Manual	N/A	No	

1.2.2-9.5.2. Sensors:

1.2.2-9.5.2.1. Wall switch sensors shall be factory-set to vacancy mode (manual on/auto off).

1.3-9.6. Exterior Lighting:

1.3.1-9.6.1. Illuminance Targets:

1.3.1.1-9.6.1.1. Exterior illuminance targets shall be selected in accordance with *The Illuminating Engineering Society Lighting Handbook, Latest Edition*.

1.3.1.1.1-9.6.1.1.1. All areas should be considered Lighting Zone 2 (LZ2) with a high activity level.

1.3.1.1.2-9.6.1.1.2. All illuminance targets are maintained values at grade unless noted otherwise.

1.3.1.2-9.6.1.2. No adjustment to illuminance targets shall be made for mesopic adaptation.

Exterior Illuminance Levels	
	Maintained Illuminance (fc)

AREA	Horizontal Minimum @ grade	Horizontal Uniformity Average to Minimum	Vertical Minimum (1)	Vertical Uniformity Average to Minimum	Lighting Reference IES Lighting Handbook 10 th Edition
Bike Rack	2	4:1	0.5 (2)		Table 4.1 Cat H
Building Entrance	2.0 (canopy) 1.0 (open)	2:1	1.0	4:1	Table 22.2, High Activity, L22
Bus Stop	2	4:1	0.5 (2)		Table 4.1 Cat H
Open Parking Lot	0.6	4:1			Table 26.2, High Activity, L22 Table 4.1, Category D
Roadway	0.6 (6)	4:1			Section 26.2.14 Table 4.1, Category D
Walkway	0.4	4:1			Table 26.2, High Activity, L22 Table 4.1, Category C
Walkway Stairs and Ramps	0.6 (3)	5:1	0.2 (2)	10:1	Section 26.2.8, Table 34.2, High Activity; L22
Plazas	0.4	5:1	0.2 (2)	10:1	Table 34.2, High Activity; L22
Facades (4)			4.0	3:1	Table 26.2, High Activity; L22
Drive Under Canopy (Porte-Cocheres)	4.0	2:1	2.0 (2)	4:1	Table 22.2, High Activity; L22
Parking Garages (5)					
Basic	3.8	4:1	0.5 (2)		Table 4.1 Cat H
Ramps (day)	Basic X 2	4:1	Basic X 2		Section 26.2.5.1
Ramps (night)	Basic	4:1	Basic		Section 26.2.5.1
Entry/Exit (day)	Basic X 10	4:1	Basic X 10		Section 26.2.5.1
Entry/Exit (night)	Basic	4:1	Basic		Section 26.2.5.1

4.3.2-9.6.2. Uniformity:

~~1.3.2.1-9.6.2.1.~~ The illuminance uniformity levels shall be based on the ratio of the average illuminance to the minimum illuminance in the calculation area.

~~1.3.2.2-9.6.2.2.~~ This ratio is a maximum and should not be exceeded.

~~1.3.2.3-9.6.2.3.~~ Lower uniformity ratios are acceptable.

~~1.3.3-9.6.3.~~ Special Applications:

~~1.3.3.1-9.6.3.1.~~ Sports Lighting:

~~1.3.3.1.1-9.6.3.1.1.~~ Exterior sports lighting shall be designed to meet current IESNA recommendations based on the specific application.

~~1.3.3.1.2-9.6.3.1.2.~~ Coordinate design criteria with Owner.

~~1.3.3.2-9.6.3.2.~~ Parking Garages:

~~1.3.3.2.1-9.6.3.2.1.~~ Shall be designed to meet the controllability and lighting power density requirements of *ANSI/ASHRAE 90.1-2010*.

~~1.3.3.2.2-9.6.3.2.2.~~ Refer to **Exterior Illuminance Levels** table above for specific illuminance and uniformity requirements.

~~1.3.4-9.6.4.~~ Exterior Illuminance Table Notes:

~~1.3.4.1-9.6.4.1.~~ Vertical illuminance measured at 5-feet above grade.

~~1.3.4.2-9.6.4.2.~~ Vertical illuminance in at least two (2) primary directions of circulation.

~~1.3.4.3-9.6.4.3.~~ Illuminance at treads and landings.

~~1.3.4.4-9.6.4.4.~~ Provide lighting reduction control in accordance with ASHRAE 90.1-~~2010~~

~~1.3.4.5-9.6.4.5.~~ Refer to IESNA interior recommended illumination levels for parking ramp stairways and elevator lobbies.

~~1.3.4.6-9.6.4.6.~~ Select roadways may require additional illumination due to pedestrian conflict. Coordinate requirements with the Owner.

~~1.3.5-9.6.5.~~ Light Trespass:

~~1.3.5.1-9.6.5.1.~~ Projects located at the edge of the campus shall comply with the published light trespass requirements of the adjoining municipality.

~~1.3.5.2-9.6.5.2.~~ No other portions of the municipal ordinances shall apply to university projects.

~~1.3.5.3-9.6.5.3.~~ Project specific light trespass requirements near residence halls or light sensitive areas shall be reviewed with Owner.

~~1.3.6-9.6.6.~~ Exterior Lighting Calculations:

1.3.6.1-9.6.6.1. Lumen Maintenance:

1.3.6.1.1-9.6.6.1.1. Base Lamp Lumen Depreciation (LLD) on the manufacturer's estimated lumen maintenance at 100,000 hours of operation.

1.3.6.1.2-9.6.6.1.2. The LLD may be adjusted for an average ambient nighttime temperature of fifty (50) degrees F (ten (10) degrees C), based on manufacturer testing.

1.3.6.1.3-9.6.6.1.3. The Luminaire Dirt Depreciation (LDD) factor shall be at least five percent (5%).

1.3.6.2-9.6.6.2. Obstructions:

1.3.6.2.1-9.6.6.2.1. Lighting calculations shall model any obstructions that may have an impact on illumination levels in the project area.

1.3.6.2.2-9.6.6.2.2. Obstructions include trees, fences, retaining walls and architectural elements.

1.3.6.3-9.6.6.3. Calculation Grid:

1.3.6.3.1-9.6.6.3.1. Calculation grids shall be selected to provide a reasonable sampling of the project area.

1.3.7-9.6.7. Exterior Lighting Design Submittals:

1.3.7.1-9.6.7.1. Design Professional to submit photometric lighting calculations and results tables for each calculation area.

1.3.7.1.1-9.6.7.1.1. Tables shall include maximum, average, and minimum illumination levels, average to minimum uniformity ratio, and lighting power density.

1.3.7.2-9.6.7.2. Include horizontal point by point plots as well as vertical foot candle levels at the property line and 15-feet beyond the property line.

1.3.7.3-9.6.7.3. Include consideration adjacent lighting.

1.3.7.4-9.6.7.4. Calculation shall identify the fixture mounting heights.

1.3.7.5-9.6.7.5. Light loss factors shall be clearly noted.

1.3.7.6-9.6.7.6. Provide manufacturer's photometric data (IES file).

1.3.7.7-9.6.7.7. Compliance shall be reviewed by the Owner and Utility Operator and approved by the Owner at the conclusion of Schematic Design, Design Development, and Construction Document phases.

1.3.7.8-9.6.7.8. Title block with project name, project number, and date (track revisions).

~~1.3.7.9.9.6.7.9.~~ Color boundaries with legend defining the lighting classification applied to each area within the site boundary.

~~1.3.7.10.9.6.7.10.~~ Legend stating required foot candles for each classification.

~~1.3.7.11.9.6.7.11.~~ Model shall include existing lighting in the area and adjacent area (site and/or building) and all proposed lighting. Provide existing lighting schedule (building and site).

~~1.3.8.9.6.8.~~ Wiring for exterior light fixtures shall be installed in Schedule 40 PVC conduit, 2-inch minimum.

~~1.3.8.1.9.6.8.1.~~ Minimum burial depth shall be 24-inches.

~~1.3.9.9.6.9.~~ Tracer wire shall be pulled in conduit with wiring.

~~1.3.9.1.9.6.9.1.~~ Tracer wire shall be A-Z #12 Solid PE-30 green jacket with yellow stripe.

~~1.3.10.9.6.10.~~ Temporary lighting around the perimeter of the project shall be provided during major construction projects which have displaced existing exterior lighting.

~~1.3.11.9.6.11.~~ Circuiting shall be 208V, 3-phase, 4-wire plus ground with 120V fixtures being installed in a phase "A", "B", "C" alternating fashion.

~~1.3.11.1.9.6.11.1.~~ Provide fusing in base of pole, Ferraz Shawmut FEB-11-11 600V, 30A or equal.

~~1.3.12.9.6.12.~~ Provide in-grade pull boxes (hand-holes) sized and located as required by NEC.

~~1.3.12.1.9.6.12.1.~~ Pull-boxes shall be a minimum of 12-inches by 12-inches; or as required by NEC according to number and size of wires and conduits.

~~1.3.12.2.9.6.12.2.~~ Basis of design is Hubble Quazite concrete service box #PC1212BA12 with lid #PC1212CA00.

~~1.3.12.3.9.6.12.3.~~ Lid to read "U OF I ELECTRIC."

~~1.3.12.4.9.6.12.4.~~ Pull boxes shall be installed at light poles and shall be installed on the side of the light pole opposite the walkway or roadway.

~~1.3.12.5.9.6.12.5.~~ Pull boxes shall be flush with the surface when installed in pavement (PCC, ACC, and pavers).

~~1.3.12.6.9.6.12.6.~~ Pull boxes installed in landscape beds shall be 2-inches above finished grade (which shall consider mulch).

~~1.3.12.7.9.6.12.7.~~ Pull boxes shall be installed on top of a minimum of 12-inches of clean gravel for drainage.

1.3.13.9.6.13. For UIHC:

9.6.13.1. Each point of egress require minimum of two (2) light heads.

1.3.13.1.9.6.13.2. Exterior lighting not attached to the building shall be 120-volt.

1.3.13.2.9.6.13.3. Lighting bollards and luminaires in sidewalks, roadways and retaining walls are prohibited.

1.3.13.3.9.6.13.4. All light sources shall be LED.

1.3.13.4.9.6.13.5. Color temperature shall be 54000 degrees K +/- 300 degrees.

1.3.14.9.6.14. Main Campus walkways, parking lots and outdoor gathering areas shall use the following fixtures:

1.3.14.1.9.6.14.1. Type S1:

1.3.14.1.1.9.6.14.1.1. Description: Single LED type-3 or type-4 cobra head mounted on a 27 ½-foot concrete pole with 6-foot mast arm.

1.3.14.1.2.9.6.14.1.2. Luminaire: Lumark LD-RL-T3-E06-E-BZ -LCF, multi-volt, bronze color

1.3.14.1.3.9.6.14.1.3. Distribution: Type-3

1.3.14.1.4.9.6.14.1.4. Color Temperature: 4000K

1.3.14.1.5.9.6.14.1.5. Power Input: 146W

1.3.14.1.6.9.6.14.1.6. Lumen Output: 12302 lumens

1.3.14.1.7.9.6.14.1.7. Pole: Stresscrete P275-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4-inches, Pole Butt: 9 ¼-inches

1.3.14.1.8.9.6.14.1.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.1.9.9.6.14.1.9. Mast Arm: KA186-H-1 ARM CH BRNZE-TXT

1.3.14.1.10.9.6.14.1.10. Mounting: Anchor bolts, concrete base

1.3.14.1.11.9.6.14.1.11. Application: Parking lots.

1.3.14.2.9.6.14.2. Type S2:

1.3.14.2.1.9.6.14.2.1. Description: Double LED type-3 or type 4 cobra head mounted on a 27 ½-foot concrete pole with 6-foot double mast arms.

1.3.14.2.2.9.6.14.2.2. Luminaire: Two Lumark LD-RL-T3-E06-E-BZ -LCF, multi-volt, bronze color

1.3.14.2.3.9.6.14.2.3. Distribution: Type-3

1.3.14.2.4-9.6.14.2.4. Color Temperature: 4000K

1.3.14.2.5-9.6.14.2.5. Power Input: 146Wx2

1.3.14.2.6-9.6.14.2.6. Lumen Output: 12302x2 lumens

1.3.14.2.7-9.6.14.2.7. Pole: Stresscrete P275-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4-inches, Pole Butt: 9 ¼-inches

1.3.14.2.8-9.6.14.2.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.2.9-9.6.14.2.9. Mast Arm: KA186-H-2 ARM CH BRNZE-TXT, double mast arm.

1.3.14.2.10-9.6.14.2.10. Mounting: Anchor bolts, concrete base

1.3.14.2.11-9.6.14.2.11. Application: Parking lots.

1.3.14.3-9.6.14.3. Type S3:

1.3.14.3.1-9.6.14.3.1. Description: Single LED type-3 or type 4 cobra-head mounted on a 34-foot direct buried concrete pole with 6-foot mast arm.

1.3.14.3.2-9.6.14.3.2. Luminaire: Lumark LD-RL-T3-E06-E-BZ -LCF, multi-volt, bronze color

1.3.14.3.3-9.6.14.3.3. Distribution: Type 3

1.3.14.3.4-9.6.14.3.4. Color Temperature: 4000K

1.3.14.3.5-9.6.14.3.5. Power Input: 146W

1.3.14.3.6-9.6.14.3.6. Lumen Output: 12302 lumens

1.3.14.3.7-9.6.14.3.7. Pole: Stresscrete E340-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4-inches, Pole Butt: 10 ½-inches

1.3.14.3.8-9.6.14.3.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.3.9-9.6.14.3.9. Mast Arm: KA186-H-1 ARM CH BRNZE-TXT

1.3.14.3.10-9.6.14.3.10. Mounting: Direct burial

1.3.14.3.11-9.6.14.3.11. Application: Parking lots.

1.3.14.4-9.6.14.4. Type S4:

1.3.14.4.1-9.6.14.4.1. Description: Double LED type-3 or type 4 cobra head mounted on a 34-foot direct buried concrete pole with 6-foot double mast arm.

1.3.14.4.2-9.6.14.4.2. Luminaire: Two (2) Lumark LD-RL-T3-E06-E-BZ -LCF, multi-volt, bronze color

1.3.14.4.3-9.6.14.4.3. Distribution: Type 3

1.3.14.4.4-9.6.14.4.4. Color Temperature: 4000K

1.3.14.4.5-9.6.14.4.5. Power Input: 142Wx2

1.3.14.4.6-9.6.14.4.6. Lumen Output: 12302x2 lumens

1.3.14.4.7-9.6.14.4.7. Pole: Stresscrete E340-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4-inches, Pole Butt: 10 ½-inches

1.3.14.4.8-9.6.14.4.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.4.9-9.6.14.4.9. Mast Arm: KA186-H-2 ARM CH BRNZE-TXT

1.3.14.4.10-9.6.14.4.10. Mounting: Direct burial

1.3.14.4.11-9.6.14.4.11. Application: Parking lots.

1.3.14.5-9.6.14.5. Type S5:

1.3.14.5.1-9.6.14.5.1. Description: LED pedestrian type-3 or type 4 shoebox mounted on a 19-foot direct buried concrete pole with custom adapter, net pole height 14-feet.

1.3.14.5.2-9.6.14.5.2. Luminaire: Lumark LD-RV-T3-E03-E-BZ -LCF, multi-volt, bronze color

1.3.14.5.3-9.6.14.5.3. Distribution: Type 3

1.3.14.5.4-9.6.14.5.4. Color Temperature: 4000K

1.3.14.5.5-9.6.14.5.5. Power Input: 73W

1.3.14.5.6-9.6.14.5.6. Lumen Output: 6680 lumens

1.3.14.5.7-9.6.14.5.7. Pole: Stresscrete E190-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 7.61 inches.

1.3.14.5.8-9.6.14.5.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.5.9-9.6.14.5.9. Adapter: Custom hex fitter adapter

1.3.14.5.10-9.6.14.5.10. Mounting: Direct bury

1.3.14.5.11-9.6.14.5.11. Application: Pedestrian walkways

1.3.14.6-9.6.14.6. Type S6:

1.3.14.6.1-9.6.14.6.1. LED pedestrian ornamental Queen Anne style luminaire on a decorative 10-foot or 12-foot cast-iron pole.

1.3.14.6.2-9.6.14.6.2. Spring City Electrical Mfg. William & Mary #ALMWMM-LE-2F2Height 34-inches or ALWMMML-LE height 32 3/4-inches clear acrylic globe material. Specify the Tenon size and coordinate with Utility Operator

1.3.14.6.3-9.6.14.6.3. Color to be Semi-Gloss black.

1.3.14.6.4-9.6.14.6.4. Distribution: Optical System Type V

1.3.14.6.5-9.6.14.6.5. Color Temperature: 4000K

1.3.14.6.6-9.6.14.6.6. Power Input: 80W

1.3.14.6.7-9.6.14.6.7. Pole:

1.3.14.6.7.1-9.6.14.6.7.1. Spring City Electrical, Arcadian #PSARC-20-10-00-20 base, height 10-feet or 12-feet, coordinate with Utility Operator for height.

1.3.14.6.7.2-9.6.14.6.7.2. Light center:

1.3.14.6.7.2.1-9.6.14.6.7.2.1. 10-feet 8 11/16-inches.

1.3.14.6.7.2.2-9.6.14.6.7.2.2. One (1) piece heavy wall cast iron per ASTM 11A 48-83 class 30.

1.3.14.6.7.2.3-9.6.14.6.7.2.3. Provide grounding stud, four (4) each 3/4-inch by 24-inch by 3-inch hooks (fully galvanized with one (1) galvanized nut and one (1) galvanized washer per bolt).

1.3.14.6.7.3-9.6.14.6.7.3. Access door located in base with tamper-proof hex socket screws.

1.3.14.6.7.4-9.6.14.6.7.4. Pole Finish:

1.3.14.6.7.4.1-9.6.14.6.7.4.1. Prime paint Sherwin-Williams two (2) part re-coatable epoxy primer (B67H5-Part G and B67V5-Part H)

1.3.14.6.7.4.2-9.6.14.6.7.4.2. Final coat to be Sherwin Williams Semi-Gloss Black.

1.3.14.6.8-9.6.14.6.8. Adapter: Tenon 7-inch diameter by 3/4 -inch high.

1.3.14.6.9-9.6.14.6.9. Mounting: Anchor bolts, concrete base

1.3.14.6.10-9.6.14.6.10. Application: Pentacrest, T. Anne Cleary Walkway

1.3.14.7-9.6.14.7. Type S7:

1.3.14.7.1-9.6.14.7.1. Description: LED round pole-top luminaire on a 19-foot direct buried concrete pole with custom adapter, net pole height 14-feet.

1.3.14.7.2-9.6.14.7.2. Luminaire: Kim CCS-21P3-120L4K120-DB-P, bronze color

1.3.14.7.3-9.6.14.7.3. Distribution: Type 3

1.3.14.7.4-9.6.14.7.4. Color Temperature: 4200K

1.3.14.7.5-9.6.14.7.5. Power Input: 126W

1.3.14.7.6-9.6.14.7.6. Lumen Output: 10297 lumens

1.3.14.7.7-9.6.14.7.7. Pole: Stresscrete E190-APH-G-S90-C/W-HEX RING, hexagonal

1.3.14.7.8-9.6.14.7.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

1.3.14.7.9-9.6.14.7.9. Adapter: Custom hex fitter adapter

1.3.14.7.10-9.6.14.7.10. Mounting: Direct burial

1.3.14.7.11-9.6.14.7.11. Application: Gathering areas

1.3.15-9.6.15. For Oakdale Campus:

1.3.15.1-9.6.15.1. Walkway Lighting:

1.3.15.1.1-9.6.15.1.1. Luminaire: Cooper LDRV T3 or T4-E03-E-LCF-BK, LED, Black

1.3.15.1.2-9.6.15.1.2. Pole: Stresscrete E190-APH-G-E11, hex ring, black

1.3.15.2-9.6.15.2. Parking Lot Lighting:

1.3.15.2.1-9.6.15.2.1. Luminaire: Cooper LDRL-T3 or T4-E06-E-BK-LCF (Cobra Head), LED, Black

1.3.15.2.2-9.6.15.2.2. Pole: Stresscrete E340-APH-G-E11 with KA186-A-H-1-TXT-BLK arms

1.3.15.3-9.6.15.3. Street Lighting:

1.3.15.3.1-9.6.15.3.1. Luminaire: Cooper LDRL-T3 or T4-E06-E-BK-LCF (Cobra Head), LED, Black

1.3.15.3.2-9.6.15.3.2. Pole: Stresscrete E340-APH-G-E11 with KA186-A-H-1-TXT-BLK arms

1.4.9.7. Exterior Lighting Controls:

1.4.1-9.7.1. All exterior lighting shall be controlled in accordance with the requirement of *ANSI/ASHRAE 90.1-2019*.

~~1.4.1.1-9.7.1.1.~~ Exception:

~~1.4.1.1.1-9.7.1.1.1.~~ Due to the 24-hour nature of the campus and safety concerns, illumination levels for parking lots, walkways and building entrances shall not be reduced in accordance with the requirements of *ANSI/ASHRAE 90.1-2019* 9.4.1.7(c).

~~1.4.2-9.7.2.~~ Exterior lighting not attached to the building shall be controlled by the Utility Operator via lighting contactor.

~~1.4.3-9.7.3.~~ Exterior lighting shall not be controlled by the building's energy management system.

~~1.4.3.1-9.7.3.1.~~ Contactor shall be 208 volt, 3-phase, 4-wire, 60 amp (minimum), with hand-off-auto.

~~1.4.3.2-9.7.3.2.~~ Control voltage shall be 120-Volt.

~~1.4.3.3-9.7.3.3.~~ Exterior lighting shall be metered separately from building power.

~~1.4.3.4-9.7.3.4.~~ Contactor shall be mounted downstream of site lighting electrical meter.

27) COMMUNICATIONS

1. General:

1.1. Refer to Section III Article 2 Space Guidelines for Telecommunication Room (TR) requirements.

1.2. Telephone, Wired Network, and Wireless Network hardware shall be included within the project scope. Cost and quantity estimates shall be provided by ITS, ~~or~~ HCIS or Design Professional as applicable.

~~1.3. Telephone, Wired Network, and Wireless Network infrastructure shall be included within the project scope. Cost and quantity estimates shall be provided by Design Professional.~~

~~1.4.1.3.~~ 1.4.1.3. Wireless connectivity shall not replace wired connections, but rather is a supplement.

~~1.5.1.4.~~ 1.5.1.4. There exists a Utility Network separate from the ITS network, BAS, Fire Alarm, and Access Controls systems. The Utility Network cabinet shall be shown on the floor plans.

~~1.6. Use removable fire stopping pillows for cable tray penetrations. Appropriately sized EZ-Path shall be used for cable tray penetrations.~~

~~1.7.1.5.~~ 1.7.1.5. Telephone and miscellaneous signals shall be in conduit. Conduit systems may consist of rigid galvanized steel, IMC, EMT, or a combination of these as required by applicable codes and standards.

2. Utility Network:

2.1. Refer to *UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL* in Appendices for utility network cabinet and pathways.

2.2. University's Utility Operator will provide, pull, and terminate all utility network cable.

3. Telecommunication Pathways:

3.1. Refer to *TELECOMMUNICATION CABLE OUTLET DETAIL* in Appendices.

~~3.2.~~ 3.2. Conduit pathway shall not exceed 40% conduit fill.

~~3.2.3.3.~~ 3.2.3.3. Sections of conduit shall be no longer than 100-feet and shall not have more than two (2) bends between pull points or pull boxes with individual bends not to exceed ninety (90) degrees.

3.2.1. Inside bending radius shall be at least six (6) times the inside conduit diameter for conduit 2-inches or less and at least ten (10) times the conduit diameter for conduit greater than 2-inches.

3.2.2. Pull boxes shall be placed directly after a bend or sized accordingly if the pull box is located at the bend.

~~3.3.3.4.~~ 3.3.3.4. Size conduits, raceway, and pathways with the assumption that each outlet box receives two (2) cables, although only one (1) cable may be installed during a project.

~~3.4.3.5.~~ 3.4.3.5. Conduit and raceway for wall phones shall be sized to receive one (1) cable.

~~3.5.3.6.~~ 3.5.3.6. Secondary pathways shall be minimum 1-inch conduit from work area outlet box to within 24-inches of nearest cable tray of work area outlet.

3.5.1. Secondary alternative solutions shall be coordinated with Owner prior to design or installation.

~~3.6.3.7.~~ Rough-in box at secondary pathway destination shall be Randle Industries Inc., 5 Square Telecommunications box, part number T-55017.

~~3.7.3.8.~~ For rooftop destinations:

3.7.1. Rough-in box at secondary pathway destinations shall be 6-inch by 6-inch by 4-inch NEMA 3-box, mounted and secured on unistrut.

~~3.8.3.9.~~ Fire Rated Pathways shall be:

3.8.1. Specified Technologies Inc., EZ-Path Fire Rated Pathways or approved equal.

3.8.2. ~~Coordinate with Owner size of~~ EZ-Path Fire Rated Pathway locations shall be approved by Owner and allow for 50% growth.

3.8.3. Utilize five (5) ganged pathway bracket in all telecommunications rooms, part number EZP544W.

3.8.3.1. Provide five (5) ~~EZD44S2EXD44S~~ Pathways at each bracket.

3.8.4. Utilized for all interior Telecommunication ~~ClosetRoom~~ primary cable pathways.

~~3.8.5.~~ Utilized for all interior fire-rated communication primary cable pathways.

~~3.8.6.~~ For poke-thru device or floor box, provide a minimum of two (2) 1-1/4 inch conduit from the floor device to the above ceiling space

~~3.8.7.~~ All conduits shall have a plastic bushing on the ends to prevent cable scraping.

~~3.8.8.~~ Rough-in Requirements:

~~3.8.8.1.1.~~ All conduits shall be sized 1-1/4 inch unless otherwise specified.

~~3.8.8.1.2.~~ Typical work outlet shall be Randle Industries Inc, 5 Square Telecommunications box, part number T-55017, with a single gang opening

~~3.8.9.~~ Basket style tray shall be utilized in the above accessible ceiling spaces as the primary means to support and distribute the bulk of all telecommunications cabling.

~~3.8.10.~~ Cable tray shall be sized not to exceed 50% total tray capacity for scheduled Category 6A cables.

~~3.8.11.~~ Designer shall coordinate with architect and engineers to ensure above ceiling space can be accommodated.

~~3.8.12.~~ Provide a minimum of 3-inch clearance from top of ceiling tile to bottom of cable tray.

~~3.8.13.~~ Provide a minimum of 12-inch clearance from top of cable tray to bottom of structure or other obstruction.

3.8.14. Basket tray shall not be routed through rated walls. Utilize EZ-Path fire-rated sleeves to transition through all rated walls. EZ-Path capacity through rated walls shall match the installed cable tray capacity.

3.8.15. J-hooks may be utilized for small quantities of cabling in an above accessible ceiling space.

3.8.16. Category cabling shall be supported with a j-hook every 3 to 5 feet with no cabling resting on any ceiling tiles. Refer to manufacturer's recommended requirements for j-hook placement to avoid reflections in the cable's performance.

3.8.17. Provide a minimum of 3-inches of clearances above ceiling tile and support channels.

~~3.8.5~~3.8.18. System Integrator is responsible for secondary J-hook pathways from main cable tray.

PATHWAY TRADE SIZE	<u>CAT 6</u> 40% FILL CABLES DESIGN	<u>CAT 6A</u> 40% FILL CABLES DESIGN
2-inch caddy clip	35	24
1-inch EMT conduit	8	5
1 ¼-inch EMT conduit	14	8
2-inch EMT conduit	32	19
2 ½-inch EMT conduit	55	33
3-inch EMT conduit	84	50
3 ½-inch EMT conduit	110	65
4-inch EMT conduit	140	83
EZD44	126	156
2400 Wiremold	8	5

MESH TRAY SPECS

SHAPED PART NUMBER	WIDTH	WT. per pc.	FILL*	LOAD lbs./ft	SPLICE / QTY
WBT2X4S	4-inches	7 lbs.	108	45	2
WBT2X6S	6-inches	9 lbs.	163	50	4
WBT4X4S	4-inches	12 lbs.	205	49	4
WBT4X6S	6-inches	13 lbs.	310	49	5
WBT4X8S	8-inches	15 lbs.	416	78	6
WBT4X12S	12-inches	23 lbs.	621	78	6
WBT4X16S	16-inches	27 lbs.	837	108	7
WBT4X18S	18-inches	29 lbs.	942	116	7

*Fill is a theoretical calculation based on a .22-inch diameter cable

3.9.3.10. For UIHC ONLY Pathways:

~~3.9.1. Conduit pathway sizing shall not exceed 40% conduit fill.~~

~~3.9.2.3.10.1. A single continuous conduit run shall not exceed 100-feet without providing a pull box.~~

~~3.9.3.3.10.2. No single conduit bend shall be greater than 90 degrees or an aggregate of bends greater than 180 degrees between pull boxes.~~

~~3.9.4.3.10.3. All 1 1/4-inch conduits shall contain no more than nine (9) Category 6A cables.~~

~~3.9.5. For poke thru device or floor box, provide a minimum of two (2) 1 1/4-inch conduit from the floor device to the above ceiling space.~~

~~3.9.6.3.10.4. Each room shall have an appropriately sized EZ-Path sleeve installed in addition to the conduit rough-ins shown in the appendix.~~

~~3.9.7.3.10.5. The conduit rough-ins shall be stubbed to a ceiling space that can be accessed from the corridors. Or to a common ceiling space with an EZ-Path that feeds the given room from the corridor.~~

~~3.9.8.3.10.6. All conduits shall have a plastic bushing on the ends to prevent cable scraping.~~

~~3.9.9.3.10.7. Rough-in Requirements:~~

~~3.9.9.1. All conduits shall be sized 1 1/4-inch unless otherwise specified.~~

~~3.9.9.2.3.10.7.1. Typical work outlet shall be 4 11/16-inch W by 4 11/16-inch H by 3 1/2-inch D with a single gang opening.~~

~~3.9.9.3.3.10.7.2. Digital signage and status boards shall be FSR Products PWB-200.~~

~~3.9.9.4.3.10.7.3.~~ Video Monitor for AV Conferencing shall be FSR Products PWB-100.

~~3.9.9.5.3.10.7.4.~~ TV (CATV) shall be FSR Products PWB 100/200.

~~3.9.9.6.3.10.7.5.~~ Omnicell/Medical Dispenser shall be FSR Products PWB-200.

~~3.9.10. Basket style tray shall be utilized in the above accessible ceiling spaces as the primary means to support and distribute the bulk of all telecommunications cabling.~~

~~3.9.11. Cable tray shall be sized not to exceed 50% total tray capacity for scheduled Category 6A cables.~~

~~3.9.12. Designer shall coordinate with architect and engineers to ensure above ceiling space can be accommodated.~~

~~3.9.13. Provide a minimum of 3 inch clearance from top of ceiling tile to bottom of cable tray.~~

~~3.9.14. Provide a minimum of 12 inch clearance from top of cable tray to bottom of structure or other obstruction.~~

~~3.9.15. Basket tray shall not be routed through rated walls. Utilize EZ-Path fire-rated sleeves to transition through all rated walls. EZ-Path capacity through rated walls shall match the installed cable tray capacity.~~

~~3.9.16. J hooks may be utilized for small quantities of cabling in an above accessible ceiling space.~~

~~3.9.17. Category cabling shall be supported with a j hook every 3 to 5 feet with no cabling resting on any ceiling tiles. Refer to manufacturer's recommended requirements for j hook placement to avoid reflections in the cable's performance.~~

~~3.9.18. Provide a minimum of 3 inches of clearances above ceiling tile and support channels.~~

~~3.9.19. System Integrator is responsible for secondary J hook pathways from main cable tray.~~

~~3.9.20.3.10.8.~~ Refer to UIHC HCIS TECHNOLOGY TYPICAL DETAILS in appendices.

4. Racks, Cabinets and Enclosures

4.1. Racks shall be used to house termination components of the telecommunications cabling infrastructure. They shall also host data network equipment.

4.2. The racks shall be a standard 7-foot tall, 2-post with a floor mounted design. Provide with two-sided EIA hole pattern and 19-inch wide.

4.3. A minimum of three (3) feet shall be given between rows of racks.

4.4. Install 10-inch vertical cable manager between adjoining racks and a 6-inch cable manager closest to the wall. The rack closest to the wall shall be given 6-inches of clearance away from the wall.~~Install 12-inch vertical wire managers between adjoining racks and a 6-inch cable manager at each end of the row. The rack closest to the wall shall be given 6-inch of clearance away from the wall.~~

4.5. All racks shall be secured and anchored at the base of the rack.

4.6. Each rack shall be bonded with a dedicated #6 AWG copper conductor back to the [TC's TDR's](#) TGB.

4.7. For UIHC ONLY:

4.7.1. TDR rack numbering shall start with RR-01 at the wall opposite the TDR door entrance.

4.7.2. Refer to TYPICAL RACK DIAGRAM DETAIL in appendices.

~~4.7.2.4.7.3.~~ Refer to TYPICAL UI-ITS RACK DIAGRAM DETAIL in appendices.

5. Cable Management

5.1. Provide horizontal cable managers inside each rack. See the rack diagram illustrations in the appendix for additional information.

5.2. Provide wall mounted ladder tray to help manage and support cabling at all floor penetrations and sleeves. The width of the tray shall cover the width of the series of floor penetrations.

~~5.5.3.~~ All cabling entering the TC shall be neatly bundled utilizing hook and loop straps for support. Maintain these bundles while cable enters each rack for termination. Bundle sizes shall not exceed manufacturer's recommendations to minimize crosstalk.

~~5.1.5.4.~~ For UIHC ONLY:

~~5.1.1.5.4.1.~~ All racks scheduled for a telecommunications room shall host double-sided cable managers. A 6-inch cable manager shall be placed at the ends of the row. All other vertical managers placed between racks shall be 12-inch in width. Any reduction in size from 12-inch shall require authorization from HCIS department.

~~5.1.2. Provide horizontal cable managers inside each rack. See the rack diagram illustrations in the appendix for additional information.~~

~~5.1.3. Provide wall mounted basket tray to help manage and support cabling at all floor penetrations and sleeves. The width of the tray shall cover the width of the series of floor penetrations.~~

~~5.1.4. All cabling entering the TDR shall be neatly bundled utilizing hook and loop straps for support. Maintain these bundles while cable enters each rack for termination. Bundle sizes shall not exceed manufacturer's recommendations to minimize crosstalk.~~

6. Grounding and Bonding:

6.1. Telecommunication Main Ground Busbar (TMGB):

6.1.1. Chatsworth Products Inc. ¼-inch by 4-inch by 20-inch, part number 40158-0120

6.2. Telecommunication Grounding Busbar (TGB):

6.2.1. Chatsworth Product Inc., ¼-inch by 4-inch by 12-inch, part number 40153-012

6.3. Telecommunication Horizontal Rack Busbar:

6.3.1. Chatsworth Product Inc., 3/16-inch by ¾-inch, part number 10610-019

6.4. Bonding Conductors shall be insulated copper.

- 6.5. Flat, braided, aluminum ground straps shall be utilized for bonding sections of aluminum cable tray.
- 6.6. Bonding Conductor size shall be determined by NEC.
- 6.7. Interconnecting Bonding Conductor (IC):
 - 6.7.1. Shall be insulated, copper, number 3/0 AWG referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications.
- 6.8. Telecommunication Bonding Backbone (TBB):
 - 6.8.1. Shall be insulated, copper, number 3/0 AWG min or as required by code.
- 6.9. Equipment Bonding Conductor (EK):
 - 6.9.1. Shall be green colored insulation, copper, number 6 AWG.
- 6.10. Bonding Conductor Terminations:
 - 6.10.1. Two ~~(2)~~-hole compression lugs shall be Panduit or approved equivalent. Thomas and Betts.
 - 6.10.2. Two ~~(2)~~-hole lugs for No. 6AWG: Panduit, Pan-Lug LCCX6-14AL, compression lug, two-hole, long barrel, color blue. Panduit part number LCCX6-14A-L, long barrel type, catalogue number 54816BE, high conductivity wrought copper, electro tin plated, or approved equal, installed at TMGB or TGB location.
 - 6.10.3. One ~~(1)~~-hole compression lugs should be Panduit or approved equivalent. shall be Thomas and Betts.
 - ~~6.10.4. Two-hole compression lugs for No. 6 AWG: Panduit, Pan-Lug LCA6-14L, compression lug, one-hole, standard barrel, color blue. Panduit part number LCA6-14L, long barrel one (1) hole lugs, catalogue number 54905BE, high conductivity wrought copper, electro tin plated, or approved equal, installed at out ends from TMGB or TGB.~~
 - 6.10.4. Two-hole compression lugs for No. 3/0 AWG: Panduit, Pan-Lug LCC3/0-12W-X copper compression lug, two-hole, long barrel, color orange. Panduit part number LCC3/0-12W-X.
 - 6.10.5. All cable trays within the TC shall be grounded and bonded to the cable tray system.
 - 6.10.6. A grounding bus bar shall be provided within every TC mounted in an approved location by ITS-Physical Infrastructure.
 - 6.10.7. Provide a grounding/bonding connection from the telecommunications grounding bus bar to:
 - 6.10.7.1. Each individual rack
 - 6.10.7.2. Each conduit penetration entering the room
 - 6.10.7.3. Ladder Rack
 - 6.10.7.4. Shield/jacket of fiber optic cable

6.10.7.5. Exposed structural steel

6.11. For UIHC ONLY:

~~6.11.1. All cable trays within the TDR shall be grounded and bonded to the cable tray system.~~

~~6.11.2. A grounding bus bar shall be provided within every TDR mounted above the cable tray system. It shall be a 12 inch by 4 inch insulated copper bus bar and grounded to the electrical service ground.~~

~~6.11.3. Provide a grounding/bonding connection from the telecommunications grounding bus bar to:~~

~~6.11.3.1. Each individual rack~~

~~6.11.3.2. Each conduit penetration entering the room~~

~~6.11.3.3. Basket tray~~

~~6.11.3.4. Shield/jacket of fiber optic cable~~

~~6.11.3.5. Exposed structural steel~~

6.11.1.1. Refer to UIHC HCIS Bonding Connection Figure T1-1 in Appendices.

6.11.3.6.2 Eliminate Telecommunication Horizontal Rack Busbar. -Existing rack has mounted grounding lug.

7. Data and Voice Horizontal Infrastructure:

7.1. Horizontal Station Cable:

7.1.1. Base cabling design shall be Commscope Systemax GigaSPEED CAT 6A, 23 AWG, 4 pair, Unshielded, UTP, Solid Bare Copper Conductor, FEP/PVC, CMP, Plenum Cable, White Jacket part number 2091B WHT C6A 4/23 U/UTP W1000/ 760107268, ANSI/TIA-56-C.2 Category 6A.

7.1.2. Cabling shall be white.

7.1.3. Install all cables through primary and secondary pathways.

7.1.3.1. Installation methods and techniques shall satisfy current ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

7.1.3.2. Cables shall not be installed or routed in any manner that violates the manufacturer's specifications.

7.1.4. Support all cable such that they will not be damaged by normal building use.

7.1.5. Communications may share support superstructures with multiple utilities.

7.1.6. Design superstructures to support the entire connected load.

- 7.1.7. Provide metallic conduit sleeves and nylon bushings for all floor and wall penetrations.
- 7.1.8. Horizontal cabling shall be continuous from the work area communication outlet to the distribution frame.
- 7.1.9. Cables shall be terminated in accordance with current ANSI/TIA/EIA-568, Commercial Building Telecommunications Cabling Standard, observing the industry standards for terminating color-coded cables for premises and campus environments.

7.2. Patch Panels:

- 7.2.1. Patch panels shall be CommScope [Discrete Distribution Module Pane, M-series, UTP, 1U, 24 port, White, CommScope part number](#)~~Systimax 360-EVOLVE 24-PORT PATCH PANEL 360-E-MOD 1U-24 CPP-UDD14-1U24, Systimax part number_760245531.~~

7.3. Information Outlets:

- 7.3.1. Outlets shall be CommScope ~~Systimax GigaSPEED X10 M-Series Modular Jack, RJ45, Cat6A Unshielded, White. CommScope XL-MGS600-262-CAT6A 1-Port MOD-JACK 110-8W8P-UTP T568A/B-CAT6A, Systimax part number 760092429-WHITE.~~

- ~~7.3.1.~~7.3.2. Contractor shall utilize T-568B, T-568A for UI, termination style for all data jacks.

7.4. Faceplates:

- 7.4.1. Two (2) port faceplates shall be CommScope ~~Systimax 2-PORT FLUSH MT UNLOADED SGL GANG M-SERIES, part number 10833063-WHITE, CS-COMMSCO M12LE-262, CommScope part number 018168469.~~
- 7.4.2. Four (4) port [faceplates](#) shall be CommScope ~~Systimax 4-PORT FLUSH MT UNLOADED SGL GANG M-SERIES, Systimax part number 108333162-WHITE, CS-COMMSCO M14LE-262 M14L-262. ComScope part number 108168543.~~
- 7.4.3. Wall phone faceplates shall be CommScope ~~Systimax SINGLE PORT WALL PHONE PLATE 1-PORT FLUSH MT UNLOADED SGL GANG M-SERIES W/MTG LUGS, Systimax part number M10LW4SP STAINLESS.~~

7.5. Patch Cables:

- 7.5.1. Patch cables shall be CommScope ~~Systimax GigaSPEED XL CAT6A Patch Cable CBL ASSY MOD 23-4PR CAT6A T568B Blue, Systimax part number CPCSSX2-0ZFxxx.~~
- 7.5.2. USER END: Patch cables shall be CommScope ~~Systimax GigaSPEED XL CAT6A patch cable CBL ASSY MOD 23-4PR 10FT CAT6A T568B BLUE, Systimax part number CPCSSX2-0ZF010 (10-FT).~~
- 7.5.3. ITS SPACES: Patch cables shall be CommScope ~~Systimax GigaSPEED X10D CAT6A patch cable CBL ASSY MOD 23-4PR 15FT CAT6A T568B BLUE, Systimax part number CPCSSX2-0Z015 (15-FT).~~ ~~XL-CAT6A patch cable CBL ASSY MOD 23-4PR 14FT CAT6A T568B BLUE, Systimax part number CPCSSX2-0ZF014 (14-FT).~~

7.6. For UIHC:

- 7.6.1. Typical work area outlet cable shall be Category 6A with minimum of 2 cables.
- 7.6.2. Wireless access points cable shall be Category 6A with minimum of 2 cables.
- 7.6.3. Telemetry cable shall be Category 6A, FTP.
- 7.6.4. HDBase-T/Audio Visual Application cable shall be Category 6A, FTP.
- 7.6.5. Project is to provide copper patch cables. Coordinate length and quantity with ITS-Physical Infrastructure. HCIS. 70% capacity of installed horizontal.
- 7.6.6. All riser-rated cabling shall be blue. All plenum-rated cabling shall be white.
- 7.6.7. UIHC HCIS approved low-voltage vendors: CEC, Tri-City Electric, and Baker Group.
- 7.6.8. Refer to UIHC HCIS TYPICAL FACEPLATE DETAIL in appendices.
- 7.6.9. Refer to UIHC HCIS APPROVED MANUFACTURERS AND PRODUCTS in appendices.

8. Fiber Optic and Copper Backbone and Riser Cable:

8.1. Premise Fiber Optic Risers Cable:

- 8.1.1. Unless otherwise noted, optical fiber backbone cabling shall be Corning MIC Tight-Buffered, Interlocking Armored cable, 24-F Single-mode (OS2) plenum rated. Corning part number 024E88-33131-A3. Optical fiber riser cable must be Corning FREEDM Loose Tube Gel-Free Plenum Cable. Strand count will be specified per project.

8.1.1.1. Single mode application use OS2 SM

8.1.1.2. All fiber shall be installed as a home run.

8.1.1.3. No mid-span splices are allowed.

8.1.1.4. Provide a service loop of 240-feet (minimum) at both ends of the cable.

8.1.2. Accepted Single Mode OS2 Connector Installation:

8.1.2.1. Corning CCH Pigtail Cassette CCH-CS12-B3-POORE.

8.1.2.2. Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-B3-POORE cassette loaded with LC/APC connectors.

8.1.3. Accepted Single Mode Connectors for Non-Building Plenum Fibers:

8.1.3.1. Corning UniCam LC/APC High-Performance Connectors

8.1.4. Accepted Fiber Housings:

8.1.4.1. Corning Closet Connector Housing CCH

8.1.4.1.1. The CCH is a one (1) piece enclosure

8.1.4.2. Clearfield xPAK

8.1.4.2.1. The xPAK Part Number 6PAK-~~SCLCA~~ fiber demarcation housing for fire panels and other similar applications.

8.1.5. Accepted Closet Connector Housing CCH Panels:

~~8.1.5.1. CCH-CP06-59~~ CCH-CP12-A9

~~8.1.5.2. CCH-CP06-B3~~

~~8.1.5.1-8.1.5.3.~~ CCH-CP12-B3

8.2. ~~Outside~~ Outdoor Plant Fiber Optic Cable:

8.2.1. Single-mode fiber shall have a core diameter of 8.3 microns and cladding diameter of 125 microns.

8.2.2. Maximum attenuation shall be:

8.2.2.1. 0.44 dB/Km @ 1310 nm.

8.2.2.2. 0.35 dB/Km @ 1550 nm.

8.2.2.3. Zero-dispersion wavelength of 1310 nm + or - 10 nm.

8.3. Loose-Tube Fiber Cable:

8.3.1. Provide Corning ALTOS Loose-tube, gel-free cable. ~~Strand count to be determined by ITS-Physical Infrastructure, 24 degrees F, single mode (OS2), part number 024ZU4 T4F22D20.~~

8.3.2. Suitable for underground (in conduit) and aerial installation.

8.3.3. Cable sheath rated and marked OFNR for riser applications per NEC.

8.3.4. Distances shall be marked on the outside in feet/meters in such a way that normal installation does not rub them off or make them unreadable.

8.3.5. ~~Six (6) or t~~ Twelve (12) fibers per buffer tube.

8.3.6. Use standard color codes on sub-buffers per current EIA/TIA 598.

~~8.4. Copper:~~

~~8.4.1. Copper riser cable shall be reviewed with Owner.~~

~~8.4.2. Type CMP, 24 AWG twisted, solid annealed copper conductors insulated with PVC skin over expanded polyethylene, having an overlapped corrugated aluminum shield, fire resistant FR-PVC plastic jacket, and ANSI/TIA/EIA 568-A, and Category 3 performance rated.~~

~~8.4.3. Accepted copper splice connecting hardware shall be 3M or AT&T.~~

~~8.4.4. Splice connecting hardware shall be 25-pair modular connectors specifically designed for straight splicing applications.~~

~~8.4.5. Splice modules shall be designed to accommodate splicing of 22–26 AWG solid copper conductors having Polyvinyl Chloride (PVC) or Polyethylene (PE) insulation~~

~~8.4.6. Splice connectors shall be manufactured with solder-plated contacts and be unfilled (dry) in controlled environment applications and filled (encapsulated) in moisture or corrosion prone environments.~~

~~8.4.7. Accepted copper splice closures shall be 3M.~~

8.5.8.4. For UIHC ONLY:

~~8.5.1-8.4.1.~~ Backbone fiber shall have a certification test using a Fluke DSX-5000 equivalent or higher. A summary report shall be provided with the horizontal cable test reports, verifying the fiber cabling will perform to the level it is designed and installed for. If any issues are found, the contractor shall also provide a OTDR test and provide trace reports to confirm an acceptable installation.

~~8.5.2-8.4.2.~~ Fiber type for UIHC campus locations (Intra-building Infrastructure) shall be Single Mode AND Multimode (OM4) AND Multimode (OM1). Strand count shall be minimum of 24 SM and 12 MM (OM4 and OM1). Termination type shall be LC-APC.

~~8.5.3-8.4.3.~~ Fiber type for new clinic or off-site facility shall match incoming fiber type with minimum strand count of 24. Termination type shall be LC-APC.

~~8.5.4-8.4.4.~~ Project is to provide fiber patch cables. Coordinate type and length with HCIS system integrator.

~~8.5.5-8.4.5.~~ Copper backbone cable shall be provided in all TDRs in UIHC campus locations.

~~8.5.6-8.4.6.~~ Provide a minimum 50-pair Category 3 cable landed on the rack using a patch panel. Cable shall terminate on the wall to a Category 5e-rated 110 block.

~~8.5.7-8.4.7.~~ One 50 pair Category 3 cable shall route from a dedicated 48-port patch panel mounted on a relay rack to a wall location in the telecommunications room adjacent to the multi-pair voice riser cabling. Each pair shall be terminated. Pair 24+25 shall be terminated on port 24 of the patch panel. Pair 49+50 shall be terminated on port 48 of the patch panel.

~~8.5.8-8.4.8.~~ Horizontal cabling shall be terminated in the respective telecommunications room that is on the same floor as the area it is serving.

~~8.5.9-8.4.9.~~ Category 6A (and above) cabling shall be continuous without splice.

~~8.5.10. Contractor shall utilize T-568B termination style for all data jacks.~~

~~8.5.11-8.4.10.~~ Typical work area outlets shall be 4-port, thermoplastic, and fog white in color. Operating rooms and/or clean rooms may require stainless steel.

~~8.5.12-8.4.11.~~ Any work area outlet that is scheduled to go into a patient headwall will often require oversized faceplates to sufficiently cover the rough-in opening. Coordinate with headwall provider.

~~8.5.13-8.4.12.~~ All jacks scheduled to serve typical data or telephony services shall be fog white in color. Utilize blank inserts for any unused data jack openings.

~~8.5.14-8.4.13.~~ Many ceiling and wall mounted field devices shall be served using a patch cord as the final connection. The horizontal cabling shall be terminated in an above ceiling space to a surface mounted jack and never directly to the device. The contractor shall utilize a factory terminated patch cable that matches the performance of the horizontal link.

~~8.5.15-8.4.14.~~ Refer to UIHC HCIS STANDARD 4-PORT DATA OUTLET AND LABELING SCHEME in appendices.

~~8.5.16-8.4.15.~~ Refer to UIHC HCIS TYPICAL COPPER RISER CABLING TERMINATION DETAIL in appendices.

9. CATV Distribution and Horizontal Infrastructure:

~~9.1. Horizontal drop cable shall be Plenum rated 75Ω Series 6.~~

~~9.2. Horizontal drop lengths shall not exceed 295 feet over Series 6 (refer to note below under Cable Type).~~

~~9.3. Horizontal cabling between Telecommunications Rooms and outlet/drop locations shall be made as individual home runs.~~

~~9.3.1. Intermediate splices or couplings are not allowed.~~

~~9.4. Group individual drops by cable length/loss and connected to a multi-port tap with appropriate dB loss level within that outlet's associated TC.~~

~~9.5. Label all horizontal drops with outlet location and run length.~~

~~9.6. Distribution feeds less than 500 feet shall be plenum rated, 75Ω Series 11.~~

~~9.7. 75-ohm port terminators will be installed on all unused tap ports at both remote and head-end. Torque all terminators to 20 pounds/inch.~~

~~9.8. F Connectors shall be hand tightened and then torqued to 20 pounds/inch.~~

~~9.9. The Constructor shall ensure that the CATV System meets or exceeds the following system design criteria at any and all CATV System drops:~~

~~9.9.1. Minimal Signal level range as required.~~

~~9.9.2. Analog marker channels 2, 78, and 120 will be 6dBmV+/- 4 dBmV.~~

~~9.9.3. Carrier to noise ratio shall be 43 dB (minimum).~~

~~9.9.4. Humidity shall be one percent (1%).~~

~~9.10. Cable Type:~~

~~9.10.1. Horizontal Plenum ≤295 feet Series 6 — Commscope 2276V WHRL Belden — Snap n-Seal SNS6PLA.~~

~~9.10.2. Closet Risers ≤ 500 feet Plenum — Series 11 Commscope 2285V WHRL Plenum compression Connector — Corning / Gilbert GAF UR 11PL.~~

~~9.10.3. Risers between closets exceeding 500 feet to be semi flex .500 (Times Fiber part number T10500J/GRS500AFMDU03 F/M) or fiber optic cable.~~

~~9.10.4. Cable Type shall be coordinated with Owner.~~

9.11.9.1. For UIHC:

9.1.1.

New construction and full remodels shall not use CATV infrastructure. Only to be used for partial remodel and retrofit.

~~9.11.1.9.1.2.~~ This system (product, software and installation shall be procured outside of the contract documents. It shall be the role of the technology designer to illustrate the required rough-in, pathways and power needed to support the system. See the inserted images for a rough-in legend, call outs used and back box mounting heights.

~~9.11.2.9.1.3.~~ Refer to the appropriate pathways section above.

9.1.4. Refer to UIHC HCIS A/V DESIGN in appendices.

~~9.11.3. New construction and full remodels shall not use CATV infrastructure. Only to be used for partial remodel and retrofit.~~

10. Nurse Call Design

10.1. The nurse call system (product, software, and installation) shall be procured outside of the contract documents. It shall be the role of the technology designer to illustrate the required rough-in, pathways, and power needed to support the system.

10.2. Refer to UIHC HCIS NURSE CALL SYMBOL LEGEND in Appendices.

10.3. Refer to UIHC HCIS NURSE CALL ROUGH-IN DESIGN REQUIREMENTS in Appendices.

11. Audio Visual (A/V) Systems:

11.1. General

11.1.1. LST-A/V group shall approve all A/V designs, including equipment locations, up-to-date accepted models, and design guidance.

11.1.2. Equipment shall be installed with the latest firmware and software.

11.1.3. All signals shall be scaled to the highest possible resolution for the equipment.

11.1.4. Constructor shall use industry Audio Visual Best Practices as outlined by InfoComm / AVIXA.

- 11.1.5. Equipment mounting enclosure / closet shall be sufficiently ventilated to assure that equipment operates at or below manufacturer recommendations.
- 11.1.6. Provide system training for operations staff and departmental users.
- 11.1.7. All unused and/or abandoned A/V low-voltage cables shall be removed.

11.2. Submittals and Shop Drawings:

- 11.2.1. Submittals shall include equipment specifications, floor plan locations, rack elevations, and equipment riser diagram showing equipment terminations.
- 11.2.2. Submit as-built drawings, including keypad buttons and GUI layouts for controllers, equipment locations, and cable routing to the LST-A/V group prior to Final Completion.
- 11.2.3. A/V distribution and control system configuration files, including source code and GUIs, shall be submitted to the Owner prior to Final Completion.
- 11.2.4. Provide EASE (Enhanced Acoustics Simulator for Engineers), or equivalent acoustic model for auditoriums, screening rooms, or special use rooms.

11.3. Pathways and Cables:

- 11.3.1. Pathways shall be specific for A/V, no sharing with other cables (e.g., network cables).
- 11.3.2. All cables and adaptors shall be 4K or better.
- 11.3.3. All A/V-over-IP category cables shall be Commscope (700210164) Cat 6 Plenum Cable Spring Green color.
- 11.3.4. All A/V-over-IP cables shall be terminated in patch panels at the equipment rack.
 - 11.3.4.1. All patch panels shall be Commscope Systimax 360 Evolve series.
- 11.3.5. Cables shall be installed in J-Hooks or in 1 ¼-inch conduit, unless otherwise noted.
- 11.3.6. Cables shall meet or exceed the manufacturer's requirements and/or recommendations, Belden is preferred.
- 11.3.7. All cabling shall be homerun; no splicing allowed.
- 11.3.8. Cable shall be properly rated for use case (riser, plenum, or wet location installation). All cables installed within walls or above ceiling shall be plenum rated.
- 11.3.9. Cabling shall be labeled with function, specific origination and termination point at both ends of cable. Numbering alone is not acceptable.
- 11.3.10. Hook and loop (Velcro) fasteners shall be used for cable management.
 - 11.3.10.1. Tie wraps or zip ties are not acceptable.

11.4. Control Equipment:

- 11.4.1. Primary Touch Panels shall be Extron TLP Pro Series 10-inches or 12-inches.
- 11.4.2. Primary Keypad Controllers shall be Extron MediaLink Plus series or eBUS series.
- 11.4.3. Processors shall be Extron Pro.
 - 11.4.3.1. Processor shall be integrated into keypad or video switch chassis.

11.5. Network Switches

- 11.5.1. Unmanaged network switches shall be Luxul A/V series.
- 11.5.2. Managed network switches shall be Luxul; A/V series.

11.6. Switching and Distribution:

- 11.6.1. Matrix Switchers shall be Extron DTP CrossPoint 4K series with integrated IPCP control processor and 100-watt 70-volt audio amplifier.
- 11.6.2. Presentation Switchers shall be Extron IN1608xi series integrated DTP/HDBaseT transmitter and receiver with integrated IPCP control processor, 100-watt 70-volt amplifier.
- 11.6.3. A/V-over-IP solutions shall not be allowed unless approved by LST-AV group.
- 11.6.4. Media Distribution shall be Extron DTP and XTP Transmitters and Receivers.
- 11.6.5. All switching and distribution shall all be 4K, or better, from end-to-end.

11.7. Audio Equipment:

- 11.7.1. Amplifiers shall be Extron digital amplifiers; 70-volt systems designed with a minimum twenty percent (20%) headroom.
- 11.7.2. Speakers shall be JBL Control Contractor, Extron.
- 11.7.3. Digital Signal Processors (DSP) shall be Biamp Tesira / TesiraForte / Devio, Extron.
- 11.7.4. Ceiling Microphones shall be Audix M3, Audix M55, or Biamp. (Design shall correct polar pattern for application).
- 11.7.5. Wireless Microphones shall be Shure.
- 11.7.6. Desktop Microphones shall be Shure.
- 11.7.7. All rooms with voice uplift require an Extron AAP 301 plate with an XLR in and an XLR out (70-103-18) to allow for assisted listening device and a microphone / mixer input.

11.8. Video (Visual) Equipment:

- 11.8.1. Projectors shall have a laser light engine. Lamp-based projectors shall not be used.
 - 11.8.1.1. 5000 lumens and less projectors shall be Sony.

- 11.8.1.2. 5001 lumens and greater projectors shall be Epson.
- 11.8.2. Displays shall be commercial rated; Samsung, Sony, or LG.
- 11.8.3. Cameras (PTZ) shall be Sony, Vaddio, or PTZ Optics.
- 11.8.4. Cameras (USB) shall be Sony, Vaddio, PTZ Optics, or Logitech.
- 11.8.5. Screens shall be Da-Lite or Draper and shall be recessed with low voltage wall switch for backup control.
- 11.8.6. Blu-ray Players shall be Sony or LG.
- 11.8.7. Contact LST-AV group for currently accepted Document Cameras.
- 11.8.8. Unified Camera / Soundbar / Speakerphone shall be Crestron UC-SB1-CAM or Logitech MEETUP.

~~11.8.9. For UIHC:~~

~~11.8.9.1. Review projectors and other related video (visual) equipment with the Owner.~~

11.9. Equipment Racks, Lecterns, Mounts and Back Boxes:

- 11.9.1. Racks and Rack Accessories shall be Middle Atlantic with Middle Atlantic Security Screws HSK.
- 11.9.2. Use pull-out and rotating rack when rear access to rack is not easily available.
- 11.9.3. Empty rack spaces shall be filled with 1U or 2U blank panels (no larger than 2U).
- 11.9.4. Lecterns shall be ADA compliant, current standard is Spectrum Freedom One eLift.
- 11.9.5. Mounts shall be Chief, RPMA series for projectors and Fusion for displays.
 - 11.9.5.1. Chief THINSTALL may be used for ADA compliance.
- 11.9.6. Back boxes shall be FSR PWB-320-AC2 and PWB-320-CV.
- 11.9.7. All back boxes for displays shall be mounted 60-inches above finished floor to center unless otherwise noted.
- 11.9.8. Rack layout:
 - 11.9.8.1. All equipment to be used by instructor shall be located at the lectern.
 - 11.9.8.2. Preferred layout starting at top of rack is power distribution unit (PDU), application access point (AAP), Blu Ray, PC, Equipment drawer.
 - 11.9.8.3. If equipment rack is full height, layout shall be started at center so usable equipment is easily accessible.

11.10. Miscellaneous Equipment:

- 11.10.1. Power Distribution Unit (PDU) shall be Luxul PDU-08 and shall be included in all equipment racks.
- 11.10.2. AV USB Bridge shall be Extron MediaPort 200.
- 11.10.3. Video Conferencing Codec shall be Zoom, Skype for Business, and Microsoft Teams.
- 11.10.4. Lecture Capture shall be Panopto.
- 11.10.5. Room Scheduler Shall be Meetio MR-PH10-Y3 mount to Vidabox VB VESA MNT FSW.
- 11.10.6. BYOD shall be Mersive Solstice Pod Gen3 Enterprise Edition with unlimited users and shall include a maintenance agreement that includes operating system updates / compatibility for a total of five (5) years from acceptance (Substantial Completion of the system).

11.11. For UIHC

11.11.1. This system (product, software, and installation) shall be procured outside of the contract documents. It shall be the role of the technology designer to illustrate the required rough-in, pathways and power needed to support the system. See the inserted images for a rough-in legend, call outs used and back box mounting heights.

11.11.2. Refer to the appropriate pathways section above.

11.11.3. Refer to UIHC HCIS A/V DESIGN in appendices.

11.12. Primex Wireless Clocking

11.12.1. UIHC to provide direction on which types of clocks to use for different applications; Digital clocks are typical for procedure type rooms

11.12.1.1. POE Digital clocks CFCI

11.12.1.2. RF Analog clocks OFCI

~~11.12.1.3.~~ 11.12.1.3. POE Analog Clocks OFCI

12. UIHC-ITS-Physical Infrastructure Telecommunications Close-out Process and Deliverables:

12.1. The consultant shall specify that the contractor is responsible to provide the following documentation.

12.1.1. Telecommunications Room Readiness Checklist

~~Checklists and as-builts must be provided when TRs are ready or minimum 15 days prior to activation.~~

12.1.1.1. The general contractor / construction manager shall supply a checklist to the owner that indicates that the telecommunications room is ready for equipment installation. Checklists and as-builts must be provided when TRs are ready or minimum 15 days prior to activation.

~~12.1.1.1~~,~~12.1.1.2~~. The checklist shall include, at minimum, the following:

~~12.1.1.2~~,~~12.1.1.3~~. All dirty construction work has been completed. This includes drilling, hammering or any work that can create dust and debris inside the room.

~~12.1.1.3~~,~~12.1.1.4~~. Closet is cleared of all construction debris.

~~12.1.1.4~~,~~12.1.1.5~~. Floors are cleaned, sealed, and mopped.

~~12.1.1.5~~,~~12.1.1.6~~. Ladder rack, cable tray and racks are installed per construction documents.

~~12.1.1.6~~,~~12.1.1.7~~. EZ-Path sleeves are all installed.

~~12.1.1.7~~,~~12.1.1.8~~. Walls, ~~+~~ Plywood, and overhead structures are painted.

~~12.1.1.8~~,~~12.1.1.9~~. All backbone and horizontal infrastructure is pulled, terminated, tested, and labeled.

~~12.1.1.9~~,~~12.1.1.10~~. Power properly installed with dedicated ground, printed labels with circuit breaker number.

~~12.1.1.10~~,~~12.1.1.11~~. Permanent lighting is installed.

~~12.1.1.11~~,~~12.1.1.12~~. Verify all electrical outlets are operational.

~~12.1.1.12~~,~~12.1.1.13~~. Telecommunications grounding and bonding system is fully installed. Submit ground test results.

~~12.1.1.13~~,~~12.1.1.14~~. Telecom room door is secure with card access and an automatic closer. Closer shall be properly adjusted. Dust sweep has been installed on inside of the room.

~~12.1.1.14~~,~~12.1.1.15~~. Room environmental controls are adequate and operating to maintain proper temperature and humidity levels.

~~12.1.1.15~~,~~12.1.1.16~~. The list shall have columns that assign responsibility to the appropriate trade, completion date and room for comments.

12.1.2. As-Builts:

12.1.2.1. Provide a hard copy floor plan print to be placed inside each telecommunications distribution room and an electronic copy to HCIS for internal record keeping (HCISProjectAsBuilts@healthcare.uiowa.edu). This shall be a clean drawing illustrating only telecommunications infrastructure with updated quantities that accurately reflect everything that was installed during the project. All labeling will be visible on this drawing to indicate locations that correlate to the patch panels inside the telecommunications room.

12.1.2.2. Multi-phased projects require as built documentation for each phase, so activations can happen as phases become occupied.

12.1.3. Cabling Run Excel Document:

12.1.3.1. Provide a formatted excel schedule that contains information for all copper cabling on the project. The schedule shall have the following columns with all associated information filled in.

12.1.3.2. Building Name/Number

12.1.3.3. Room Name (location of data jack)

12.1.3.4. IDF Closet Number, [TC for UI](#)

12.1.3.5. Wire run (jack label)

12.1.3.6. Pairs

12.1.3.7. Termination Style (568B, [56A for UI](#))

12.1.3.8. Cable Type (Category 6, 6A, 6A foil)

12.1.3.9. Function (data, camera, wall phone, ELMS reader, RTLS, WAP)

12.1.3.10. Provide a formatted excel schedule that contains information for all fiber optic cabling on the project. The schedule shall have the following columns with all associated information filled in.

12.1.3.11. Fiber

12.1.3.12. Source Building

12.1.3.13. Source Room

12.1.3.14. Source FB (Fiber Box or Shelf), [FP \(Fiber Panel\) for UI](#)

~~12.1.3.15. Source FB Panel (Splice panel)~~

~~12.1.3.16.~~~~12.1.3.15.~~ Destination Building

~~12.1.3.17.~~~~12.1.3.16.~~ Destination Room

~~12.1.3.18.~~~~12.1.3.17.~~ Destination FB (Fiber Box or Shelf), [FP \(Fiber Panel\) for UI.](#)

~~12.1.3.19. Destination FB Panel (Splice panel)~~

~~12.1.3.20.~~~~12.1.3.18.~~ Fiber Type (single mode, multimode OM1, multimode OM4)

~~12.1.3.21.~~~~12.1.3.19.~~ Length

~~12.1.3.20.~~ Strand count

[12.2. For UIHC ONLY](#)

[12.2.1. Source FB Panel \(Splice panel\)](#)

~~12.1.3.22.12.2.2.~~ [Destination FB Panel \(Splice panel\)](#)

28) ELECTRONIC SAFETY AND SECURITY

1. Electronic Access Control and Security (AMAG):

1.1. General:

- 1.1.1. Owner shall be involved in the planning and design of all AMAG projects.
- 1.1.2. Renovations and additions shall use the Owner's existing software license.
- 1.1.3. Stairwell Fire Re-entry Requirements shall be identified in the Door Sequence of Operations in the documents.
 - 1.1.3.1. Provide card reader at Fire Alarm Control Panel or as directed by the Owner and Authority Having Jurisdiction.
- 1.1.4. Design Professional shall review condition of existing doors and hardware and advise Owner of necessary or recommended replacements or upgrades.
- 1.1.5. Access Control Function shall be identified on the door schedule and access controls narrative.
 - 1.1.5.1. Use Access Control Function definitions included in this section.
- 1.1.6. Design Professional shall determine the impact on cable tray and conduit capacity during Design Development Phase and review with Owner

1.2. Definitions:

1.2.1. Monitored:

- 1.2.1.1. Utilizes door position switch, latch bolt monitor, and/or request to exit.

1.2.2. Controlled:

- 1.2.2.1. Any monitored opening that utilizes electronic locking and unlocking.

1.2.3. Access Control Function Designations and Definitions:

- 1.2.3.1. **RDR** - Single Card Reader Entrance, Acceptable Exit: Single proximity card reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts.
- 1.2.3.2. **DRDR** – Dual Card Reader Entrance: Dual card reader (card in / card out), electrically unlocking door hardware, latch bolt monitoring, door position contacts.
- 1.2.3.3. **HRDR** – Hand Geometry Reader Entrance, Acceptable Exit: Hand geometry reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts.
- 1.2.3.4. **ERDR** – Hand Geometry and Card Reader Entrance, Acceptable Exit: Hand geometry reader and single proximity card reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts. Either reader allows access.

- 1.2.3.5. BRDR – Hand Geometry and Companion Reader Entrance, Acceptable Exit: Hand geometry reader and single proximity card reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts. Both readers required for access.
- 1.2.3.6. PEAE – Programmable Entrance Acceptable Exit: Electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts. Unlocked via programming, no reader.
- 1.2.3.7. AEO – Acceptable Exit Only: Request to exit, latch bolt monitoring, door position contacts. Cannot be electrically unlocked.
- 1.2.3.8. EES – Emergency Exit with Sounder: Latch bolt monitoring, door position contacts, locally audible piezo sounder connected to access control system.
- 1.2.3.9. EEO – Emergency Exit Only: Latch bolt monitoring, door position contacts.
- 1.2.3.10. DCO – Door Contact Only: Door position contacts.
- 1.2.3.11. RRDR – Stairwell reentry doors with failsafe electrically unlocking locks, single card reader entrance, acceptable exit, request to exit, latch bolt monitor, door position contacts and key switch at fire panel to unlock all stairwell doors simultaneously.

1.2.4. Building / Space Security Level Definitions:

- 1.2.4.1. Security level designations correspond to internal University Security processes and protocols.

- 1.2.4.1.1. Definitions are provided to establish minimum security requirements.

- 1.2.4.1.2. Individual spaces within a building may have differing Security Levels.

- 1.2.4.1.3. All spaces shall be reviewed with the Owner.

- 1.2.4.2. Level 1: Low Risk:

- 1.2.4.2.1. Spaces are accessible during normal working hours and locked after hours.

- 1.2.4.2.2. Exterior doors have alarms that register in the software and self-closers.

- 1.2.4.2.3. Scheduled exterior doors have electronic locks.

- 1.2.4.2.4. Occupants are responsible for security of interior doors.

- 1.2.4.3. Level 2: Moderate Risk:

- 1.2.4.3.1. Spaces are locked when unoccupied.

- 1.2.4.3.2. All items in Level 1, plus self-closers on all interior public corridor doors.

- 1.2.4.3.3. Alarms may be required on some interior doors.

- 1.2.4.4. Level 3: Substantial Risk:

1.2.4.4.1. All items in Level 2, plus electronic locks/card readers and self-closers on selected interior doors, card access on elevators to restricted floors, emergency lock down buttons on large capacity rooms.

1.2.4.4.2. Door alarms may also be local, audible alarms.

1.2.4.5. Level 4: High Risk:

1.2.4.5.1. Building and spaces have restricted access.

1.2.4.5.2. All items in Level 3, plus intrusion detection system, card reader on main door to exit, some areas require 2-factor authentication to enter.

1.2.4.6. Level 5: Extremely High Risk:

1.2.4.6.1. Building and spaces have restricted access.

1.2.4.6.2. All items in Level 4, plus video surveillance system (only required at entrances and exits of restricted areas) and 2-factor authentication

1.3. Openings:

1.3.1. When the entry door into a space has access control functionality, all other doors into that space shall be electronically monitored.

1.3.1.1. If electronic access is added to a room with multiple doors, all doors shall use AMAG.

1.3.2. Each opening utilizing request to exit function shall be wired to an individual reader port on a central door controller.

1.3.3. Openings with multiple doors shall have a single card reader controlling a single opening.

1.3.4. Any opening with a reader shall have keyed override.

1.3.5. Access control readers shall control only one (1) opening.

1.3.6. Secure side door operator actuator shall only be active when door is electrically unlocked.

1.4. Openings, Exterior Doors:

1.4.1. Shall be controlled.

1.4.2. Shall have Fail Secure unlocking lever handles, powered by the battery back-up system in the Access Control System, as required.

1.4.3. Shall be unlocked by same fire entry card reader that unlocks stair well doors for reentry onto building levels from stairwells.

1.4.3.1. Card reader shall be located next to fire alarm panel or in the fire command center.

1.4.3.2. The active credential for this card reader to be kept in the building Knox Box.

1.4.4. Overhead doors shall be monitored, less latch bolt monitor.

1.4.5. Main entrances shall be monitored.

1.4.5.1. One (1) door shall be controlled via reader(s).

1.4.5.2. Remaining doors to be exit only.

1.4.6. For UI Housing:

1.4.6.1. All exterior doors building entry shall have card readers.

1.4.6.2. Exit only doors shall not require a card reader.

1.5. Roof and Terrace Doors:

1.5.1. Unoccupied roof or terrace, or with occupancy loads less than fifty (50), shall be mortise locks with deadbolts.

1.5.1.1. Deadbolts shall be locked / unlocked by key from either side and include deadbolt monitor switch.

1.5.1.2. Door shall include door position switch, furnished, and installed by Access Control supplier.

1.5.2. Assembly occupancy roof or terraces with occupancy loads of more than fifty (50), are to swing into the building.

1.5.2.1. Doors shall have an exit device with latch bolt monitor switch, to allow free egress from the roof or terrace.

1.5.2.2. Door shall include door position switch, furnished, and installed by Access Control supplier

1.5.3. Roof and Terrace doors shall use Yale CRCN 8860-2 FL DBM or equivalent.

1.6. Openings, Interior Doors:

1.6.1. Main entrances into university classrooms and auditoriums shall be controlled by reader(s).

1.6.2. Document Requirements:

1.6.2.1. The Design Professional shall develop a Sequence of Operations narrative and include sequence in documents.

1.6.2.2. The documents shall include an access control door schedule for all monitored and controlled doors.

1.6.2.3. Schedules shall identify the door/room served, Door Function, list of device/devices on opening, special functionality, and location.

1.6.2.4. Door function to be identified according to the Access Control Function Designations and Definitions listed above.

- 1.6.3. Openings into University Classrooms shall have auto-lock and auto-unlock features through the access control system.
- 1.6.4. Spaces shall have emergency locking pushbutton switches located near the lectern.
- 1.6.5. A single emergency pushbutton shall operate all doors.
- 1.6.6. The Access Control Head-end equipment shall be in the ITS Equipment Room and shall have:
 - 1.6.6.1. 120-volt emergency power circuit direct-wired into an Access Control panel. A circuit from an ITS electrical panel may be used.
 - 1.6.6.2. All lock power supplies shall be direct-wired from a dedicated 120-volt circuit.
- 1.6.7. Entry door into space shall have an RDR function.
- 1.6.8. Equipment room shall have ¾-inch sanded walls, one (1) side fire-rated plywood with a painted finish. Plywood to be provided by General Contractor.
- 1.6.9. Dedicated Ethernet port shall be located on wall adjacent to the equipment.
- 1.6.10. For UI Housing:
 - 1.6.10.1. Interior secured doors shall have strikes with latch bolt monitoring and door contact.
 - 1.6.10.1.1. Door contract shall be ElectronicRex Moxion Control.
 - 1.6.10.1.2. Power supplies shall be fed from emergency power.
 - 1.6.10.2. Student sleeping rooms:
 - 1.6.10.2.1. To gain access to a student room there needs to be two (2) locations to use credentials (ID access card).
 - 1.6.10.2.1.1. The first is external entry into the residential portion of the building from a public space, including stairwells, public corridors to residential corridors, residential elevator access and/or residential elevator lobby access.
 - 1.6.10.2.1.2. The second access control point credential is the student room door. Student room doors shall have wireless card readers.
 - 1.6.10.3. Student living space corridors do not need to be secured from other student space corridors (i.e., if two (2) residential "Houses" are on the same level without public space between them, no secured entry separation is required.
 - 1.6.10.4. Elevators:
 - 1.6.10.4.1. Elevators that travel to student residential floors need to be secure such that a person who gains entry in a public space cannot travel to student space without using a credential (ID Card) to gain access.

1.6.10.4.2. This can be achieved in one of the following ways, listed in order of preference priority, as follows:

1.6.10.4.2.1. First preference: Elevators to student space may be located behind a locked (access controlled) door that a resident would need to present credential (ID card) to gain access to elevator lobby through doors.

1.6.10.4.2.2. Second preference: Elevators may require the use of a credential (ID card) to gain access to the elevator car.

1.6.10.4.2.3. Third preference (Least desired approach): Students would be required to use credential (ID card) inside the elevator car to gain access to the student living floors.

1.6.10.4.3. Public elevator(s) that are used by the public to travel between public floors (Madison Street entrance and Anne Cleary Walkway entry, for example) shall not have stops at student living space floors and public elevator lobby to be separated from residence hall elevator lobbies.

1.6.10.4.4. Freight elevator(s) that can be reached by public require use of access control credential or key, to limit access to University's authorized staff only.

1.7. Electronic Access:

1.7.1. Submittals and Shop Drawings:

1.7.1.1. Constructor submittals shall include product data, system block diagram(s), door details, controller schedule, door schedule, and camera schedule.

1.7.1.2. Schedules shall reference room numbers, door numbers, and equipment numbers, as applicable.

1.7.2. The access control supplier and integrator shall be Security Equipment, Inc.

1.7.3. Vendor identification information is permitted only on access control system panels.

1.7.4. All component hardware shall be 24-volt.

1.7.5. Equipment and components shall be located to allow access for maintenance and inspection.

1.7.6. UL or WH fire-rated doors or frames shall not be modified as to void the label or fire-rating.

1.7.7. Unless otherwise noted, electrical components are to be furnished and installed by the Access Control Supplier.

1.7.8. For UIHC:

1.7.8.1. Any new systems shall be tied into the existing Software House C*Cure 800 system.

1.7.8.2. Programming and final connections shall be provided by the Owner.

1.7.8.3. Entrances to inpatient units shall be controlled by access control system with communication to unit clerk location.

1.7.8.3.1. Coordinate device locations and voltages with the Owner.

1.7.8.4. Electric strikes, automatic door operators, door position switches, magnetic locks, and any power supplies shall be coordinated for who provides each device (door hardware supplier or access control system installer) and what voltage each device shall be.

1.7.8.5. Door access control devices and hardware shall be coordinated with the emergency paths of egress to maintain life safety.

1.7.8.6. Door Security Levels shall be as follows:

1.7.8.6.1. Level 0 Door:

1.7.8.6.1.1. No Security.

1.7.8.6.2. Level 1 Door:

1.7.8.6.2.1. Local alarm, request to exit device, door position switch, Secure Core.

1.7.8.6.2.2. Examples: Exterior and stairwell entry doors.

1.7.8.6.3. Level 2 Door:

1.7.8.6.3.1. Local alarm, request to exit device, door position switch, door locking device (either a magnetic lock or an electric strike depending on application), Secure Core.

1.7.8.6.3.2. Examples: Clinic entrances for electronic unlocking during business hours.

1.7.8.6.4. Level 3 Door:

1.7.8.6.4.1. Local alarm, request to exit device, door position switch, door locking device (either a magnetic lock or an electric strike depending on application), proximity card reader, Secure Core.

1.7.8.6.4.2. Examples: Clinic main entrances for afterhours proximity card access, Telecom closets, sensitive areas, and exterior staff access.

1.7.8.6.5. Level 4 Door:

1.7.8.6.5.1. Local alarm, request to exit device, door position switch, door locking device (either a magnetic lock or an electric strike depending on application), proximity card reader, Secure Core.

1.7.8.6.5.2. Level 4 doors also require a fixed color, day/night CCTV camera and wire to an Owner provided phone.

1.7.8.6.5.3. Examples: Entrance doors from building exterior to permit remote or card access.

1.7.8.7. The following are the typical system components:

1.7.8.7.1. Control Panel: Software House C*Cure iStar controller 16-door.

1.7.8.7.2. Card Reader: HID 5455 proximity card reader.

1.7.8.7.3. DSM: Door status monitor, GRI 180/184/8080T series.

1.7.8.7.4. REX: t.Rex-Lt2.

1.7.8.7.5. Electric Strike: HES 1006.

1.7.8.7.6. Mag Lock: Locknetics 390+ 24-volt DC.

1.7.8.7.7. Single door: Mortice lock Sargen 8200 LW1-L with Storeroom function.

1.7.8.7.8. Cables: Types and sizes per the manufacturer's recommendations with labeled jacket.

1.7.8.8. Provide one (1) extra device for each five (5) devices on the project, minimum one (1) per device.

1.7.8.9. All panel locations, including in Telecommunication rooms, shall be access controlled.

1.7.8.10. All cabling shall be installed in conduit, cable tray or J-hooks.

1.7.8.10.1. Cabling shall not lay on ceiling grid.

1.7.8.11. Cable tray shall be installed in the main corridors with conduit stubs extended from the devices to the cable tray.

1.7.9. AMAG System:

1.7.9.1. Access control and monitoring systems shall be networked with the existing AMAG Symmetry Enterprise for Central Station managed by Facilities Management.

1.7.9.2. Server(s), central station software, back-up systems, proximity cards, badging station, and printer shall be provided by the Owner.

1.7.10. AMAG Panel:

1.7.10.1. Panels shall AMAG M2150.

1.7.10.2. Provide M2150 100k memory module for nodes requiring more than 20,000 card holders.

1.7.10.3. Provide AMAG M2100 for systems containing biometric devices.

1.7.10.4. Access Control enclosure shall be Flex Power model FP0150/250-2C82D8E8A.

1.7.11. Power Supplies:

- 1.7.11.1. Power supplies for QEL, motor driven, electric latch retraction of panic devices shall be provided as an integral, on-board part of the Norton 6061 automatic operator provided and installed by the Hardware Supplier.
- 1.7.11.2. Maintenance access to power supply shall not interfere with door operation.
- 1.7.11.3. Lock power, other than for QEL, motor driven, electric latch retraction panic devices shall be supplied by power supply internal to Access Control enclosure.

1.7.12. Emergency Locking Push-Button Switches:

- 1.7.12.1. Safety Technology International, series 2000 and custom labeled 'PUSH TO LOCK DOOR.'

1.7.13. Door Position Switch and Latch Bolt Monitoring:

- 1.7.13.1. Door position switches for wood doors shall be 3/8-inch diameter recessed, similar to GRI model 2020-12.
- 1.7.13.2. Door position switches for steel doors shall be 1-inch diameter recessed, similar to GRI model number 184-12.
- 1.7.13.3. Latch bolt monitor to be provided with door hardware.

1.7.14. Door position switch monitoring and latch bolt monitoring shall be wired separately, such that the system shall indicate whether the door is held open, or the latch is retracted.

1.7.15. A general door alarm is not acceptable.

1.7.16. Card Readers:

- 1.7.16.1. Card readers shall be HID Signo Series. HID Signo Reader 40 for wall-mount or HID Signo Reader 20 for mullion or jamb mount.

1.7.16.1.1. Color shall be charcoal gray or black.

1.7.16.1.2. Mounting height shall be 36-inches above finished floor to centerline.

1.7.16.1.2.1. **For UIHC:** Mounting height shall be 46-inches above finished floor to centerline.

1.7.16.1.3. Wiegand Interface Modules shall be provided.

- 1.7.16.2. LED on the proximity readers shall be wired such that the green LED lights up when a valid card is presented and the red LED lights up when an invalid card is presented.

1.7.17. Biometric Reader:

- 1.7.17.1. Hand geometry readers shall be Schlage Recognition Systems HKCR Handkey with enrollment stations as necessary.

1.7.18. Request to Exit Motion Detectors:

1.7.18.1. When integral hardware request to exit switches are not possible, motion detectors similar to Bosch DS160 series shall be utilized.

1.7.19. Stairwell Fire Reentry Card Reader:

1.7.19.1. Card reader shall simultaneously unlock required reentry exit stairwell doors and transmit an alarm to University Key and Access Services.

1.7.19.1.1. Key and Access Services will remotely relock doors.

1.7.19.2. Shall be installed next to fire panel or in fire command room, as directed by the Owner and Authority Having Jurisdiction.

1.7.19.3. Provide signage to indicate "Fire Department Emergency Access Only."

1.7.19.3.1. Mount directly adjacent to card reader adjacent to fire panel.

1.7.19.4. Provide red/green LED at card reader to indicate door status.

1.7.19.4.1. Red = Doors Secure.

1.7.19.4.2. Green = Doors Unlocked.

1.7.19.5. Provide monitor relay in Electronic Access Control and Security system to provide door secure status.

1.7.20. Cabling and Pathways:

1.7.20.1. Card reader cabling shall be yellow jacket, plenum-rated, continuously labeled 'Access Control Cable,' similar to CSC model number 112115.

1.7.20.2. Biometric reader cabling shall include all of the following

1.7.20.2.1. Yellow jacket, plenum-rated, continuously labeled 'Access Control Cable,' similar to CSC model number 112115.

1.7.20.2.2. Yellow jacket, plenum-rated, continuously labeled 'Access Control Cable,' similar to Lake Cable P222EPST-04CO.

1.7.20.2.3. Yellow jacket, plenum-rated, continuously labeled 'Access Control Cable,' similar to Lake Cable P182CS-04CO.

1.7.20.3. Monitored opening cabling shall be yellow jacket, plenum-rated, continuously labeled 'Access Control Cable,' similar to CSC model number 110200.

1.7.20.4. Pull strings shall be provided in all cabling pathways.

1.7.20.5. Cabling in occupied spaces shall be in conduit.

1.7.20.5.1. Exposed conduit in occupied spaces shall be painted to match adjacent surfaces.

1.7.20.6. Conduit shall be minimum ¾-inch with pull boxes at a minimum every 50-feet.

1.7.20.7. Maximum conduit fill shall be forty percent (40%).

1.7.20.8. Communication cable shall be supported by ITS cable trays, when available.

1.7.20.8.1. Design Professional shall determine the impact on cable tray and conduit capacity during the Design Development Phase.

1.7.20.9. When cable trays are not available or have inadequate capacity, J-hooks (spaced at a maximum of 4-feet) or conduit shall be used.

1.7.20.10. ITS closets shall have access control when used as a cabling pass thru.

1.7.20.11. Wire and cable from the node to all devices at each door shall be continuous, without splices.

1.7.21. Elevators:

1.7.21.1. Elevator nodes shall be located in the elevator equipment room.

1.7.22. System startup:

1.7.22.1. Constructor shall conduct a one hundred percent (100%) device check-out prior to Owner's demonstration and training.

1.7.22.2. Service Device check-out documentation to be submitted to Owner.

1.7.22.3. Electronic Access as-built drawings shall be provided to the Owner prior to Owner's demonstration and training.

2. Video Surveillance Systems:

2.1. Video surveillance systems require Owner approval.

2.2. Video surveillance shall be installed at entrances and exits to and from building / space(s) with security level designated as level 5: extremely high risk.

2.3. Video recording for IP cameras shall be on a server managed and maintained by ITS.

2.3.1. Video surveillance cameras shall be AXIS® IP based capable of H.264/H.265 Video Codec compression standards. The camera shall record at no less than 8 frames per second (fps) and at no less than a resolution of 720p.

2.3.2. Analog cameras are prohibited except as a temporary transition to IP based cameras, where video encoding can be utilized temporarily to transition the account to the IP camera standard.

2.3.3. Elevator car video surveillance installations shall use a 2N® Telecommunications 2-wire adapter for coaxial or 2-wire provisioning of PoE power and ethernet data with an IP camera.

2.4. The video license for each camera shall be purchased from DPS by the department as part of the project.

2.5. Design Professional shall indicate camera and equipment locations on Construction Documents.

2.6. For UI Housing:

2.6.1. Provide video surveillance cameras at the following locations:

- 2.6.1.1. Front Desk facing guest access to desk
- 2.6.1.2. Elevator lobbies
- 2.6.1.3. Each entry door (corridor doors, stairway doors, etc.) into student sleeping floors/areas
- 2.6.1.4. Each exterior door
- 2.6.1.5. Dining facility grill station point of sale facing public corridor
- 2.6.1.6. Exterior site locations determined by the Owner
- 2.6.1.7. Each passenger elevator car and special elevator car
- 2.6.1.8. Cash register locations that involve credit or cash transactions

2.7. For UIHC:

2.7.1. Security Cameras shall not be installed in exam/consult rooms unless written approval has been obtained from the UIHC Legal Counsel.

2.7.2. Typical system components are Bosche unless noted otherwise, as follows:

- 2.7.2.1. Cameras: Model #LTC 0455.
- 2.7.2.2. Lens Guide: Model #TC9902, #TC9908, or #TC9958 (depending on focal length, zoom capabilities, and iris range). Exact types shall be coordinated with Safety & Security.
- 2.7.2.3. Camera Ceiling Housing: #TC9369.
- 2.7.2.4. Camera Corner Wall/Ceiling Housing: #TC2075 or #TC2073.
- 2.7.2.5. Camera Wall/Ceiling Housing for Secure Area: #TC9305.
- 2.7.2.6. Camera Domed Housing: #TC9345MT7.
- 2.7.2.7. Camera Mounts: #TC9211 or #TC9216 (16-inch).
- 2.7.2.8. Camera Weatherproof Housing: #TC9340-1 with #SS4500 sunshield and #LK4500 lock kit.
- 2.7.2.9. Indoor/Outdoor Scanner: Model #TC6230S-115.
- 2.7.2.10. Receiver/Driver: Model #TC8560-1.
- 2.7.2.11. Digital Video Recorder (DVR): American Dynamics Intellex #D6003D-048R.
- 2.7.2.12. Intellex, 16-channel, Deluxe, #480GB, rack mounted.
- 2.7.2.13. Network Video Technologies #NV-1662R and #NV-213A active hub and transceivers.

2.7.2.14. Cables: Dukane or West Penn. Types and sizes per the manufacturer's recommendations.

3. Security Alarm/Intrusion Alarm Systems:

3.1. Shall be approved by Department of Public Safety.

3.2. Shall utilize AMAG or a system approved by Department of Public Safety.

3.3. If AMAG is used, the area that is protected by the security system shall be set up as its own company within the software.

4. Fire Alarm and Detection Systems:

4.1. General

4.1.1. Do not place detention systems Mechanical and Telecom spaces as there is a high occurrence of false alarms.

4.1.1.4.1.2. Refer to BUILDING FIRE ALARM SYSTEM DETAILS in Appendices for existing building system manufacturer and model.

4.1.2.4.1.3. AHU shut-down circuit shall automatically reset after FACP is reset.

4.1.3.4.1.4. Where special installations may apply, refer to the State Fire Marshal, University's Insurance Carrier, UIHC Safety and Security, or UI Department of Public Safety for additional requirements.

4.1.4.4.1.5. Refer to specification section 28 31 00 FIRE ALARM AND DETECTION SYSTEMS located at <https://www.facilities.uiowa.edu/design-construction-specification-documents>.

4.1.5.4.1.6. Any proposed changes affecting the fire alarm system require Owner approval.

4.1.6.4.1.7. Finished back boxes shall be provided by equipment supplier for any surface-mounted pull stations or signaling devices.

4.1.7.4.1.8. All detection devices shall be placed in easily accessible locations. Smoke, heat, audio visual devices, etc., shall be ceiling mounted ~~on solid surfaces~~.

4.1.8.4.1.9. Constructor shall assume responsibility and control of the building fire alarm system when the project affects ten percent (10%) or more of the existing fire detection and notification devices.

4.1.9.4.1.10. The Constructor shall coordinate with Department of Public Safety and UIHC Safety and Security when off-site reporting is required.

4.1.10.4.1.11. The Constructor shall follow the Fire Safety acceptance testing procedures noted in the Fire Alarm and Detection Specification.

4.1.11.4.1.12. All non-UIHC fire alarm systems shall provide outputs to the campus wide UI Fire Safety Department Command Center Systems

~~4.1.12.4.1.13.~~ The building shall be one hundred percent (100%) tested and approved by UI Fire Safety, UIHC Safety and Security, and/or UI Housing prior to Substantial Completion.

~~4.1.13.4.1.14.~~ For UI Housing:

~~4.1.13.1.4.1.14.1.~~ Systems shall be Notifier.

~~4.1.13.2.4.1.14.2.~~ Signals shall go to fire alarm panel and show alarm.

~~4.1.14.4.1.15.~~ For UIHC:

~~4.1.14.1.4.1.15.1.~~ Refer to specification section 28 31 00 UIHC FIRE ALARM AND DETECTION SYSTEMS located at <https://www.facilities.uiowa.edu/design-construction-specification-documents>.

~~4.1.14.2.4.1.15.2.~~ For the Main Hospital Campus - the existing fire alarm system consists primarily of addressable Simplex panels with some non-addressable panels in the older areas of the facility.

~~4.1.14.3.4.1.15.3.~~ Temporary connections shall be made to ensure continued service of the remaining areas affected by the fire alarm work.

~~4.1.14.4.4.1.15.4.~~ All devices removed from the fire alarm system during construction shall be removed in the program and verified at the True Station Worksite.

~~4.1.14.5.4.1.15.5.~~ Reprogramming of devices shall occur at the time the portion of the work is completed, to return the fire detection system to its original state.

~~4.1.14.6.4.1.15.6.~~ The program shall be free of all troubles relating to the area impacted by the project.

~~4.1.14.7.4.1.15.7.~~ All fire alarm systems shall provide outputs to the RCP – Command Center.

~~4.1.14.8.4.1.15.8.~~ Prior to Substantial Completion of the project, reprogramming of the devices shall be required to return the fire detection system to its original status.

~~4.1.14.9.4.1.15.9.~~ All new devices shall be connected to the nearest addressable panel per the direction of UIHC Safety and Security.

~~4.1.14.9.1.4.1.15.9.1.~~ A Class A addressable loop may be required to extend to and from the renovated area.

~~4.1.14.10.4.1.15.10.~~ For renovation projects on the UIHC Main Campus, existing devices may be connected to an older non-addressable system.

~~4.1.14.10.1.4.1.15.10.1.~~ Devices shall be removed and returned to the Owner.

~~4.1.14.10.2.4.1.15.10.2.~~ New and reused devices may not be connected back to the non-addressable panels.

4.2. Fire Alarm Control Panel (FACP):

4.2.1. General:

- 4.2.1.1. Systems shall include capacity for handling a minimum of 20% more circuits and alarm causing and signaling devices.
- 4.2.1.2. Coordinate FACP location with local authority having jurisdiction and Owner.
- 4.2.1.3. FACP shall be Simplex 4100ES intelligent analog system with voice.
 - 4.2.1.3.1. No substitutions shall be allowed as other manufacturers do not work with the existing fire alarm network.
- 4.2.1.4. Fire alarm control panel cabinets shall be mounted at 6-feet 0-inches to the top of the cabinet with 6-inch spacing between cabinets.
- 4.2.1.5. Panel door locks shall be front mounted.
- 4.2.1.6. Fire alarm panel shall be an intelligent analog system with voice.
- 4.2.1.7. Top of FACP shall be 6-feet above finished floor and shall have minimum 2-foot clearance on each side.
- 4.2.1.8. When multiple FACP's are required, set panels 6-inches apart while maintaining 2-foot clearance on each side.
- 4.2.1.9. Provide Owner all hardware devices and software for off-line programming, complete with manuals and software files.
- 4.2.1.10. Provide locking breaker on 120-volt AC power source and label "Fire Alarm.", EClips ELOCK-FA or Owner approved equal.
- 4.2.1.11. Fire alarm control panel power shall be supplied dedicated circuit(s).
- 4.2.1.12. Single pole, 120/277V switches shall be installed within the fire alarm control panel to disconnect all AC and battery power.
- 4.2.1.13. A duplex receptacle on a circuit separate from the fire alarm panel shall be installed under the main fire alarm control panel.
- 4.2.1.14. Provide battery back-up capable of supplying a minimum of 24-hours of operation in normal conditions followed by no less than 15 minutes of alarm.
- 4.2.1.15. Coordinate location with Sprinkler System Fire Department Connection.
- 4.2.1.16. For UI Housing:
 - 4.2.1.16.1. Coordinate fire alarm control panel manufacturer with Owner.
- 4.2.1.17. **For UIHC:**
 - 4.2.1.17.1. Systems shall include capability for handling a minimum of twenty-five percent (25%) more mapnet/IDnet addresses and twenty-five percent (25%) more audio/visual devices, in addition to any planned future building expansions.

4.2.1.18. A separate Signaling Line Circuit shall be installed per floor.

4.2.1.19. FACP Bypass Switches:

4.2.1.19.1. Access Level 3:

4.2.1.19.1.1. City disconnect (for both alarms and troubles).

4.2.1.19.1.2. Audio by-pass.

4.2.1.19.1.3. Visual circuit by-pass.

4.2.1.19.1.4. Electronic door latches / locks.

4.2.1.19.1.5. Air handler by-pass.

4.2.1.19.2. Access Level 1:

4.2.1.19.2.1. Damper by-pass.

4.2.1.19.2.2. Elevator by-pass.

4.2.1.19.2.3. Fire Door by-pass.

4.2.1.19.3. Provide separate fan shutdown switches for each air handler.

4.2.1.19.4. Provide smoke purge by-pass where required.

4.2.1.20. FACP shall be located at the designated fire department entrance.

4.2.1.20.1. Coordinate location with local fire department, UIHC Safety and Security (as applicable), and UI Department of Public Safety.

4.2.1.20.2. Remote annunciator(s) shall only be provided when required by UIHC Safety & Security, UI Fire Safety Department, UI Department of Public Safety, State Fire Marshal, and/or Authority Having Jurisdiction.

4.2.2. System Resets:

4.2.2.1. A fire alarm resets shall require a security level access level of 3.

4.2.2.2. Equipment that has been bypassed in software shall not change state-of-condition during a reset.

4.2.3. Voice Control Point Switches:

4.2.3.1. "All Clear" message.

4.2.3.2. "Weather Alert" message.

4.2.3.3. "All Speakers" talk switch.

4.2.3.4. Audio zone momentary contact switches to manually select the following individual speaker circuits:

4.2.3.4.1. Each Elevator Car

4.2.3.4.2. For UIHC:

4.2.3.4.2.1. Each Elevator Bank.

4.2.3.4.3. Each stairwell connected to adjacent floor zone.

4.2.3.4.4. Each building level and approved fire zone.

4.2.3.4.5. Outside speakers.

4.2.4. LED Lights:

4.2.4.1. Only fire alarm zone lights and device type lights shall annunciate with a red LED.

4.2.4.2. Device type, address, and exact location shall annunciate on the digital readout.

4.2.4.3. Any bypass disable or trouble condition shall annunciate with an amber LED, a trouble sounder and annunciate on the digital readout.

4.2.4.4. When speakers or phone circuits are active, green LEDs shall annunciate the appropriate speaker circuits.

4.2.4.5. Individual speaker circuits shall be capable of being activated without a pass code.

4.2.4.6. Individual speaker control shall be possible with loss of A/C power.

4.2.5. Communications:

4.2.5.1. Digital Alarm Communicating Transmitter (DACT) shall be installed within fire panels.

4.2.5.2. Coordinate DACT requirements with UIHC Safety and Security, UI Fire Safety, and UI Housing, as applicable.

4.2.5.3. Communication requirements are based on the fire alarm system and require a fiber optic line and/or two (2) copper lines from the telecommunications room to the main FACP.

4.2.5.4. Coordinate cabling with Division 27.

4.2.5.4.1. Simplex 4100ES systems shall be provided with 6-strand 28E Grade (8.3/125 Micron) fiber optic line.

4.2.5.4.2. Notifier NFS 3030 systems shall be provided with two copper telephone lines.

4.2.5.4.3. The lines shall be installed to the main panel with SC termination boxes. Use RJ45 for copper, RJ 31x Jacks for boxes.

4.2.5.5. Send the following signals to The University of Iowa Police Dispatch Office:

- 4.2.5.5.1. Alarms (Zone 1).
- 4.2.5.5.2. Troubles (Zone 3).
- 4.2.5.5.3. Supervisory (Zone 4).
- 4.2.5.6. The DACT trouble signal shall track the FACP trouble piezo.
- 4.2.5.7. Provide communications pathway from the fire alarm control panel to designated telecommunications closet.
- 4.2.5.8. Radio repeaters shall be installed as required by local fire department and AHJ.
- 4.2.6. Audio Systems:
 - 4.2.6.1. Amplifiers shall be 100-watt minimum, except in dual-channel applications where the elevator channel may use 25-watt amplifiers.
 - 4.2.6.2. Amplifiers shall have redundant back-up amplifier(s) that automatically transfer.
 - 4.2.6.3. Amplifier sizing calculations:
 - 4.2.6.3.1. One (1) watt per interior speaker (in restrooms and small rooms set taps to ¼-watt).
 - 4.2.6.3.2. Two (2) watts per outside and mechanical room speaker.
 - 4.2.6.3.3. Each audio amplifier shall be sized to include twenty percent (20%) spare capacity for future connection of audio speakers.
- 4.2.7. Minimum Sprinkler Systems Monitoring Points:
 - 4.2.7.1. Fire pump items include pump running, fire pump power, and fire pump phase reversal.
 - 4.2.7.2. Jockey pump power.
 - 4.2.7.3. Water flow switches by fire zone with separate address for each device.
 - 4.2.7.4. Tamper switches by fire zone with separate address for each device.
 - 4.2.7.5. All hardware devices and software for off-line programming, complete with manuals and software files, shall be turned over to the Owner.
 - 4.2.7.6. **For UIHC:**
 - 4.2.7.6.1. Include fire pump emergency power and emergency power loss.
- 4.2.8. Releasing Panels:
 - 4.2.8.1. The main FACP shall not be used as a releasing panel for special hazard or alternative suppression systems.
 - 4.2.8.2. Keypad controls shall be within visual distance of releasing agent location.

- 4.2.8.3. The main FACP may be used for releasing sprinkler pre-action or dry systems.
- 4.2.8.4. Releasing panel shall be Simplex 4100ES.
- 4.2.8.5. Separate Simplex 4100ES releasing panel is required for releasing other than sprinkler systems, such as Novec 1230.
- 4.2.8.6. **For UIHC-** will be provided with one (1) Idnet Card, one (1) IdNac card, and one (1) power supply with the same part number used in the installation of that fire panel.

4.3. Initiation Devices:

4.3.1. General

- 4.3.1.1. Comply with NFPA 72 for smoke detector location and quantity.
- 4.3.1.2. End-of-line resistors shall be located at the device that is farthest away from the panel or module.
- 4.3.1.3. Detectors shall be placed so that they can be tested directly from the floor level
- 4.3.1.4. Each device shall have a separate address.
- 4.3.1.5. All sleeping rooms shall have low frequency addressable sounder bases installed.
- 4.3.1.6. Ceiling mounted applications shall be mounted to have minimum eighty percent (80%) surface coverage.
- 4.3.1.7. Device Locations:

4.3.1.7.1. Photo Electric Smoke Detectors shall be located in the following spaces:

- 4.3.1.7.1.1. Corridors
- 4.3.1.7.1.2. Custodial Spaces
- 4.3.1.7.1.3. IT Spaces
- 4.3.1.7.1.4. Libraries
- 4.3.1.7.1.5. Storage rooms
- 4.3.1.7.1.6. Laboratories (Refer to Heat Detectors, below)
- 4.3.1.7.1.7. Mechanical rooms (except high temperature areas)
- 4.3.1.7.1.8. Elevator Lobbies
- 4.3.1.7.1.9. Student sleeping rooms

4.3.1.7.2. Heat Detectors shall be in the following spaces:

- 4.3.1.7.2.1. Copy centers, vending rooms, kitchens

- 4.3.1.7.2.2. High temperature mechanical rooms
- 4.3.1.7.2.3. Laboratories, with written approval from Owner
- 4.3.1.7.3. Duct Smoke Detectors shall be located in accordance with International Mechanical Code.
 - 4.3.1.7.3.1. Duct smoke detectors shall be used only in duct 6-inches or larger in diameter.
 - 4.3.1.7.3.2. Applications that require detection in ducts smaller than 6-inches in diameter shall be reviewed with UIHC Safety and Security, UI Housing, and UI Fire Safety, as applicable.
- 4.3.1.7.4. Pull Stations shall be in the following spaces:
 - 4.3.1.7.4.1. At exits leading to the exterior.
 - 4.3.1.7.4.2. At stairwell exits on each floor.
 - 4.3.1.7.4.3. As required by NFPA and fire code official reviews.
 - 4.3.1.7.4.4. Maximum distance between pulls shall be less than 200-feet.
- 4.3.1.8. Pull Stations:
 - 4.3.1.8.1. Pull stations shall be addressable and ADA compliant, Simplex #4099-9006.
- 4.3.1.9. Smoke Detectors:
 - 4.3.1.9.1. Shall provide a solid red LED on the detector or base when the device is in the alarm condition.
 - 4.3.1.9.2. Smoke detectors shall be low-profile analog.
 - 4.3.1.9.3. Smoke detectors shall not be located within 3 feet of an air vent.
- 4.3.1.10. Duct Detectors:
 - 4.3.1.10.1. Each duct detector shall be provided with labeled red LED indicating light.
 - 4.3.1.10.2. Indicating light may be wall or ceiling mounted in direct vicinity of the duct detector.
 - 4.3.1.10.3. For Main Campus and UI Housing:
 - 4.3.1.10.3.1. Remote test switches are not required unless directed by UI Fire Safety or UI Housing.
 - 4.3.1.10.4. For UIHC:**

4.3.1.10.4.1. All duct detectors will be installed with a remote test switch located in a non-sterile area and no greater than 6-feet above finished floor.

4.3.1.11. Heat Detectors:

4.3.1.11.1. Heat detectors shall be restorable and provide a red LED on the detector or base when the device is in the alarm condition.

4.3.1.11.2. Heat detectors shall be analog addressable rate-of rise and fixed temperature unless they are high temperature devices.

4.3.1.11.3. All detectors shall be magnet testable.

4.3.1.11.4. For UI Housing:

4.3.1.11.4.1. Provide heat detectors only where required by code.

4.3.1.12. Beam Detectors:

4.3.1.12.1. If beam detectors are proposed, Design shall be reviewed by UIHC Safety and Security and UI Fire Safety, as applicable, for appropriate application, maintenance, and accessibility.

4.3.1.12.2. Provide a beam detector test switch for each detector.

4.3.1.12.3. All beam detectors shall have a transmitter and a mirror, no receiver.

4.3.1.12.4. All beam detectors shall have a key or magnet test station.

4.3.1.13. Aspirating Smoke Detection (ASD):

4.3.1.13.1. If ASD is proposed, design shall be reviewed by UIHC Safety and Security and UI Fire Safety, as applicable, for appropriate application, maintenance, and accessibility.

4.4. System Annunciation:

4.4.1. General:

4.4.1.1. Combination visual and audible devices shall be used where possible.

4.4.1.2. Message boards shall be used only in selected areas approved by UIHC Safety & Security (as applicable), UI Fire Safety and UI Public Safety.

4.4.1.3. For UI Housing:

4.4.1.3.1. Provide intelligent sounder smoke detectors in student sleeping areas.

4.4.1.4. Constructor shall not mount a separate visual device and separate speaker side-by-side.

4.4.2. Audible Devices:

- 4.4.2.1. Design Professional's audible device selection and layout shall have a reasonable expectation of achieving NFPA 72 intelligibility and audibility requirements.
 - 4.4.2.2. The Design Professional shall employ modeling software or other means to make this determination.
 - 4.4.2.3. In new construction, where the acoustic properties of an Acoustically Distinguishable Space (ADS) make intelligibility unachievable, but intelligibility is required, the acoustic properties of this space shall be modified.
 - 4.4.2.3.1. The Design Professional shall indicate on the construction drawings which Acoustically Distinguishable Spaces (ADS) will require intelligibility through a schedule or other means on the design drawings. NFPA 72-2013 18.4.10.2.
 - 4.4.2.3.2. Speech Transmission Index (STI) of each Acoustically Distinguishable Space (ADS) that requires intelligibility shall meet the requirements of NFPA 72, Annex D.
 - 4.4.2.3.3. Ninety percent (90%) of the measurement locations within each ADS shall have a STI of not less than 0.45 and an average STI of 0.50.
 - 4.4.2.3.4. The Design Professional shall indicate actual or anticipated ambient Sound Pressure Levels (SPL) of each Acoustically Distinguishable Space (ADS) in dBA. This shall be done through a schedule or other means on the design drawings. NFPA 72-2013 7.3.4.3.
 - 4.4.2.4. Audible devices shall meet NFPA 72 Public mode requirements of 15dBA above ambient sound pressure levels.
 - 4.4.2.5. Exterior audible devices shall be located at all building entrances. Devices shall be a minimum of 2 Watts.
 - 4.4.2.6. Provide a dedicated audio circuit for exterior devices.
 - 4.4.2.7. Contractor shall perform Speech Transmission Index (STI) and Sound Pressure Level (SPL) testing and provide testing results to Owner.
- 4.4.3. Visual Devices:
- 4.4.3.1. Strobe intensity and location shall be determined by NFPA 72 prescriptive requirements. If a performance-based alternative is used, the Design Professional shall submit calculations.
 - 4.4.3.2. All strobes in the building shall be synchronized.
 - 4.4.3.3. Each visual circuit shall be capable of being individually controlled through software.
 - 4.4.3.4. Each strobe circuit shall include twenty percent (20%) spare capacity for future connections of visual devices.
 - 4.4.3.5. Strobes shall be no more than 100-feet apart, visible from any location in the room, and placement shall be coordinated with furniture and/or art locations.

4.4.3.6. Provide visual coverage in compliance with NFPA 72.

4.4.3.7. For UIHC:

4.4.3.7.1. Devices shall be white with red text that reads: ALERT.

4.4.3.8. Fire Department Connection Horn Strobe:

4.4.3.8.1. Provide Potter Sash 24 number 10000755 Sprinkler / Siren Strobe

4.4.3.8.2. Locate directly above the fire department sprinkler connection on the exterior of the building.

4.4.4. Other Devices:

4.4.4.1. General

4.4.4.1.1. All devices being controlled by the fire alarm control panel (i.e., dampers, doors, etc.) shall be operated using control modules and not by relay-type devices in detector bases or relay cards.

4.4.4.1.2. Auxiliary equipment shall not be directly connected to an addressable control module.

4.4.4.1.3. 24-volt DC power shall be supervised at each device.

4.4.4.1.4. Each control module shall activate a supervised 24-volt DC relay with red LED when in the alarm condition.

4.4.5. Smoke Dampers:

4.4.5.1. Smoke damper indicator lights shall be Select-A-Switch, Model SL53413-6-BG.

4.4.5.2. Place damper indicator lights in corridors whenever possible. Graph displays are not allowed.

4.4.5.3. For UI Housing:

4.4.5.3.1. Where allowed by code, provide end switches for monitoring smoke / fire dampers that are integrated into the command center.

4.4.5.3.2. Program as to provide an alert when closed.

4.4.5.3.3. Provide auxiliary relays on smoke / fire damper equipment to provide signals to the Fire Alarm Panel.

4.4.6. Door Hold Open:

4.4.6.1. Door magnets shall be powered by 24-volt power source other than the FACP.

4.4.6.2. Powering down the FACP shall not automatically close the fire doors. Door hold-opens shall not close on loss of power to the FACP.

- 4.4.6.3. Electronic door hold-opens shall be 24-volt DC.
- 4.4.6.4. Electronic door hold-opens with built-in smoke detectors shall not be allowed.
- 4.4.6.5. Coordinate provider of door hold-opens with door hardware requirements.
- 4.4.6.6. For UI Housing:
 - 4.4.6.6.1. Provide 5-minute delay to door release on power failure.

4.4.6.7. For UIHC:

- 4.4.6.7.1. Door magnets shall be powered by 120-volt power source.
- 4.4.6.7.2. Electronic door hold-opens shall be 120-volt AC with disconnect.

4.4.7. Building Automation Controls:

- 4.4.7.1. The fire alarm system shall provide dry contacts for Direct Digital Control (DDC) system to control HVAC or purge system during alarm.
- 4.4.7.2. The fire alarm system shall provide monitor module to close all fire smoke dampers via signal from Building Automation System when associated air handling unit is shut down.

4.4.8. Fire Shutters:

- 4.4.8.1. Fire shutters shall not be used without written approval from Owner.
- 4.4.8.2. If used, shutters shall be readily accessible and motorized, with remote push-button to re-open the shutter.

4.5. Raceways, Boxes, and Cables:

- 4.5.1. Each floor shall have a separate conduit feed.
- 4.5.2. All fire alarm devices, junction and pull boxes shall be easily accessible without removing light fixtures, equipment, conduits, junction boxes or other items.
- 4.5.3. Use of junction box extension rings shall not be used.
- 4.5.4. Conventional wiring shall be solid, THHN.
- 4.5.5. Insulate all grounding shields with 3M number 130C rubber tape.
- 4.5.6. Junction and pull boxes shall be a minimum size of 4 11/16-inches square by 2 1/8- inches deep.
- 4.5.7. Exposed fire alarm and detection conduit in finished spaces may be painted to match wall or ceiling excludes UIHC facilities.
- 4.5.8. No fire alarm and detection conduit shall be installed in floors.
- 4.5.9. Line voltage (120-volt AC) shall be run in separate conduit.

4.5.10. Spare conductors shall not be allowed in conduit or junction boxes.

4.5.11. Box extensions shall not be permitted on new construction.

4.5.12. Splicing shall not be allowed in device mounting boxes.

4.5.13. Wiring size and color shall be per the Owner's specifications.

4.5.14. For UIHC:

4.5.14.1. Fire alarm and detection conduits shall be red.

5. Area of Refuge Phone:

5.1. Provide cabling for area of refuge telephone as required by Code.

5.1.1. GIA-TRONICS Telephone shall be provided by Owner and installed by Constructor.

5.1.2. Constructor to contact Owner for rough-in template.

6. Emergency Responder Radio Coverage System (ERRCS):

6.1. Refer to specification section 28 53 00 EMERGENCY RESPONDER RADIO COVERAGE SYSTEM (ERRCS) located at <https://www.facilities.uiowa.edu/design-construction-specification-documents>.

6.2. An ERRCS shall be provided in accordance with the International Fire Code, local fire department, or Authority Having Jurisdiction.

6.3. New facilities, additions and major renovations shall have a Radio Frequency (RF) survey performed during the construction process.

6.3.1. RF Survey shall indicate all areas that do not meet acceptable levels of emergency responder radio coverage.

6.3.2. The Owner's representative and UI Fire Safety Coordinator shall be in attendance during the survey.

6.4. ERRCS shall comply with the minimum requirements of IFC 510.

6.5. All signal boosters and other active system components must have FCC certification prior to installation.

6.6. System must provide the following signal strengths:

6.6.1. Downlink: Minimum signal strength of -95 dBm throughout the coverage area.

6.6.2. Uplink: Minimum signal strength of -95 dBm received at the UI DPS or AHJ Radio System.

6.7. Signal booster shall be a Class B Public Safety type as designated by the FCC or as required by the AHJ.

6.8. ECCS may utilize primary telecommunications pathways. Dedicated secondary pathways and rough-in boxes shall be provided.

6.8.1. Proposed roof penetration location for antenna shall be reviewed during design.

6.9. The fire alarm system shall provide monitoring of system per IFC.

29) **RESERVED FOR FUTURE EXPANSION**

30) **RESERVED FOR FUTURE EXPANSION**

31) EARTHWORK

1. General:

- 1.1. Construction documents shall show all activities contained within construction boundaries indicated on site plan.
- 1.2. Include a base bid quantity and unit price for rock removal on the Form of Bid when rock is anticipated to be encountered during construction.
- 1.3. Specified excavation requirements, precautions, and protective systems shall be taken into consideration when establishing construction boundary.
- 1.4. Design Professional shall specify inspection and testing requirements and shall include procedures for evaluation of test data.
- 1.5. Ensure movement of trucks and equipment on Owner's property is in accordance with Owner's instructions and depicted on construction documents.
- 1.6. Topsoil shall be stripped from the construction site when possible and stockpiled in designated area for reuse.
- 1.7. Disposal off-site (per direction of Owner and/or Utility Operator).
- 1.8. Constructor shall remove excess suitable and unsuitable fill materials from project site and dispose of legally off the Owner's property.
- 1.9. All bearing soil and backfill shall be inspected and tested immediately prior to placement of reinforcing steel and concrete and at the discretion of the Owner and/or Utility Operator and the Geotechnical Engineer.
- 1.10. Owner shall retain the services of an Engineering Inspection and Testing Firm.
 - 1.10.1. Constructor shall be responsible for coordinating and scheduling inspections.
- 1.11. The Design Professional shall assist the Owner and/or Utility Operator in obtaining all necessary permits for the project.
- 1.12. Post-Construction Storm Water Management: Refer to ENVIRONMENTAL COMPLIANCE for design requirements.

2. Utility Abandonment:

- 2.1. Piping to be abandoned shall be removed where feasible. Design Professional shall review with Owner.

- 2.2. Remove tees to mechanical distribution systems and replace with a straight section of pipe to eliminate dead end services.
- 2.3. Plug all abandoned storm and sanitary sewer services at the upstream and downstream manholes.
- 2.4. Pressure-grout all pipes that are abandoned in place.
3. Subsurface Investigation:
 - 3.1. Constructor shall contact Iowa One-Call for location of utilities 48-hours before any excavation takes place.
 - 3.2. All locates shall be Joint Locates.
 - 3.3. If investigative soils analysis is required during project design, Owner and/or Utility Operator shall retain a Geotechnical Engineer.
 - 3.3.1. The Geotechnical Engineer, in consultation with the Owner and/or Utility Operator and the Design Professional, shall determine number, sizes, depth, and proposed location of borings and/or pits.
 - 3.3.2. In general, there shall be one (1) boring for every 10,000 square feet of building footprint, with a minimum of four (4) soil borings.
 - 3.3.3. To the extent possible, borings shall be located near the location of proposed footings/piers.
 - 3.4. Boring information shall be shown, with dimensions, on a plot plan to be submitted electronically by the Design Professional to the Owner and/or Utility Operator at least five (5) working days prior to proposed sampling.
 - 3.4.1. The plan shall show:
 - 3.4.1.1. A graphic scale, north arrow, and location of existing buildings and trees.
 - 3.4.1.2. Above and below ground service/utility lines (both utility company and University-owned).
 - 3.4.1.3. Pavement areas and established benchmark(s) with elevation(s) noted.
 - 3.4.1.4. Existing site features, not specifically mentioned, impacting boring or pit locations.
 - 3.4.1.5. The soils/geotechnical report shall be included as an informational item of the bidding documents in the general requirements, Section I.
 - 3.5. For purposes of identifying and measuring rock, which may be encountered during classified excavation, the following definitions shall be used.
 - 3.6. The definitions are based on minimum equipment requirements, which shall be equaled or exceeded by the Constructor.

3.7. If the Constructor chooses to use equipment of lesser size, capacity, or power than specified for excavating purposes, the Constructor shall assume all responsibility for the cost and method of removal of material resembling rock, which cannot be removed with their equipment.

3.7.1. Therefore, contract unit prices submitted by the Constructor for rock excavation shall only be applicable if the Constructor's equipment equals or exceeds equipment requirements specified below:

4. Open Excavation:
 - 4.1. Rock excavation in open excavations shall include removal and disposal of any sound and solid mass, layer, or ledge, regardless of origin, which cannot be effectively loosened or broken down in multiple passes in opposite directions.
 - 4.2. A late model crawler-type tractor rated with at least 170 net flywheel horsepower, equipped with a hydraulic ripper with one (1) digging point of standard design and size, and with tractor operating in low gear.
5. Pit and/or Trench Excavation:
 - 5.1. Rock excavation in trenches and pits shall include removal and disposal of any sound and solid mass, layer, or ledge, regardless of origin, which cannot be excavated and removed by a 3/4 cubic yard capacity hydraulic backhoe, rated at not less than 90 net flywheel horsepower, and 30,000-pound drawbar pull.
6. Drilled Pier Excavation:
 - 6.1. Weathered rock/shale pier excavation is defined as any material that cannot be drilled or removed with conventional earth augers and requires the use of rock augers for drilling.
 - 6.2. Rock excavation is defined as any sound and solid mass, layer, or ledge, regardless of origin, which cannot be drilled with conventional earth augers or under reaming tools and requires alternate drilling methods for removal, such as special core barrels, air tools, and/or other methods of rock excavation.
 - 6.3. The minimum size drill rig is rated positive crowd force of 37,000 pounds and a continuous torque rating of 25,000-foot pounds.
 - 6.4. Backfill and subgrade compaction shall conform to Geotechnical Engineer's recommendations.
 - 6.4.1. For projects without a geotechnical report, the following criteria shall be specified:
 - 6.5. Bearing soil for spread footings, pad footings, and slabs on grade shall be compacted to a minimum of 95 percent of maximum density at optimum moisture content (-2 percent to +4 percent) standard proctor.
 - 6.5.1. Excavation to undisturbed soils is not considered adequate.
 - 6.6. Backfill for foundations shall be compacted to a minimum of eighty-eight (88%) and a maximum of ninety-two percent (92%) of maximum density under landscaped areas and a minimum of ninety-five percent (95%) of maximum density under other areas at optimum moisture content (+/-2 percent) standard proctor.
 - 6.7. Backfill shall be installed in no more than 12-inch lifts.
 - 6.8. Specific soils or situations may require smaller lifts.
 - 6.9. Backfill for trenches shall be well-graded, granular materials ¾-inch to 1-inch clean material vibrated in lifts.
 - 6.9.1. Provide sand envelope around pipe.

- 6.10. Proof rolling shall be specified for areas to be paved and shall conform to the Geotechnical Engineer's recommendations.
- 6.11. For projects without a Geotechnical Engineer's recommendation, the following criteria shall be specified:
 - 6.11.1. All areas to be paved (that are of sufficient size to permit the required equipment) shall be proof rolled prior to placement of the aggregate base course.
 - 6.11.2. Proof rolling shall consist of passing/driving a loaded, 20-ton, tandem dump truck over the prepared subgrade soil with a maximum allowable displacement of 1 inch.
 - 6.11.3. Any areas that displace more than 1- inch shall be compacted until this criterion is met, or those areas may be excavated and backfilled with compacted Type 1 Aggregate for Base.
 - 6.11.4. All proof rolling shall be performed in the presence of Owner.
- 7. Site Survey:
 - 7.1. For new construction and major renovations, a complete and thorough site survey shall be conducted prior to Design Development to identify all existing above and below ground site and utility features on the project site.
 - 7.2. This survey shall include, but not be limited to:
 - 7.2.1. Any active or abandoned utility whether University of Iowa, City of Iowa City, or private utility company services.
 - 7.2.2. Adequate topographic information and spot elevations to allow for proper design for drainage.
 - 7.2.3. Location, size, and name of all plant material shall be provided to Owner for evaluation of condition and determination of protective measures during construction.
 - 7.2.4. Location and type of all site lighting fixtures.
 - 7.2.5. Location of all structures, parking lots, sidewalks, roads, paths, etc.

32) EXTERIOR IMPROVEMENTS

1. Landscaping:

1.1. Horticultural Standards:

1.1.1. General:

- 1.1.1.1. American Standard for Nursery Stock", American National Standards Institute, Incorporated, (ANSI Z 60).
- 1.1.1.2. "Standardized Plant Names", 1942 Edition, American Joint Committee on Horticultural Nomenclature.
- 1.1.1.3. Campus Urban Forest Study, available at <http://www.facilities.uiowa.edu/space/campus-planning/>
- 1.1.1.4. LANDSCAPING PROHIBITED PLANT LIST, and LANDSCAPING RECOMMENDED PLANT LIST in Appendices. <http://www.iowadnr.gov/Conservation/Forestry/Forest-Health/Invasive-Plants>
- 1.1.1.5. Owner shall be notified prior to grade changes during backfilling.
- 1.1.1.6. Owner shall be notified a minimum of 24-hours prior to the establishment of the "rough grade" (existing grade prior to application of topsoil or growing medium for turf or other plants) to allow the opportunity for hand-holes, valve covers, manholes, and other fixtures to be located and reviewed.
- 1.1.1.7. Prior to soil arriving to site, Owner shall approve the physical soil samples and percolation test results.
- 1.1.1.8. Soil or growing medium for turf or plants shall be examined and approved by Owner.
- 1.1.1.9. Projects shall include all necessary maintenance, including water, weeding, etc. for the first sixty (60) calendar days after installation or until substantial completion, whichever is later.
- 1.1.1.10. Plant material list, including cultivar, shall be included in the Operations and Maintenance Manuals.

1.1.2. Quality Assurance:

- 1.1.2.1. All plant material used within design shall be from the Landscape Plant and Tree Lists within the University of Iowa Campus Master Plan or with written approval from Facilities Management Landscape Services [or UI Healthcare Grounds](#).
- 1.1.2.2. Selection of landscape plant materials is based on USDA Hardiness Zone 5a.
- 1.1.2.3. Regardless of landscape typology, all landscape shall adhere to the ANSI American Standard for Nursery Stock, ANSI Z60.1.

- 1.1.2.3.1. The standards shall apply to all phases of planning, design, approvals, installation, and care of all landscape for the University of Iowa campuses.
- 1.1.2.4. All plant material shall meet the minimum requirements of size and grade in the latest edition of American Standard for Nursery Stock, ANSI Z60.1.
- 1.1.2.5. All plants shall be tagged with names that are in compliance with the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature.
- 1.1.2.6. All plants are to be grown in an area that has a similar climate to Johnson County Iowa.
- 1.1.2.7. All plant material shall be inspected and approved by Owner prior to installation.
- 1.1.2.8. Plant quality and size are based off of ANSI, American Nursery Stock Standards.
 - 1.1.2.8.1. Plants that do not meet the stated criteria shall be rejected and replaced at the contractor's expense.
 - 1.1.2.8.2. Plant material listed on either the University of Iowa's or the states do not plant lists shall not be accepted under any circumstances.
- 1.1.2.9. Owner retains the right of refusal of any plant.
- 1.1.2.10. Plants not in compliance with the latest edition of American Standard for Nursery Stock, ANSI Z60.1 will be rejected.
- 1.1.2.11. A list of criteria for rejection includes, but is not limited to:
 - 1.1.2.11.1. Root bound plants.
 - 1.1.2.11.2. Girdling roots.
 - 1.1.2.11.3. Loose root systems in containers.
 - 1.1.2.11.4. Broken or missing leaders.
 - 1.1.2.11.5. Plant material that has on-sided branching.
 - 1.1.2.11.6. Plants specified at a certain container size that do not fit the American Standard for Nursery Stock guidelines.
 - 1.1.2.11.7. Objectionable deformities.
 - 1.1.2.11.8. Voids in foliage or branching.
 - 1.1.2.11.9. Presence of insects, eggs, or damage.
 - 1.1.2.11.10. Plant diseases.

- 1.1.2.11.11. Mold.
- 1.1.2.11.12. Dry roots.
- 1.1.2.11.13. Bark, trunk root or leader damage.
- 1.1.2.11.14. Defects including knots, collaring, scaring, improper grafting.
- 1.1.2.11.15. Sunscald.
- 1.1.2.11.16. Frost crack.
- 1.1.2.11.17. Rodent / animal damage.
- 1.1.2.11.18. Plants larger or smaller than ANSI Z60.1 standard recommendation for container size or specified size on plan.
- 1.1.2.11.19. Broken or loose root balls.
- 1.1.2.11.20. Bare root plants only as approved by Owner.
- 1.1.2.11.21. Any bare root allowed must be dormant at time of planting.

1.1.3. Special Requirements:

- 1.1.3.1. The Design Professional shall meet with the Owner during Design Development to evaluate project impact on existing plantings and shall clearly identify any plantings proposed for removal.
 - 1.1.3.1.1. Proposed removals shall be reviewed and approved in writing by the Owner.
- 1.1.3.2. All plants shall come with a schedule:
 - 1.1.3.2.1. Schedule shall list size, quantity, botanical name of plant, common name of plant and any other requirements, as specified on the design.
 - 1.1.3.2.2. All planting schedules shall be provided no later than in the fifty percent (50%) Construction Documents.
 - 1.1.3.2.3. All plant schedules must receive written acceptance by Owner.
- 1.1.3.3. All changes to plant material of any kind will require the express written consent of the Owner.
 - 1.1.3.3.1. Failure to obtain the consent of Owner for plant material changes will result in the requirement of the contractor to replace that material at the contractor's expense.

1.1.3.4. All site conditions shall meet the construction plan requirements to the satisfaction of the designer and Owner.

1.1.3.5. Contractor shall notify Owner of any incomplete site preparations, outside of the Contractor's scope of work, prior to proceeding with planting.

1.1.4. Plant Material Warranty and Establishment Period:

1.1.4.1. All plants are to be warrantied for a period of twelve (12) months.

1.1.4.2. The warranty shall insure that all plants at the 12-month mark be in a healthy, vigorous condition.

1.1.4.3. The warranty shall start upon the acceptance of the plant material.

1.1.4.4. Inspection of plant material will be made one (1) month prior to warranty expiration.

1.1.4.5. All plants missing, not alive, or in poor health at this time shall be listed and replaced by Contractor prior to the expiration of the warranty.

1.1.4.6. The Contractor is responsible for the establishment of all plant material in their scope of work.

1.1.4.7. The establishment period is either a period of ninety (90) days, or if planted in the summer, a minimum of ninety (90) days plus any additional necessary time to assure health and vigor of plant until the weather cools.

1.1.4.8. During the establishment phase, the contractor shall be responsible for all necessary care of plant material to assure health and vigor. This includes, but is not limited to:

1.1.4.8.1. Pruning

1.1.4.8.2. cultivating

1.1.4.8.3. weeding

1.1.4.8.4. watering

1.1.4.8.5. resetting settled plants to proper grade

1.1.4.8.6. pesticide and fungicide applications as approved by Owner

1.1.4.9. All plant beds are to be kept virtually weed free during the warrantied period.

1.1.5. Replacements:

1.1.5.1. Plant material that is not alive or not healthy shall be replaced by the contractor at their expense within a period of twelve (12) months starting at the approval of plant material.

1.1.5.2. The plant material to be replaced shall be done so with the same original specifications unless written approval from Owner is received for any variances.

- 1.1.5.3. Approval of replacement material shall occur prior to planting.
 - 1.1.5.4. Replacement material shall have a one (1) year warranty from the time of replacement that is identical to the original warranty.
 - 1.1.5.5. Maintenance and establishment of the replacement plants are also the same as for the original plant material.
 - 1.1.5.6. For concerns of specified material, planting details or any other conditions, the contractor should contact Owner and receive direction prior to the ordering of plant material.
 - 1.1.5.7. Failure to do so prior to the ordering of plant material will make the plan, plants, installation, and maintenance of the plants the responsibility of the installation contractor.
 - 1.1.5.8. Upon replacement, the contractor shall notify the project manager.
- 1.1.6. Planting:
- 1.1.6.1. Optimal planting times are:
 - 1.1.6.1.1. Evergreens: April 1 to June 1, or September to October 15.
 - 1.1.6.1.2. Deciduous: April 1 to June 1 and August 15 to November 15.
 - 1.1.6.1.3. Planting outside of these times will require written consent from Owner, with warranty of plants the responsibility of the contractor.
 - 1.1.6.1.4. Planting will not be allowed in weather that is below 25 degrees F or above 90 degrees F.
 - 1.1.6.2. Constructor shall stake all plant locations prior to plant installation.
 - 1.1.6.3. The Owner shall review and approve all locations prior to planting.
 - 1.1.6.4. All baskets, burlap, containers, wires, twine, etc. shall be completely removed from all plant material prior to planting.
 - 1.1.6.5. Refer to LANDSCAPING PLANTING DETAILS in Appendices.
 - 1.1.6.6. Proper planting depth requires the root flare above finished grade.
 - 1.1.6.7. Specifications shall incorporate language and details to insure proper planting depth.
 - 1.1.6.8. Landscape plant materials shall be in accordance with the American Association of Nurserymen's Standards.
 - 1.1.6.9. The Owner shall review and approve all plant materials prior to installation.
 - 1.1.6.10. Any adjustments to the planting plan will need written approval from Owner.

- 1.1.6.11. Remove all string, wire, ties, ribbons, or wraps from plant material.
- 1.1.6.12. Place a minimum of 6-inch depth of planting material in the bottom of planting pit.
- 1.1.6.13. Spread and arrange roots in natural position.
- 1.1.6.14. Very carefully break up any root clumping or massing.
- 1.1.6.15. Center plant in hole and place plant directly upright, with desired orientation.
- 1.1.6.16. Backfill with planting soil so that the root crown is level, or slightly (>1-inch) higher than the grade.
- 1.1.6.17. Carefully compact soil in layers, filling all voids.
- 1.1.6.18. Apply water and allow soil to settle.
- 1.1.6.19. Compact the settled soil gently and mor soil back to grade.
- 1.1.6.20. If the plant is balled and burlapped, place the root ball in the hole so that the soil surface will be at the same level where the plant was previously growing.
- 1.1.6.21. Plants should be planted so that the root flare of the trunk is visible above the soil surface.
- 1.1.6.22. Cut the twine from the root ball and peel back the burlap and metal basket, along with any other material that holds the root ball together.
- 1.1.6.23. Remove burlap fabric from the top one-third (1/3) of the root ball.
- 1.1.6.24. Remove remaining metal from the root ball.
- 1.1.6.25. Be sure that anything else such as twine is also removed from around the roots or trunk.
- 1.1.6.26. Backfill soil into the hole a few inches at a time, firming up the soil with light tamping after each addition.
- 1.1.6.27. When backfilling, assure tree stays in place vertically.
- 1.1.6.28. If planting on a slope, place the root crown slightly above the finished grade.

1.1.7. Clean Work Site:

- 1.1.7.1. Prior to leaving the work site each day, the contractor is responsible to remove all trash and debris.
- 1.1.7.2. Any damage to the site caused by the contractor will be the responsibility of the contractor and repaired to a state that meets the approval of the Owner, including, but is not limited to:

- 1.1.7.2.1. irrigation damage
- 1.1.7.2.2. rutting of turf or beds
- 1.1.7.2.3. marks on concrete
- 1.1.7.2.4. broken window or concrete
- 1.1.7.2.5. trash and debris

1.1.8. Acceptance of Work:

- 1.1.8.1. Upon completion of a project, the contractor shall notify the Owner to do a final walk-through.
- 1.1.8.2. A minimum five (5) days shall be given for coordination of this walk-through.
- 1.1.8.3. All bed areas shall be free of litter, debris, weeds, dirt clods, or rocks.
- 1.1.8.4. With the completion of the review, a list of any deficiencies, damage, incomplete or unsatisfactory work, with any additional requirements for completion of work, will be provided to the contractor.

1.2. Irrigation:

1.2.1. For UIHC:

- 1.2.1.1 [HunterFore](#) shall be the Basis of Design for all irrigation equipment.

1.3. Soils:

1.3.1. General:

- 1.3.1.1 The University of Iowa follows the standards and Industry Best Practices as endorsed by the following Reference Standards:

- 1.3.1.1.1. American National Standards Institute (ANSI) Z60.1
- 1.3.1.1.2. Iowa Department of Transportation
- 1.3.1.1.3. ANSI A300-02 Soil Management (Fertilization)
- 1.3.1.1.4. Related ISA Best Management Practices (BMPs)
- 1.3.1.1.5. Iowa Administrative Code Chapter 69

- 1.3.1.2 All quality assurance and approval to be done by Owner

- 1.3.1.2.1. Prior to installation of plant material all soils should be tested through an approved company, with test results delivered to Owner and should adhere to the following standards:

1.3.2. Soil Specifications for Plant Beds, Trees, and Turf Areas:

- 1.3.2.1. Provide complete soil test profile from Central Turf Agronomy, Brent Smith 1-563-210-1616 of the soil mix that will be used within beds.
- 1.3.2.2. Planting bed mix should be sixty percent (60%) topsoil, twenty percent (20%) sand, and twenty percent (20%) compost.
- 1.3.2.3. Soil test shall be scheduled a minimum of six (6) weeks prior to planting.
 - 1.3.2.3.1. Results must fall within Industry Best Practice Standards as recommended for the applicable project i.e., lawns, flower beds, tree, and shrub beds.
 - 1.3.2.3.2. Failure to obtain Owner's approval of the soil shall replacement and or correction at the Contractor's expense.
- 1.3.2.4. Materials not passing the specifications shall be removed and replaced by the contractor/subcontractor at no additional expense to the Owner if the soils have already been put in place.
- 1.3.2.5. Supply high-quality, imported topsoil of loamy character, high in humus and organic content from local agricultural source.
- 1.3.2.6. Topsoil:
 - 1.3.2.6.1. Topsoil shall be free from clay, lumps, coarse sands, stones, roots, weeds, and other foreign matter.
 - 1.3.2.6.2. Soil shall have no toxic amounts of acid or alkaline elements.
 - 1.3.2.6.3. Topsoil shall be used for on-site mixing of backfill mix.
 - 1.3.2.6.4. Topsoil shall be free of roots, clods, stones larger than ½-inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush, and other litter.
 - 1.3.2.6.5. Topsoil shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.
 - 1.3.2.6.6. Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil.
- 1.3.2.7. Gradation Limits:
 - 1.3.2.7.1. Soil shall be a sandy loam or loam.
 - 1.3.2.7.2. The definition of soil texture shall be the USDA classification scheme cited below.
 - 1.3.2.7.3. Gravel over 2 millimeters in diameter shall be less than twenty percent (20%) by weight.

1.3.2.8. Permeability Rate:

1.3.2.8.1. Hydraulic conductivity rate shall be not less than 1-inch per hour nor more than 20-inches per hour, when tested in accordance with the USDA Handbook Number 60, method 34b or other approved methods.

1.3.2.9. Acidity:

1.3.2.9.1. The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 - 7.0.

1.3.2.10. Salinity:

1.3.2.10.1. The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 0.5 - 2.5 dS/m.

1.3.2.11. Chloride:

1.3.2.11.1. The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

1.3.2.12. Boron:

1.3.2.12.1. The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

1.3.2.13. Sodium Adsorption Ratio (SAR):

1.3.2.13.1. The maximum SAR shall be 3 measured per Method 20b, USDA Handbook Number 60.

1.3.2.14. Aluminum:

1.3.2.14.1. Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 3 parts per million.

1.3.2.15. Soil Organic Matter Content:

1.3.2.15.1. Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter.

1.3.2.15.2. The desirable range is three percent (3%) to six percent (6%).

1.3.2.15.3. The carbon: nitrogen ratio should be about 10:1.

1.3.2.15.4. A high carbon: nitrogen ratio can indicate the presence of hydrocarbons or non-humified organic matter.

1.3.2.16. Calcium Carbonate Content:

1.3.2.16.1. Free calcium carbonate (limestone) shall not be present for acid-loving plants.

1.3.2.17. Heavy Metals:

1.3.2.17.1. The maximum permissible elemental concentration in the soil shall not exceed the following concentrations:

1.3.2.17.1.1. Ammonium Bicarbonate/DTPA Extraction parts per million (mg/kilogram) dry weight basis.

1.3.2.17.1.2. Arsenic 1.

1.3.2.17.1.3. Cadmium 1.

1.3.2.17.1.4. Chromium 10.

1.3.2.17.1.5. Cobalt 2.

1.3.2.17.1.6. Lead 30.

1.3.2.17.1.7. Mercury 1.

1.3.2.17.1.8. Nickel 5.

1.3.2.17.1.9. Selenium 3.

1.3.2.17.1.10. Silver 0.5.

1.3.2.17.1.11. Vanadium 3.

1.3.2.18. Since the soil pH should be between six (6) and seven (7), the maximum permissible elemental concentration shall be reduced fifty percent (50%).

1.3.2.19. Phytotoxic constituent, herbicides, hydrocarbons etc. - Germination and growth of monocots and dicots shall not be restricted more than ten percent (10%) compared to the reference soil.

1.3.2.20. Growth-inhibiting constituents must not be present.

1.3.2.21. Sodium absorption ratio (SAR) = <3

1.3.2.22. Soil shall be free of sticks, stones, and debris larger than ½-inch.

1.3.2.23. Soil shall be free of weeds and other undesirable vegetation.

1.3.2.24. Soil shall be free of oil and other anthropogenic chemicals.

- 1.3.2.25. Soil shall be free of herbicides and insecticides that may affect subsequent growth of turf or other plantings, or that may be toxic or injurious to humans and/or animals.
- 1.3.2.26. If a local source of native sand meeting these specifications cannot be located, a commercially available masonry sand should be sampled and tested to see if it meets the above specifications.
- 1.3.2.27. Soil shall be placed at depths specified as below with subgrade being tilled to a depth of 4-inches to 6-inches:
 - 1.3.2.27.1. Lawn: a minimum of 6-inch amended topsoil.
 - 1.3.2.27.2. Plant bed: a minimum of 18-inch amended topsoil.
 - 1.3.2.27.3. Tree planting: a minimum of 36-inch amended topsoil.
 - 1.3.2.27.4. Bio-Infiltration: a minimum of 18-inch blended mixture of construction sand and organic compost.
 - 1.3.2.27.5. Finished site tilled to a minimum of 4-inches to 6-inches for plants, 4-inches to 6-inches for turf and 4-inches to 6-inches for trees.
- 1.3.2.28. Grade subsoil to have slope to allow drainage water to go through the sand and flow downhill along the top of the subsoil.
- 1.3.2.29. Subsurface drainage will be necessary in areas plated with this soil to prevent the formation of a below ground pool, especially at the bottom of the slope in areas where the soil may abut a nearby non-permeable surface, such as a concrete sidewalk or curb.
- 1.3.2.30. The prevention and or alleviation of soil compaction are crucial to plant success.
- 1.3.2.31. The contractor or Owner organization responsible, shall limit the use of heavy equipment to hardscape areas whenever possible.
- 1.3.2.32. Allow wet areas to dry before tilling or grading.

1.3.3. Percolation Testing:

- 1.3.3.1. Constructor to perform Percolation Test in accordance with Iowa Code, Chapter 69, Appendix B, "Percolation Test Procedure."
<https://www.legis.iowa.gov/docs/iac/rule/09-27-2006.567.69.1.pdf>
- 1.3.3.2. In-place infiltration tests shall be at rate of one (1) test per each plant bed, tree planting location, or as determined by Owner.
- 1.3.3.3. A percolation test to a depth of 24-inches should occur with any soil disturbance that exceeds 100-square feet.
- 1.3.3.4. Owner may direct additional testing in locations subject to compaction or adverse Constructor operations.

- 1.3.3.5. Placed planting soils exhibiting non-compliant percolation values shall be removed or restored to compliant conditions.
- 1.3.3.6. Percolation rates must meet or exceed minimum 1-inch per hour, per Iowa Code, Chapter 69.
- 1.3.3.7. Owner and Design Professional shall evaluate possible solutions for proper subgrade drainage should test results do not meet specified standards.
- 1.3.3.8. Notify Owner prior to grade changes, start of backfill, and the establishment of rough grade.
- 1.3.3.9. Final grade of planting beds and small turf areas shall be done by hand to avoid compaction and ensure all debris and clods over ½-inch are removed.
- 1.3.3.10. Large scale seeding or sodding projects may be graded using small tractors, gills, etc.
- 1.3.3.11. For any work on campus that tears up existing turf, irrigation, planting and tree areas, the contractor or the project is responsible for repairs that bring the University back to whole, with final approval from Owner.
- 1.3.3.12. Excavated areas shall be backfilled with 8-inches to 12-inches of topsoil.
- 1.3.3.13. Subsoil shall be tilled and blended with topsoil layer to avoid sharp transitions in the soil profile.
- 1.3.3.14. Unexcavated areas to be planted or seeded shall be tilled to a depth of 4-inches to 6-inches before incorporating topsoil or other amendments.
- 1.3.3.15. Do not till within the Critical Root Zone (see Tree Standards) of existing trees.
- 1.3.3.16. Notify FMLS upon completion of final grade. Contractor shall not install planting material or turf until finished grade has been approved by Owner.
- 1.3.4. Erosion Control:
 - 1.3.4.1. Hydromulch with tackifier shall be applied at a minimum of 2500-pounds per acre.
 - 1.3.4.2. Erosion Control Matting shall contain only bio-degradable netting and used with Owner permission.
 - 1.3.4.3. Mats and matting that contain Polypropylene netting shall not be used.
 - 1.3.4.4. If areas plated with this soil are to be sodded, the sod needs to be grown on a soil that is compatible with the above specifications.
 - 1.3.4.5. Sod shall not be grown on a clay textured soil be placed above the specified sandy soil.

- 1.3.4.6. Turf species and cultivars should be selected carefully and favor cool season grasses that have high salinity tolerance, drought tolerance, traffic tolerance and high recovery potential. For specific guidelines see Turf Standards.
- 1.3.4.7. Management of areas plated with the Lawn and Landscape Soil may be slightly different from areas of native clay soil.
 - 1.3.4.7.1. The turf will require the same total amount of irrigation water (approximately 1-inch per week in heat of summer). However, it will have a smaller storage capacity and may require smaller, but more frequent applications that total the same 1-inch per week.
 - 1.3.4.7.2. The use of slow-release fertilizer products will help reduce nutrient losses due to leaching.

1.4. Trees and Shrubs:

- 1.4.1. The University of Iowa follows the standards and Industry Best Practices as endorsed by the following Reference Standards:
 - 1.4.1.1. American National Standards Institute (ANSI) Z60.1
 - 1.4.1.2. University of Iowa Campus Tree Care Plan
 - 1.4.1.3. ANSI A300-01 Pruning
 - 1.4.1.4. ANSI A300-02 Soil Management (Fertilization)
 - 1.4.1.5. ANSI A300-05 Management of Trees and Shrubs during Site Planning, Site Development, and Construction
 - 1.4.1.6. ANSI A300-06 Planting and Transplanting
 - 1.4.1.7. ANSI A300-08 Root Management
 - 1.4.1.8. Related ISA Best Management Practices (BMPs)
- 1.4.2. Pre-Construction:
 - 1.4.2.1. Owner's Arborist shall provide a tree evaluation of trees on the project site and the laydown areas.
- 1.4.3. Tree Survey:
 - 1.4.3.1. All trees on all development sites shall be surveyed and shown on the site plan.
 - 1.4.3.2. If approved by the Owner, an outside tree survey can be used.
 - 1.4.3.3. Survey criteria shall state number of trees, species, and tree diameter at breast height (DBH), measured at 4-feet 6-inches typically, or at ground level for a 2-inch size or less tree.

1.4.3.4. Any tree survey must be vetted by the University Landscape Services Arborist prior to the issuance of construction documents.

1.4.4. Critical Root Zone Determination (CRZ):

1.4.4.1. General:

1.4.4.1.1. Owner’s Arborist shall coordinate specific requirements regarding construction forms and equipment, foundation and construction traffic, or any other issues as they relate to the CRZ.

1.4.4.1.2. These standards act as the minimum amount of preservation required, with the exceptions of historical, significant, or very large, valuable trees as outlined below:

1.4.4.1.2.1. Historical, significant, or very large, valuable trees that shall have 2-foot of radial protection per diameter inch of tree shall determine CRZ (i.e., a 20-inch tree would have a 40-foot diameter CRZ).

1.4.4.1.2.2. Most trees will have a 1 ½-foot of radial protection per diameter inch of tree that shall determine CRZ (i.e., a 20-inch tree would have a 30-foot diameter CRZ; see chart below).

1.4.4.2. Areas:

1.4.4.2.1. Areas within one quarter of the CRZ means no impact is allowed.

1.4.4.2.2. Areas within one half of CRZ means no cut or fill greater than 2-inches is allowed.

1.4.4.2.3. Any cuts required will be performed by Owner’s Arborist or a member of his/her team.

1.4.4.2.4. Total CRZ needs to be preserved by at least seventy-five percent (75%).

Tree diameter, DBH (inches) measured 4.5 feet ½ inches from ground	Critical Root Zone, CRZ (feet)
8 inches	12 feet
10 inches	15 feet
15 inches	22.5 feet
20 inches	30 feet
25 inches	33 feet
30 inches	45 feet
40 inches	60 feet

1.4.5. Tree Protection Fencing:

- 1.4.5.1. Any tree, or area to be preserved for a duration of eight (8) months or longer shall be protected with temporary 6-foot-tall chain-link fencing, which shall not be moved during any time of construction unless written permission is obtained from the Owner's Arborist.
- 1.4.5.2. Trees being preserved for less than eight (8) months can use other types of fencing if approved by Owner.
- 1.4.5.3. If this is not practical or is harmful to a tree or an area, coordination of alternatives should occur in coordination with the Owner's Arborist.
- 1.4.5.4. Protection fencing shall be installed prior to the start of any project work and shall be maintained throughout all phases of the construction project until the final walk-through is performed unless prior approval is sought through Owner's Arborist.
- 1.4.5.5. Tree protection fencing that is damaged or found to be non-compliant shall be repaired/replaced within 24-hours of notice or a stop work order shall be given.
- 1.4.5.6. Erosion and sedimentation control barriers shall be installed or maintained in a manner that does not result in damage to the tree or Critical Root Zone (CRZ) and in a manner that does not result in soil buildup.
- 1.4.5.7. Protective fences shall surround the trees or groups of trees and will remain at the location specified in the approved site plan. For natural areas, protective areas shall follow the limit of construction line in order to prevent the following:
 - 1.4.5.7.1. Soil compaction in the root zone areas from vehicular traffic or storage of equipment and materials.
 - 1.4.5.7.2. Root zone disturbances due to grade changes (greater than 2-inches of cut or fill) or trenching not approved or authorized by Owner's Arborist.
 - 1.4.5.7.3. Wounds to exposed roots, trunk, or limbs by equipment.
 - 1.4.5.7.4. Other activities detrimental to trees such as chemical storage, concrete clean-outs and other construction spoils, or portable toilets.
 - 1.4.5.7.5. Exceptions to installing fences at CRZ shall be permitted in the following cases:
 - 1.4.5.7.5.1. Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, erect the fence 2-to-4-feet beyond the area disturbed.
 - 1.4.5.7.5.2. Where permeable paving is to be installed within a tree's CRZ, erect the fence at the outer limits of the permeable paving area (prior to site grading so that the area is graded separately prior to paving installation to minimize root damage).

- 1.4.5.7.5.3. Where trees are close to proposed buildings, erect the fence so there is 6-to-10-feet of workspace between the fence and the building, as possible.
- 1.4.5.7.5.4. Where there are severe space constraints due to Limits of Construction (LOC) or other special requirements contact the Owner's Arborist
- 1.4.5.7.5.5. Special Note: For the protection of natural areas, fences are required. There shall be no exceptions.

1.4.6. Tree Protection During Construction and CRZ Management:

- 1.4.6.1. Projects on the University of Iowa campus shall adhere to specifications based on the most current editions of the following:
 - 1.4.6.1.1. American National Standards Institute (ANSI) A300– 05 Management of Trees and Shrubs during Site Planning, Site Development, and Construction (2020).
 - 1.4.6.1.2. ANSI z133.1 Safety Standards.
 - 1.4.6.1.3. Related ISA Best Management Practices (BMPs).
- 1.4.6.2. Unless this is a shared project with the City of Iowa City or Coralville, all trees within the LOC are the property of the University of Iowa and shall be treated as a valued asset. In order to do this and best assure the survival of these assets, the following shall be enacted:
 - 1.4.6.2.1. Weekly (or as often as needed) inspections of tree protection fencing.
 - 1.4.6.2.2. All deviations of tree protection and the CRZ shall be brought to the attention of the Owner.
 - 1.4.6.2.3. Any project from University's Utility Operator will need to be managed under the direction of the University of Iowa Director of Utilities in coordination with Owner.
 - 1.4.6.2.4. Any deviation from the campus standards or the approved tree protection plans will require written approval with sign offs from the University of Iowa Arborist and Landscape Services Management.
 - 1.4.6.2.5. The University of Iowa Landscape Services adheres to and requires the following management practices for Critical Root Zone:
 - 1.4.6.2.5.1. For any root larger than 1-inch that is damaged by any construction or work, shall be communicated to the University of Iowa Arborist who will prune the root flush with the soil.
 - 1.4.6.2.5.2. Damaged roots properly attended shall be backfilled with high quality soil or compost as soon as possible.

1.4.6.2.5.3. Cuts to oak roots shall be made using disinfected tools.

1.4.6.2.5.4. If exposed roots cannot be covered within a 48-hour time period, they shall be covered with organic material to reduce soil temperature and minimize evaporative water loss.

1.4.6.2.5.5. Excavations occurring within the CRZ shall be coordinated to expose roots through a means of air excavation performed by the University arborist or a member of his/her team to significantly reduce damage to a tree and its root system and enhance survivability.

1.4.6.3. CRZ Maintenance within Limits of Construction (LOC):

1.4.6.3.1. The contractor is responsible for care or landscape and lawn unless communicated and coordinated through the Owner.

1.4.6.3.2. Grass shall not be allowed to grow in excess of the surrounding maintained turf outside of the LOC and should not be cut less than 4-inches in height at any given time.

1.4.6.3.3. Routine hand weeding will likely be necessary to maintain the area as an acceptable standard.

1.4.6.3.4. All trash in area is to be frequently removed and should not be in place when mowing or trimming.

1.4.7. Irrigation (Watering) Standards for Preserved Trees:

1.4.7.1. Coordination for irrigation must occur prior to any construction or activity and should typically be done in the pre-construction meeting.

1.4.8. Tree Inspections:

1.4.8.1. Owner's Arborist or a member of his/her team will conduct inspections of the area on a regular basis.

1.4.8.2. Frequency will be based on project needs.

1.4.8.3. The inspections shall include the following:

1.4.8.3.1. Tree preservation zone encroachment.

1.4.8.3.2. Tree fence quality and integrity.

1.4.8.3.3. Irrigation/ soil moisture levels.

1.4.8.3.4. Evidence of plant stress.

1.4.8.3.5. Insect/ disease issues.

1.4.8.3.6. Dust levels on leaves.

1.4.9. Trees as University Assets:

1.4.9.1. Any tree shall not be removed without a review by the Owner's Arborist.

1.4.9.2. Work on tree or removal of tree will require written permission by the Owner's Arborist.

1.4.9.3. Any historical or significant tree shall make every attempt to preserve in place.

1.4.9.3.1. If possible, relocation of tree might be considered.

1.4.9.3.2. Removal of any of these trees will require written permission from the Owner and require replacement of tree.

1.4.9.4. Trees removed by any work or projects shall be replaced at the expense of the project.

1.4.9.5. Criteria for replacement is as follows:

1.4.9.5.1. A tree labeled as heritage or significant, as listed on the UI Tree website shall be replaced on a 3-inch to 1-inch ratio.

1.4.9.5.1.1. For example, a 24-inch caliper tree is to be replaced with 72-inches of total tree caliper.

1.4.9.5.1.2. This can be accomplished a variety of ways, such as twenty-four (24) 3-inch trees or thirty-six (36) 2-inch caliper trees.

1.4.9.5.2. Larger non historical/ significant trees shall be replaced at a 1-inch-to-1-inch ratio.

1.4.9.5.3. Trees less than 6-inches shall be replaced at a 1:1 ratio.

1.4.10. Tree Design and Tree Planting Specifications:

1.4.10.1. Projects on the University of Iowa campus shall adhere to the specifications based on the most recent editions of the following:

1.4.10.1.1. American National Standards Institute (ANSI) A300 – 06 Planting and Transplanting Standards.

1.4.10.1.2. American National Standards Institute (ANSI) Z60.1-2013, standards for nursery stock.

1.4.10.1.3. ANSI Z133.1 Safety Standards.

1.4.10.1.4. Related ISA Best Management Practices (BMPs).

1.4.11. Additional Design Guidelines:

1.4.11.1. No additional tree plantings will be allowed within existing CRZ.

- 1.4.11.2. No new plant material will be allowed within a tree's CRZ. Mulch only.
- 1.4.11.3. All nursery stock shall be inspected and approved prior to installation based on ANSI Z60.1 standards and correct genus, species, cultivar, variety, or specific epithet, as per approved landscape plan and Campus master Plan Acceptable Plant List.
- 1.4.11.4. For types of trees refer to the Campus Landscape Master Plan.
- 1.4.11.5. All trees planted on campus shall meet the American Standard for Nursery Stock (ANSI Z60.1).
- 1.4.11.6. Tree spacing is to adhere to the following:
 - 1.4.11.6.1. Large trees (defined as 30-foot-tall and wide or larger) are to typically be planted a minimum of 30-feet off center from each other.
 - 1.4.11.6.2. Large trees shall have a minimum of 1,000 cf of soil unless otherwise approved by Owner.
 - 1.4.11.6.3. Medium trees (defined as 20-foot-tall and wide up to 30-feet) are to typically be planted a minimum of 20-feet off center from each other.
 - 1.4.11.6.4. Medium trees shall have a minimum soil volume of 800 cf.
 - 1.4.11.6.5. Smaller trees shall be planted with proper spacing per tree species.
- 1.4.11.7. Soil volume can be shared among trees.
- 1.4.11.8. If the soil volume is not available, tree industry technologies that provide additional volume can be considered under the approval of Owner.
- 1.4.11.9. Trees shall be planted in a naturalized manner.
- 1.4.11.10. Tree selection should be made following the guidelines of thirty percent (30%) from a family, twenty percent (20%) from a genus and ten percent (10%) from species.
- 1.4.11.11. Trees should be specified to be planted during the ideal windows of planting for our climate which is April into mid-June and September through October.
- 1.4.11.12. Recommended planting size for the Owner is 2-inches to 3-inches caliper and generally does not exceed 3-inches.
- 1.4.11.13. Prepare the hole two and a half (2½) to three (3) times the diameter of the container or ball of the tree.
- 1.4.11.14. The depth of the hole should allow the root flare to be visibly above grade with the top of the root ball sitting roughly 1-inch to 1 ½-inch above grade.
- 1.4.11.15. The first structural root should be 1-inch below grade.

- 1.4.11.16. If the tree comes in a container, lay the containerized tree or shrub on its side, and gently slide the plant out of the container.
 - 1.4.11.16.1. It may be necessary to push on the sides of the container to loosen the root ball.
 - 1.4.11.16.2. If the plant has become root-bound and roots have circled the container, slice the root ball in four (4) to five (5) places with a pruning saw or hand pruners that will cleanly cut roots.
 - 1.4.11.16.3. Loosen exterior of root ball to promote lateral root growth.
 - 1.4.11.16.4. Place the intact root system and soil from the container into the hole.
 - 1.4.11.16.5. Trees should be planted so that the root flare of the trunk is visible above the soil surface.
 - 1.4.11.17. Ball and burlap trees should be planted so that the root flare of the trunk is visible above the soil surface.
 - 1.4.11.17.1. Cut the twine from the root ball and peel back the burlap and metal basket, along with any other material that holds the root ball together.
 - 1.4.11.17.2. Remove all burlap fabric from the root ball. Remove remaining metal from the root ball.
 - 1.4.11.17.3. Be sure that anything else such as twine is also removed from around the roots or trunk.
 - 1.4.11.17.4. Backfill soil into the hole a few inches at a time, firming up the soil with light tamping after each addition.
 - 1.4.11.17.5. When backfilling, assure tree stays in place vertically.
 - 1.4.11.18. Staking the trees are not typically advised.
 - 1.4.11.19. All staking must be approved beforehand by Owner and will typically be a two (2) stake system with t-posts and caps.
 - 1.4.11.20. For any tree work in a project the Owner's Arborist shall perform inspections before, during and after the project to assure compliance to standards and quality of work regarding trees.
- 1.4.12. Common Planting Problems:
- 1.4.12.1. Planting too deep – roots suffocate.
 - 1.4.12.2. Planting too shallow – roots dry out.
 - 1.4.12.3. Hole too narrow – root system struggles to establish.

- 1.4.12.4. Soft fill added to bottom of hole – plant settles too deeply.
- 1.4.12.5. Twine left on trunk – girdles trunk.
- 1.4.12.6. Wire basket left intact – girdles roots.
- 1.4.12.7. Container tree circling roots left intact – root system struggles to establish/girdles trunk.

1.4.13. Tree Work on Campus:

- 1.4.13.1. All tree work on campus trees, such as pruning, shall be done either by FMLS or under the direct supervision of the Owner’s Arborist.
- 1.4.13.2. Issues that need addressed are to be reported to the University Arborist before damage occurs to tree. (i.e., a low hanging branch should be reported before a truck tears it by driving under it.)

1.4.14. Tree Care for Emergency and/or Utility Work:

- 1.4.14.1. The following are guidelines are required for utility work:

1.4.14.1.1. Long-term Planning:

- 1.4.14.1.1.1. Because there are times that are much safer and healthier for tree work, coordination of all known future work within a six (6) month or longer period shall be undertaken between the known project and the Owner’s Arborist.
- 1.4.14.1.1.2. Work on trees shall take place between the months of September through the middle of June.
- 1.4.14.1.1.3. Tree work is to be performed prior to any of these known projects and in some cases, it may be necessary to coordinate this work a few months before summer work so that this tree work can be done in preparation for the project. Examples of this work may be long-term projects such as from a Master Plan or known project.

1.4.14.1.2. Short-term Planning:

- 1.4.14.1.2.1. For emergency or utility work that can be planned a few days out, the Utility Operator shall contact the Owner’s Arborist to allow necessary tree work prior to the utility or emergency work.

1.4.14.1.3. Emergency Work:

- 1.4.14.1.3.1. For emergency work that can allow no preparation or coordination, the Utility Operator shall contact the Owner’s Arborist immediately.

- 1.4.14.1.3.2. When possible, the site shall be secured and prior to any backfilling, the Owner's Arborist shall have the opportunity to do any needed work to the tree such as root pruning roots damaged in excavation. Backfilling after this work can then be performed.
- 1.4.14.1.3.3. For any work that is performed after coordination with the Utility Operator, work shall not happen beyond the demarked point of where all tree care work was performed.
- 1.4.14.1.3.4. If roots were pruned, no work or further excavation is allowed to happen between that point and the tree.

1.5. Turf – New or Existing:

1.5.1. Turf Specifications:

- 1.5.1.1. Bluegrass variety to be specified for all University projects is Urban Stabilization Mix.
- 1.5.1.2. RTF Fescue is not acceptable.
- 1.5.1.3. All projects shall provide sod at building entrances and high-profile areas or when required for erosion control, unless otherwise approved by Owner.
- 1.5.1.4. Soil pH shall be between 6.0 and 7.0, as specified in University of Iowa Soil Standards, prior to any sod installation.
- 1.5.1.5. Sod installation shall take place between April and into June, and September and October, unless coordinated and approved through Owner.
- 1.5.1.6. All sod shall be dense and healthy cut between 2-inches and 3-inches in height before being removed from sod farm and delivered to the Owner.
- 1.5.1.7. Sod shall be delivered in untorn, continuous pieces in either roll or square, as specified.
 - 1.5.1.7.1. It shall be cut with a minimum of 1-inch soil and root in a manner that allows rolls or squares to remain intact through the installation process.
- 1.5.1.8. Sod shall be disease, insect, and weed free with no contamination of other grass varieties.
- 1.5.1.9. No sod shall show damage or discoloration.
- 1.5.1.10. Bluegrass leaf color to be dark green.
- 1.5.1.11. Sod to be delivered and installed within 24-hours of harvesting.
- 1.5.1.12. All pricing for sod shall include delivery and unloading at areas specified by Owner.
- 1.5.1.13. All sod to be installed within 24-hours of delivery.
- 1.5.1.14. Any sod not meeting the above specifications will be rejected.

- 1.5.1.15. Sow Bluegrass seed at a rate of 4 to 6 lbs. per 1,000 sf.
- 1.5.1.16. Seed installed on a slope shall be applied by hydroseed and include tackifier. One (1) bag mixed with 300 gallons of water.
- 1.5.1.17. Blue grass seed shall be mixed with SOS (annual rye) for quicker germination and coverage.
- 1.5.1.18. A 13-13-13 fertilizer shall be applied at the same time.
- 1.5.1.19. No erosion matting shall be used unless coordinated and approved through Owner or required by Iowa DNR standards for slopes.

1.5.2. Soil Prep/ Finish Grade Prior to Installation:

- 1.5.2.1. Area shall be hand raked and free of debris.
- 1.5.2.2. All clods and rocks larger than 1-inch diameter shall be removed.
- 1.5.2.3. All rock, clods, trash, and debris removed shall be the contractor's responsibility to remove from site.
- 1.5.2.4. For sod that is to be installed next to concrete or hardscape, a reduced elevation shall be installed to allow for the thickness of sod where the top of sod shall tie into the top of slab.
- 1.5.2.5. Sod thickness is 1-inch.
- 1.5.2.6. All areas where sod is to be laid shall be graded properly, having no humps and no depressions that hold water.
- 1.5.2.7. Area to be graded with a minimum two percent (2%) slope.
- 1.5.2.8. All drainage exit points to be determined by Owner.
- 1.5.2.9. Any work not meeting the above specifications will be rejected.

1.5.3. Installation Specifications:

- 1.5.3.1. All Finished turf areas shall have a final grade no steeper than 1-foot vertically to 3-feet horizontally.
- 1.5.3.2. Steeper areas shall be covered with ground covers or modified with walls or other treatments.
- 1.5.3.3. Providing adequate turf coverage to allow timely acceptance for National Pollutant Discharge Elimination Systems (NPDES), Phase II, Municipal Separate Storm System (MS4) storm water management permits shall be considered in selecting seed or sod.
- 1.5.3.4. All sod is to be installed as follows:

- 1.5.3.4.1. All sod joints on edges and ends tightly abutted together.
- 1.5.3.4.2. No gaps will be allowed.
- 1.5.3.4.3. Sod shall not have overlapping joints.
- 1.5.3.4.4. All sod seams shall be laid similar to a brick pattern where the seams of one line of sod are offset to the adjacent lines.
- 1.5.3.4.5. No torn or damaged sod shall be installed.
- 1.5.3.5. Any damage to sod or grade during installation, such as ruts or tracks, shall be fixed to the satisfaction of Owner.
- 1.5.3.6. All sod shall be cut around drains, utility boxes, sprinkler heads, or any other permanent structure in the installation site.
- 1.5.3.7. No scraps of sod, debris, trash of any kind is to be left on site at completion of job. Removal and disposal is the responsibility of the contractor.
- 1.5.3.8. Watering for sod installed in areas without automated sprinklers is the responsibility of the contractor.
- 1.5.3.9. Contractor shall water sod daily to complete saturation until Substantial Completion.
- 1.5.3.10. If approval is given to sod or seed past June, longer and more frequent watering may need to take place and shall be coordinated with Owner.
- 1.5.4. Turf Repair Specifications:
 - 1.5.4.1. All areas of campus used for laydown are to be repaired to the original conditions with approved acceptance by Owner.
 - 1.5.4.2. All trash and debris to be completely removed.
 - 1.5.4.3. Removal and disposal are the responsibility of the contractor.
 - 1.5.4.4. All damaged areas shall be stripped of sod at a depth of 1-inch with a sod cutter.
 - 1.5.4.5. The subgrade shall be roughed up to assure decompaction.
 - 1.5.4.6. Soil shall be added or removed to restore site to the original (or improved) state.
 - 1.5.4.6.1. Any contaminated soil shall be completely removed with new soil brought in by the contractor.
 - 1.5.4.6.2. Removal and disposal are the responsibility of the contractor.
 - 1.5.4.7. Grade for surface drainage will be determined by Owner prior to project acceptance.

- 1.5.4.8. Areas that were used for parking shall be excavated to a depth of the material that was used plus one (1) to two (2) inches.
- 1.5.4.9. Subgrade shall be tilled and leveled to assure decompaction.
- 1.5.4.10. Fill material that shall go back is to meet the standards of the University of Iowa Soil Specification Standards.
- 1.5.4.11. All trash and debris exposed or on site during the restoration process is to be removed from site.
- 1.5.4.12. Removal and disposal are the responsibility of the contractor.
- 1.5.4.13. The contractor is responsible for the clean-up of all materials, spills, or any issue that was caused during the course of the project and shall return the site to the original (or improved) condition.
 - 1.5.4.13.1. Coordination and acceptance of clean-up shall take place with Owner.
- 1.5.4.14. Irrigation damaged or removed shall be replaced.
- 1.5.4.15. Sod shall be installed between April 15 and June 15 or between August 15 and November 15.
- 1.5.4.16. Seeding shall be installed between April 15 and June 15 or between August 15 and October 15.

2. Landscape Furniture and Fixtures:

- 2.1. Site plans shall indicate the location of all site furniture (benches, signs, fences/barriers, bike racks, landfill, and recycling receptacles, etc.).
- 2.2. Any surface greater than 6-inches and less than 4-feet 0-inches above grade and over 4-feet 0-inches in length, adjacent to a smooth paved surface, shall be designed to deter skateboard and inline skate damage.
 - 2.2.1. This shall include retaining walls, handrails, seat walls and site furniture benches, etc.
 - 2.2.2. Proposed solutions shall complement and be an integral part of the overall site design.
- 2.3. Where necessary to control pedestrian traffic, the standard post and chain fence shall be used. Refer to LANDSCAPING POST AND CHAIN FENCE DETAILS in Appendices.
- 2.4. All site furniture shall be surface mounted on concrete.
- 2.5. Custom designed site furnishings shall require written approval from Owner.
- 2.6. All metal shall be painted black.
- 2.7. All wood shall be lpe.
- 2.8. Benches:

2.8.1. Stone and concrete benches shall not be used.

2.8.2. Benches shall be from Landscape Forms.

2.9. Bicycles and Bicycle Parking:

2.9.1. Bicycle parking shall be provided per UI Parking and Transportation requirements.

2.9.2. Bicycle parking shall be evaluated based on the building programming, existing demand, and future growth.

2.9.3. Current guidelines are one (1) bicycle space for each ten (10) employees plus one (1) space for each ten (10) students of planned capacity or one (1) space for each 20,000 square feet of floor space, whichever is greater.

2.9.4. Minimum of two (2) spaces, as based on the Association of Pedestrian and Bicycle Professionals' Bicycle Parking Guidelines.

2.9.5. Final bicycle count shall be approved by Owner.

2.9.6. Bicycle racks shall be located along a major building approach line and clearly visible from the approach.

2.9.7. The rack area shall be within 50-feet of an actively used building entrance but no farther than 120-feet from an entrance.

2.9.8. A rack area shall be as close as, or closer than, the nearest car parking space.

2.9.9. Bicycle racks shall be the Bike Rib Series Linear Rack or Bikerib2.0, galvanized steel, as manufactured by Function First, Inc.

2.9.10. Parallel racks shall be installed to allow pedestrian traffic between parked bikes.

2.9.11. Bicycle racks shall be surface-mounted.

2.9.11.1. Install 24-to-30-inches from surrounding wall or object.

2.10. Recycling and Landfill Receptacles:

2.10.1. Receptacle shall be from Landscape Forms.

3. Roadways, Parking Lots, and Walkways:

3.1. General:

3.1.1. Curbs shall be Portland cement concrete.

3.1.2. Pavements shall be designed to accommodate the design vehicle for the pavement's use.

3.1.3. The minimum lane width shall be 10 feet, excluding curb and shy distance (concrete pavements), curb and gutter (asphalt pavements), or striping. Curve radii and intersection radii shall accommodate the design vehicle's design speed and turning movements.

- 3.1.4. All sidewalks, ramps, and other paved, exterior walking surfaces shall be concrete. Concrete pavers may be used in limited areas as accents.
- 3.1.5. All materials shall be slip resistant.
- 3.1.6. Ramps shall be a minimum width of 7 feet clear of handrails and/or walls. Any switchback on a ramp shall be dimensioned to allow Bobcat-type snow removal equipment to navigate turns.
- 3.1.7. Design shall be in accordance with AASHTO "GREEN BOOK"— A Policy on Geometric Design of Highways and Streets.
- 3.1.8. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.
- 3.1.9. Perforated pipe for subgrade drains shall be SDR-35, Schedule 40 PVC, or HDPE conforming to ASTM F2688 or F2306.

- 3.1.9.1. Pipe shall be installed in a geotextile envelope with clean rock.

- 3.1.9.2. Perforated pipe in a 'sock' shall not be allowed.

3.2. Roadways:

- 3.2.1. The ratio of slab width to length shall not exceed 1.67 for street pavements.

- 3.2.2. Variance in joint spacing may be permitted to achieve desired architectural effect as approved by Owner.

3.2.3. Asphalt and Portland Cement Concrete Paving:

- 3.2.3.1. Asphalt/Portland cement concrete pavement shall be designed according to the following guidelines:

- 3.2.3.1.1. Roadways, rigid and flexible shall follow AASHTO Guidelines for the Design of Pavement Structures.

- 3.2.3.1.2. Parking Lots shall be:

- 3.2.3.1.2.1. Rigid - Portland Cement Association.

- 3.2.3.1.2.2. Flexible - The Asphalt Institute.

- 3.2.3.2. Walkways shall have a minimum compressive strength of 4000 psi for twenty-eight (28) days.

- 3.2.3.3. Exposed concrete, including precast concrete, shall be air entrained.

- 3.2.3.4. Asphalt surfaced parking lots shall have a minimum cross section of 3-inches of asphalt surface prime coat, 6-inches of crushed stone Type-1 aggregate for base, and an underlayment of geotextile fabric.

- 3.2.3.5. Concrete surfaced parking lots shall have a minimum cross section of 6-inches of concrete and 4-inches of Type-1 aggregate for base.

- 3.2.3.6. The concrete shall be Portland cement concrete with a heavy broom finish.
- 3.2.3.7. All joints shall be shown on the plans and shall be sealed with traffic-grade caulking.
- 3.2.3.8. Concrete strengths shall be specified in accordance with actual requirements.
- 3.2.3.9. Concrete mix shall be specified with minimum cement content, as well as maximum water/cement ratio.
- 3.2.3.10. Fibers (non-asbestos) may be used in addition to steel to control shrinkage cracking.
- 3.2.3.11. Design Professional shall specify inspection and testing requirements and shall include procedures for evaluation of test data.
- 3.2.3.12. The Owner shall retain services of a Testing Firm.
 - 3.2.3.12.1. Constructor shall be responsible for scheduling the tests.
 - 3.2.3.12.2. Constructor shall be required to notify the Owner a minimum of 48-hours prior to all placement of concrete.
 - 3.2.3.12.3. Specifications shall require strength, air entrainment, temperature, and slump tests, and shall indicate allowable limits for each measure.
 - 3.2.3.12.4. Strength tests shall require four (4) cylinders (three (3) shall be broken and one (1) spare).
 - 3.2.3.12.5. Test results shall be sent directly to the Constructor, Design Professional, and the Owner, as specified.
 - 3.2.3.12.6. Concrete shall be tested at the minimum rate of one (1) test for the first twenty-five (25) cubic yards (CY) placed each day and one (1) test for each additional fifty (50) CY placed.
 - 3.2.3.12.7. Concrete may be tested more often at the discretion of the Owner.
 - 3.2.3.12.8. Test data from concrete cylinder breaks shall be evaluated using procedures of the American Concrete Institute (latest edition of ACI 214) to determine if the compressive strength of the concrete tested is acceptable.
- 3.2.3.13. All concrete walks and drives shall be constructed on a minimum of 4-inches of compacted, crushed, stone base course.
- 3.2.3.14. Gradation of the crushed stone shall be as required for Type-1 aggregate.
- 3.2.3.15. Sand shall be from local sources meeting ASTM C-144 for mortar and ASTM C-33 Size 67 for concrete.
- 3.2.3.16. Driving surface pavement patches for utility cuts shall include 8-inches of concrete with #4 transverse bars (to the patch centerline) at 18-inch maximum centers and two (2) #4 longitudinal bars.
 - 3.2.3.16.1. Patch shall extend 1-foot minimum outside the trench.

3.2.3.16.2. Patch surface shall be concrete with abutting concrete paving or 2-inches of asphaltic concrete/tack coat with abutting asphalt surface.

3.2.4. Joints and Concrete Flatwork:

- 3.2.4.1. Expansion joints shall be installed to provide for thermal expansion of concrete pavements.
- 3.2.4.2. Generally, expansion joints shall be provided at the PC and PT of curves (where the deflection angle is greater than 30E) and intersections.
- 3.2.4.3. If required for load transfers, expansion joints shall be detailed with dowel bars to allow load transfer and expansion of the concrete slabs.
- 3.2.4.4. Non-extruding expansion joint material shall be used with expansion joints.
- 3.2.4.5. Portland cement concrete flatwork shall be isolated from manholes, existing walls, etc. by use of expansion joints.
- 3.2.4.6. Contraction joints shall be tooled during finishing or saw cut within 18-hours of concrete placement.
- 3.2.4.7. Construction joints shall be located at expansion joint locations wherever possible.
- 3.2.4.8. Construction joints at other locations shall be keyed.
- 3.2.4.9. All expansion joints on Institutional Roads shall be sealed with traffic grade, non-asphalt, non-extruding sealant.
- 3.2.4.10. Joint spacing and joint detail shall be shown on the drawings.

3.3. Parking Lots:

- 3.3.1. All accessible parking spaces shall be designed per “universal accessible” criteria defined in Iowa Administrative Code Section 661-18.3 Exception.
- 3.3.2. Parking spaces, other than accessible shall be 8 feet 6 inches in width. No compact car spaces shall be permitted.
- 3.3.3. All accessible parking spaces shall be designed per “universal accessible” criteria as defined in Iowa Administrative Code Section 661-18.3.
- 3.3.4. Metered accessible parking spaces shall include curb-cuts and sidewalk access to the meters.
- 3.3.5. Paint colors for striping shall be white for general lot striping, yellow for no parking areas, and blue for accessible spaces and areas. Lead-bearing substance paints are prohibited.

3.4. Walkways:

- 3.4.1. All sidewalks shall have a minimum width of 8-feet.
- 3.4.2. Where a sidewalk runs parallel and is immediately adjacent to a roadway back of curb, minimum width shall be 10-feet.

3.4.3. Walks adjacent to roads or driveways shall not have grass strips between sidewalk and road or driveway, unless a minimum 8-foot grass strip can be provided.

3.4.4. A medium broom finish shall be applied perpendicular to traffic flow.

3.4.4.1. All brooming directions shall be shown on the drawings and described in the specifications.

3.4.5. All sidewalks leading up to a vehicular roadway or route shall have a detectable warning plate installed.

3.4.5.1. Location of plate shall be perpendicular to path of travel and run adjacent to back of curb.

3.4.5.2. Blended radius curb ramps at street intersections shall not be permitted.

3.4.6. Site steps are not allowed on public sidewalks when ADA requirements can be accomplished with a ramp.

3.4.6.1. Design accessible exterior routes without ramps when possible and use alternatives such as sidewalks and proper grading to achieve gentler slopes.

3.4.7. The ratio of slab panel width to length shall not exceed 1.25.

3.4.8. Variance in joint spacing may be permitted to achieve desired architectural effect as approved by Owner.

3.4.9. Concrete color shall be specified to match surrounding walkways.

3.4.10. Snowmelt shall be designed into walkways as per the guidelines under HVAC – Snowmelt System.

3.4.11. Elevated walkways shall have guardrails or barrier type devices a minimum of 6-feet high that is non-climbable when the walkway is elevated 12-feet above grade or more.

3.4.12. Detectable warning plate (truncated dome) shall be cast iron, factory painted “brick red.”

3.4.12.1. Acceptable Manufacturers:

3.4.12.1.1. Neenah Foundry Co.

3.4.12.1.2. East Jordan Iron Works

3.4.12.1.3. Tuff Tile

3.5. Temporary Traffic Control:

3.5.1. Barricades:

3.5.1.1. Construction sites in or adjacent to the pedestrian access route shall be protected with a barricade.

3.5.1.2. Barricades shall be installed in the following locations:

3.5.1.2.1. Between the pedestrian access route and any adjacent construction site.

- 3.5.1.2.2. Between the alternate circulation path and any adjacent construction site.
 - 3.5.1.2.3. Between the alternate circulation path and the vehicular way, if the alternate circulation path is diverted into the street.
 - 3.5.1.2.4. Between the alternate circulation path and any protruding objects, drop-offs, or other hazards to pedestrians.
 - 3.5.1.2.5. At the down curb ramp of an intersection, if the opposite up curb ramp is temporarily and completely blocked, and no adjacent alternative circulation path is provided.
- 3.5.1.3. Wooden railing, fencing, and similar systems placed immediately adjacent to motor vehicle traffic shall not be used as substitutes for crashworthy temporary traffic barriers.
- 3.5.1.4. Tape, rope, or chain shall not be used as a control for pedestrian movements or as a safeguard to protect individuals from hazards.
- 3.5.1.5. Barricades are not required where the construction site or alternate-circulation path is enclosed with a solid, cane-detectable fence or wall.
- 3.5.1.6. Where protection is provided using a solid fence or wall, a painted or applied horizontal 6-inch minimum stripe in seventy percent (70%) contrast shall be provided at between 42-inches and 60-inches above the adjacent grade.
- 3.5.1.7. Barricade specifications:
- 3.5.1.7.1. Barricades shall meet or exceed ADA guidelines and MUTCD standards.
 - 3.5.1.7.2. Use Plastic Safety Systems Safety Wall ADA compliant pedestrian barricades or approved equal.
 - 3.5.1.7.3. Construction barricades at the alternate circulation path shall be continuous, stable, and non-flexible.
 - 3.5.1.7.4. Shall have a solid toe rail with its top edge at 6-inches minimum in height and its bottom edge no higher than 1½-inches above the adjacent surface.
 - 3.5.1.7.5. Shall have a continuous railing mounted at a top height of 36-inches to 42-inches with diagonal stripes having at least seventy percent (70%) contrast.
 - 3.5.1.7.6. The top rail shall be parallel to the toe rail and be situated to allow pedestrians to use the rail as a guide for their hand(s) for way-finding purposes.
 - 3.5.1.7.7. Barricade support members shall not protrude more than 4-inches beyond the toe rail into the alternate circulation path.

3.5.2. Warnings and Signage:

- 3.5.2.1. Warning signs shall be posted when an alternate circulation path or a barricade is created in the public right-of-way.

- 3.5.2.2. Warnings shall be located at both the near side and the far side of the intersection preceding a temporarily completely blocked pedestrian way.
- 3.5.2.3. Proximity actuated audible information devices or flashing beacon lights which are accompanied by an audible tone are the most desirable ways to provide information to pedestrians with visual disabilities (equivalent to visual signing for notification of sidewalk closures).
- 3.5.2.4. Maintaining a detectable, channelized pedestrian route is preferred over closing a walkway and providing audible directions to an alternate route involving additional crossings and a return to the original route.
- 3.5.2.5. Wall and/or post-mounted signs with a leading edge between 27-inches and 80-inches above ground shall protrude no more than 4-inches.
- 3.5.2.6. When signs are mounted between two (2) posts spaced more than 12-inches apart, a cross bar 15-inches above the ground connecting the two (2) posts is required.
- 3.5.2.7. Adequate lighting shall be required to provide visibility of signage during non-daylight hours.
- 3.5.2.8. Visual characters shall comply with the 2010 ADA Standards for Accessible Design, Section 703.5, excluding 703.5.1.
- 3.5.2.9. Finish and contrast shall be eggshell finish with a minimum seventy percent (70%) visual contrast.
- 3.5.2.10. Pedestrian control signage shall be white with black lettering, except the S1-1 and R1-6A signs.

3.5.3. Vehicular Traffic:

- 3.5.3.1. Construction Documents shall include language for Constructor to provide and install temporary construction project signage, with Constructor responsible for maintaining as installed through project completion.
- 3.5.3.2. Signs may be installed on the project fencing or supported independently, depending on site conditions.
- 3.5.3.3. Temporary traffic control shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).
- 3.5.3.4. Construction activity impacting any street shall have a temporary traffic control plan approved by the appropriate agency:
 - 3.5.3.4.1. Iowa City Engineer's Office
 - 3.5.3.4.2. Coralville City Engineer's Office
 - 3.5.3.4.3. Iowa Department of Transportation
 - 3.5.3.4.4. The University of Iowa - Building & Landscape Services

3.5.4. Pedestrian Traffic:

3.5.4.1. Pedestrian safety and planning, like traffic control planning, shall be included in bid documents and address the following, with a pedestrian safety and ADA plan that includes:

3.5.4.1.1. Limits of construction (staging areas, entrance to construction site / staging areas, vehicular circulation to and through site).

3.5.4.1.2. Pedestrian routes around construction site (accessible routes, accessible parking locations, crosswalks, curb-cuts).

3.5.4.1.3. Building entrances (key building entrances and service areas to be maintained, accessible building entrances).

3.5.4.1.4. Signage plan (proposed pedestrian signage, designated pedestrian routes, signage location).

3.5.4.1.5. Details of proposed pedestrian safety improvements (temporary sidewalks, ramps, etc.).

3.5.4.1.6. Phasing (separate plans indicating construction phasing and schedule).

3.5.4.2. Pedestrian control plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) Part 6: Temporary Traffic Control.

3.5.4.3. Alternate / Temporary Pedestrian Circulation Paths:

3.5.4.3.1. An alternate circulation path shall be provided whenever the existing pedestrian access route in the public right-of-way is blocked by construction, alteration, maintenance, or other temporary conditions.

3.5.4.3.2. Where the alternate circulation path is adjacent to potentially hazardous conditions, the path shall be protected with a barricade.

3.5.4.3.3. The alternate circulation path shall have no protrusions up to a height of 80-inches, including scaffolding and scaffolding braces.

3.5.4.3.4. A pedestrian route shall not be severed and/or moved for non-construction activities, such as parking for vehicles and equipment.

3.5.4.3.5. Access to transit stops shall be maintained.

3.5.4.3.6. Where possible, the alternate circulation path shall parallel the disrupted pedestrian access route, on the same side of the street.

3.5.4.3.7. The alternate circulation path shall consist of a smooth, continuous hard surface with no curbs or abrupt changes in grade or terrain that could cause tripping or be an impediment to wheelchair use.

3.5.4.4. Movement by work vehicles and equipment across pedestrian walkways shall be minimized and, when necessary, shall be controlled by flaggers.

3.5.4.5. Staging or stopping of work vehicles or equipment along the side of pedestrian paths shall be avoided.

3.5.4.6. Access to the workspace by workers and equipment across pedestrian walkways shall be minimized.

33) UTILITIES

1. Trench Excavation and Backfill for Utilities:
 - 1.1. Piping shall have SUDAS Class 1 (IDOT Gradation 3) bedding and envelope.
 - 1.2. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to ninety-eight percent (98%) Standard Proctor Density under paving and suitable native fill compacted to ninety-five percent (95%) Standard Proctor Density under landscape areas.
 - 1.3. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.
 - 1.4. ~~water~~ Backfill material shall be placed in continuous layers not exceeding 6-inches in compacted depth.
 - 1.5. Maintain -2 percent to +4 percent optimum content for cohesive soils.
 - 1.6. Cohesionless soils shall be pre-wetted to within +3 percent of optimum moisture content before delivery to the project site.
 - 1.7. Install warning tape 12-inches to 18-inches above piping.
2. Utility Tracer Wire:
 - 2.1. All tracer wire shall have HMWPE or HDPE insulation intended for direct bury and shall be rated 600V where run in conduits with conductors operating over 30V.
 - 2.2. All tracer wire color coated per APWA standard and below for the specific utility being marked:
 - 2.2.1. Steam, Condensate = Yellow
 - 2.2.2. Communication = Orange
 - 2.2.3. Water = Blue
 - 2.2.4. Chilled Water = Purple
 - 2.2.5. ~~Forced mMain Sanitary SsewerSewer~~ = Green
 - 2.2.6. Electric = Red
 - 2.2.7. Lighting = Green with Yellow Stripe
 - 2.2.8. ~~Natural Gas = through deviation request.~~
 - 2.2.7-2.2.9. ~~Tracer wire not required for gravity fed sanitary sewer or storm sewer~~
 - 2.3. ~~Tracer wire shall be #12 AWG solid copper wire.~~ ITS tracer wire shall be Pro-Trace Copper PE30 #10 solid copper (orange).
 - 2.4. Tracer wire splices are not allowed; all runs will be home runs.

- 2.5. A continuous length of tracer wire shall be installed between [ITS vaults to terminate 6-inches below vault lid.](#)~~terminal boxes.~~
- 2.6. No splices are allowed for new construction or relocation.
 - 2.6.1. Replace entire run of tracer wire between [ITS vaults if necessary.](#) ~~terminal boxes as necessary.~~
- 2.7. Innerduct for Tracer Wire:
 - 2.7.1. Install a 1-inch diameter, SDR 13.5 HDPE pipe (innerduct) along the top of the entire length of pipe for direct buried installation.
 - 2.7.2. Install 1 ¼-inch diameter, SDR 13.5 for trenchless installations.
 - 2.7.3. Innerduct is not needed for site lighting [or telecommunications-ITS.](#) The tracer wire for site lighting may be pulled through lighting conduit.
 - 2.7.4. Tape HDPE innerduct to top of utility line at spacing no greater than every 10-feet.
 - 2.7.5. Tape is not required for duct banks.
 - 2.7.6. Tape shall go around the full circumference of the utility for pipes 12-inch diameter or less.
- 2.8. Terminal Boxes:
 - 2.8.1. Innerduct shall be brought up into valve box, extending twelve inches up from the bottom of the valve box.
 - 2.8.2. Innerduct must be capped during installation to keep gravel and dirt out of innerduct.
 - 2.8.3. Tracer wire shall be brought to the surface at end of pipe or at intersection of main and service line next to a manhole, valve, vault wall, or building wall in a standard East Jordan 8550 valve box.
 - 2.8.4. Leave sufficient slack in wire coiled up in valve box to extend a minimum of two feet above final grade.
 - 2.8.5. Clean gravel shall fill the bottom 6 inches of terminal box pipe and shall extend an additional 12 inches below the bottom of the valve box to facilitate water drainage.
 - 2.8.6. Terminal box cover shall be marked 'UI Locates'. Covers to be provided by [Utility Operator.](#)
 - 2.8.7. Coordinate all terminal box locations with [Utility Operator](#) during design.
 - 2.8.8. Terminal box lids to be provided by Utility Operator.
- 2.9. Grounding of Tracer Wire:
 - 2.9.1. Tracer wire shall be properly grounded at all ends.
 - 2.9.2. Grounding shall be achieved by use of a 4-foot by 3/8-inch minimum drive-in copper or brass grounding rod. Ground wire shall extend up through the valve box, reaching at least 24-inches above grade.

2.10. Connections:

2.10.1. Tracer wires and ground wire shall be terminated in an Erico Intersystem Bonding Termination Bar, or equivalent.

2.11. Testing:

2.11.1. All new tracer wire installations shall be located using typical low frequency (512 Hz) line tracing equipment, witnessed by the contractor, engineer and Utility Operator prior to acceptance of ownership.

2.11.2. Verification shall be performed upon completion of rough grading and again prior to Final Acceptance of the project.

2.11.3. Continuity testing in lieu of actual line tracing shall not be accepted.

3. Sanitary Sewer:

3.1. The line of demarcation between the Utility Operator and the University is at the exterior face of the building. Refer to Appendices - Lines of Demarcation.

3.2. Sanitary sewers shall be designed in accordance with the standards and requirements of The Iowa Department of Natural Resources.

3.3. Sewer systems shall be designed to carry traffic loads in all locations.

3.4. Piping:

3.4.1. The minimum service line size shall be 6-inches.

3.4.2. The minimum sewer line shall be 8-inches.

3.4.3. Gravity piping shall be:

3.4.3.1. Polyvinyl Chloride Composite Pipe (truss type PVC) 8-inches to 15-inches is the preferred piping material.

3.4.3.2. Alternative materials include:

3.4.3.2.1. Solid Wall Polyvinyl Chloride Pipe (PVC) 8-inches to 15-inches.

3.4.3.2.2. Solid Wall Polyvinyl Chloride Pipe (PVC) 18-inches to 27-inches.

3.4.3.2.3. Closed Profile Polyvinyl Chloride Pipe (PVC) 21-inches to 36-inches.

3.4.3.2.4. Ductile iron pipe, Class 53.

3.4.3.2.4.1. Double walled polypropylene pipe wrap is required on ductile iron pipe.

3.4.4. Pressure piping shall be:

3.4.4.1. Restrained joint ductile iron pipe with restrained joints, Class 53

3.5. Accessories:

3.5.1. Design Professional shall coordinate uplift prevention measures during the 500-year flood with the Owner and Utility Operator.

3.5.2. Manholes and Lids:

- 3.5.2.1. Review manhole numbering with Owner and/or Utility Operator.
- 3.5.2.2. Pre-cast concrete manholes shall comply with ASTM C478 or ASTM C76, Class 3.
- 3.5.2.3. Cast-in-place manholes shall be fully detailed in the Construction Documents.
- 3.5.2.4. Manholes shall be used at all changes in direction and at building services within 15-feet of the building.
- 3.5.2.5. Manholes shall be placed such that change in direction of flow is not less than 90 degrees.
- 3.5.2.6. Manholes shall be placed near the building to pick up building services.
- 3.5.2.7. Manholes shall be used in lieu of cleanouts.
- 3.5.2.8. Drop piping into manholes is required where drop from invert to invert is 2-feet or greater.
 - 3.5.2.8.1. Internal drop structures used for University of Iowa manholes.
 - 3.5.2.8.2. Confirm drop structure type for manholes owned by other jurisdictions.
- 3.5.2.9. Manholes shall be precast concrete, minimum 4-feet inside diameter, unless otherwise noted.
- 3.5.2.10. Manholes shall comply with ASTM C478 or ASTM C76, Class 3
- 3.5.2.11. Rings and solid lids for sanitary sewers shall be East Jordan model number 1045ZPT, or Neenah equivalent.
- 3.5.2.12. The lids shall be marked, "University of Iowa, Sanitary Sewer."
- 3.5.2.13. All manholes located within the 500-year flood plain shall be bolted down.
- 3.5.2.14. Rings and lids for grated openings shall also use the 1045 ring, with the appropriate grated lid.
- 3.5.2.15. Lid extension ring height shall not exceed 12-inches.
- ~~3.5.2.16. Drop piping into manholes may be required.~~
- ~~3.5.2.17.~~3.5.2.16. Bases shall be poured into the bottom of manholes and a formed invert from pipe to pipe installed to create flow path.

4. Storm Sewer:

4.1. General:

- 4.1.1. Buildings and structures shall be developed so water does not enter through doors, window wells, area ways, basements, drains, etc., during a minimum 100-year storm.

- 4.1.2. Design shall maintain positive drainage away from building entrances
- 4.1.3. Connections to building drains shall be designed to prevent surcharge from the storm sewer for the hundred-year storm.
- 4.1.4. Sidewalk grade shall be set to prevent surface from collecting and channeling surface drainage.
- 4.1.5. The line of demarcation between the Utility Operator and the University of Iowa is at the exterior face of the building. See Appendices for Lines of Demarcation.
- 4.1.6. Rational Formula shall be used.
- 4.1.7. Runoff Coefficients shall be selected from the tables in the current version of SUDAS, Chapter 2 Storm Water.
- 4.1.8. [SUDAS Chapter 2](#)~~This section~~ applies to storm water conveyance systems outside the footprint of buildings. Refer to Chapter 22 for storm water within the building footprint.
- 4.1.9. Design Professional shall submit estimated storm water loads to Owner and Utility Operator for evaluation with the Campus Storm Water Study no later than Design Development Documents. Refer to Section II for information.
- 4.1.10. Trunk storm sewers are defined as the primary spine(s) of the piping system and generally carry the flow from more than one (1) site.
- 4.1.11. Storm water systems shall be designed using the actual time of concentration.
- 4.1.12. The worst case of complete development, per the current Campus Master Plan, or current conditions shall be used for calculation of offsite flow.
- 4.1.13. Joints shall conform to ASTM D3212.
- 4.1.14. Flexible elastomeric seals shall conform to ASTM F477 and C433.
- 4.2. Return Periods:
 - 4.2.1. Return periods shall be twenty-five (25) years with actual time of concentration (duration) for all building sites, pedestrian malls, streets, quadrangles, and trunk storm sewers.
 - 4.2.2. Return periods shall be ten (10) years with actual time of concentration (duration) for parking lots, park space, and open areas.
 - 4.2.3. Owner shall establish "return periods" for all other areas.
 - 4.2.4. Return period shall satisfy governing municipality's regulations.
 - 4.2.4.1. Design Professional shall compare above return periods with those required by the local municipality.
 - 4.2.4.2. Coordination with municipality may be required and shall be reviewed with the Owner and Utility Operator.
 - 4.2.4.3. Any discrepancies shall be discussed with the Owner and Utility Operator.

4.3. Piping:

4.3.1. Piping - Up to 12-inch:

- 4.3.1.1. Ductile iron conforming to ASTM A746 with cement lining conforming to ANSI/AWWA C104/A21.4, and asphaltic coating on the interior and exterior conforming to ANSI/AWWA C110/A21.10, and asbestos-free.
- 4.3.1.2. Polyvinyl chloride (PVC) conforming to ASTM D2241, PVC 1120, DR 21, PR 200 (SDR-21).
- 4.3.1.3. HDPE conforming to ASTM F2688 and F2306.

4.3.2. Piping - 12 inch and larger:

- 4.3.2.1. Reinforced Concrete Pipe (RCP) conforming to ASTM C76 or AASHTO M170, Class 3 minimum.
- 4.3.2.2. HDPE conforming to ASTM F2688 or F2306.
- 4.3.2.3. Polypropylene pipe conforming to ASTM F2736, F2764 or F2881.

4.3.3. The minimum pipe size for storm drains, except roof drains, is 15-inches.

- 4.3.3.1. Storm pipes shall run on a straight line and grade between structures.

4.4. Roof Drains:

4.4.1. Internal roof drain connections shall have a manhole just outside the building.

4.4.2. External roof drain connections to the underground piping shall have means to disassemble the connection or have a minimum 4-inch port to clean the drain.

- 4.4.2.1. Coordinate the assembly with the Owner and Utility Operator.

4.4.3. Connect external roof drains to a manhole whenever possible.

- 4.4.3.1. When not possible, utilize a wye connection to the storm sewer pipe and provide a manhole both upstream and downstream of the connection within 100-feet.

4.4.4. Accessories:

- 4.4.4.1. Grates shall be Neenah or East Jordan, heavy duty cast iron, capable of supporting H-20-wheel loading.

- 4.4.4.2. Inlets and junction boxes may be cast-in-place or precast conforming to ASTM C478.

- 4.4.4.3. Storm manholes solid lid castings shall be East Jordan Model 1045 non-bolt down or Neenah equivalent.

- 4.4.4.4. Lid shall be lettered with the words 'University of Iowa Storm Sewer' or 'University of Iowa Storm Drain.'

- 4.4.4.5. Manholes within the 500-year flood water surface elevation plus 2-feet shall have bolt down lids and frames.
- 4.4.4.6. Design Professional shall coordinate uplift prevention measures during the 500-year flood with the Owner and Utility Operator.
- 4.4.4.7. Structures over 3-feet from lid to lowest flow line shall include steps. Steps shall be Neenah 1980-J, Deeter 1606, M.A. Industries PS2-PF.
- 4.4.4.8. Above and below-ground knife-gate valve applications shall be Sure Flow Equipment, Model KG150SSMIRC.
 - 4.4.4.8.1. The valves shall conform to TAPPI TIS 405.8 face-to-face and shall be tested to MSS SP-81 standards.
 - 4.4.4.8.2. Valve body shall be full lug style, drilled and tapped to ASME Class 150 and material shall be SA351 CG8M cast 317 stainless-steel.
- 4.4.4.9. Nyloplast, PVC sub-surface drainage inlets, inline drains and catch basins may be used in landscaped areas with Owner and/or Utility Operator approval.
- 4.4.4.10. The drain basin body shall be cut at the time of the final grade.
- 4.4.4.11. No brick, stone or concrete block shall be required to set the grate to the final grade height.
- 4.4.4.12. For H-20 load rated installations, a concrete ring shall be poured under and around the grate and frame.
- 4.4.4.13. Intake Grates:
 - 4.4.4.13.1. Grates shall be placed outside of pedestrian pathways.
 - 4.4.4.13.1.1. Grates placed within pedestrian pathways require written approval from Owner.
 - 4.4.4.13.2. Consideration shall be made regarding the types of traffic, material transported in the area, and types of footwear expected.
 - 4.4.4.13.3. Refer to the current edition of "ADA Standards for Accessible Design, Floor or Ground Surfaces" for maximum spacing of grate opening and configuration.

5. Domestic Water:

5.1. General:

- 5.1.5.1.1. Piping shall have sand pipe bedding and envelope. Provide 5 feet 6 inches minimum cover. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to 98% Standard Proctor Density and suitable native fill compacted to 95% Standard Proctor Density under landscape areas.

~~5.1.1-5.1.2.~~ Design Professional shall submit estimated total connected building domestic and fire protection water loads for evaluation with the Campus Hydraulic Model no later than Design Development Documents. Refer to Section II for information.

~~5.1.2-5.1.3.~~ For tThe line of demarcation for domestic water between the Utility Operator and the University of Iowa ~~is on the downstream side of the meter bypass assembly.~~ See Appendices for Lines of Demarcation

~~5.1.3-5.1.4.~~ The line of demarcation [for Construction](#) for fire water between the Utility Operator and the University of Iowa is 5-feet from the exterior face of the building. ~~The line of demarcation is a Construction demarcation and is separate from the Concession Agreement.~~

~~5.1.4-5.1.5.~~ If a common supply serves both the domestic water system and the fire protection system, the two (2) systems shall be split and isolated outside of the building. [If service is split outside with, three valves shall be provided, one on each leg of Tee.](#)

~~5.1.5-5.1.6.~~ Flushing instructions shall be explicit in drawings, including source of water, outlet point, air relief vents, and final destination of water.

~~5.1.6-5.1.7.~~ Operation of all valves, both new and existing, shall be by the Owner or Utility Operator, according to responsible entity.

~~5.1.7-5.1.8.~~ All open-ended pipes shall be plugged with a gasketed cap at the end of the workday to prevent contamination.

~~5.1.8-5.1.9.~~ Tapping sleeves shall be approved by Owner and/or Utility Operator during Design Development and only be used if the watermain cannot be shutdown to cut in a new tee.

~~5.1.9-5.1.10.~~ Tapping sleeves shall be full body tapping sleeves. Stainless steel tapping sleeve shall be used on pipe 12-inches in diameter and larger.

~~5.1.10-5.1.11.~~ For University's Utility Operator

~~5.1.10.1-5.1.11.1.~~ System Design:

~~5.1.10.1.1-5.1.11.1.1.~~ Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping.

~~5.1.10.1.2-5.1.11.1.2.~~ Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance--like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.

~~5.1.11-5.1.12.~~ Owner/Utility Operator shall furnish, and Constructor shall install a PLC cabinet for water interface and metering.

~~5.1.11.1-5.1.12.1.~~ Meter, PLC, and Cabinet to be provided by Utility Operator.

~~5.1.11.2-5.1.12.2.~~ Refer to UTILITY DISTRIBUTION PLC CABINET DETAIL in Appendices.

5.2. Piping:

- 5.2.1. Piping shall conform to AWWA standards and the requirements of the Iowa DNR.
- 5.2.2. Piping shall have an Iowa DNR permit when required.
 - 5.2.2.1. Permit shall be filled out by the Design Professional and signed by the Owner and/or Utility Operator when design is complete.
- 5.2.3. If a common supply serves both the domestic water system and the fire protection, the two (2) systems shall be split and isolated outside the building.
- 5.2.4. Building services shall enter through walls and sealed with link seals.
- 5.2.5. Floor penetrations are not allowed.
- 5.2.6. Isolation valves shall be located to the factory installed flange of the pipe penetrating the wall inside the building.
- 5.2.7. Abandon service lines all the way back to the water main line so there are no dead ends.
- 5.2.8. Pipe shall be cement lined ductile iron class 53 restrained for all sizes. Ductile Iron piping shall be class 53 restrained piping for all sizes. Pipe shall comply with AWWA C151.
- 5.2.9. Pipe shall be cement lined according to AWWA C104 with seal coat.
- 5.2.10. Fire service pipe shall be cement lined ductile iron pipe all the way to the double check assembly inside the building.
- 5.2.11. Plain end fittings shall not be used.
- 5.2.12. Changes in direction shall be made with 45-degree, 22 ½-degree or 11 ¼-degree fittings.
 - 5.2.12.1. 90-degree fittings shall not be used without written approval from the Owner and/or Utility Operator.
- 5.2.13. Approved Manufacturers are US Pipe TR Flex, McWane TR Flex, and American Pipe Flex Ring.
- 5.2.14. Field cut joints shall use Mega Lug series 1100 restraint.
 - 5.2.14.1. Piping manufacturer's field kits shall not be used.
- 5.2.15. Piping shall be encased in minimum 8 mils polyethylene sheathing.
- 5.2.16. Wall penetrations shall be sealed with Link-Seal.
- 5.2.17. Piping stubbed through wall shall be one-piece construction with factory y installed 125# flange.
 - 5.2.17.1. Flange adaptor kits are not allowed.
 - 5.2.17.2. Install appropriate gaskets for dissimilar metals.
- 5.2.18. Provide 1-inch insulation and vapor barrier on all domestic water piping that is not direct buried.
- 5.2.19. Anchor through wall and through floor penetrations.

5.2.20. Refer to UTILITY DISTRIBUTION CHILLED, DOMESTIC AND FIRE PROTECTION WATER WALL PENETRATION DETAIL and UTILITY DISTRIBUTION CHILLED, DOMESTIC AND FIRE PROTECTION WATER FLOOR PENETRATION AND ANCHOR DETAIL in Appendices.

5.3. Accessories:

5.3.1. Water meters shall be located inside buildings.

5.3.2. Design Professional shall consult with Owner and Utility Operator to coordinate meter sizing and location.

5.3.3. Provide a 1-inch conduit from the meter back to a central Utility PLC location for remote meter monitoring.

5.3.3.1. Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices.

5.3.4. Isolation valves shall be installed on each leg of a tee.

5.3.5. All water meters shall be located inside buildings with a 1-inch raceway to the Utility Ethernet connection.

5.3.5.1. Meter to be provided by Utility Operator

5.3.5.2. Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices.

5.4. Fire Hydrants:

5.4.1. Fire hydrants shall be provided in accordance with the requirements of the local fire district or department.

5.4.2. Hydrants shall be provided with an auxiliary valve, installed with the streamer directed toward a street or drive. Hydrants shall match existing campus hydrants. Refer to UTILITY DISTRIBUTION HYDRANT DETAILS in Appendices.

5.4.3. Fire hydrants shall be Mueller Super Centurion 250, Model A-423, open right, 6-inch D 150 shoe. Color shall be safety yellow.

5.4.4. Per Iowa City/Coralville Fire code section 507.5.7: Fire hydrants threads: All new hydrants shall have National Standard Threads (NST) on the 2½-inch connections and the 5-inch connection will have a Storz connection.

5.4.5. Hydrant labeling/numbering to be completed by Owner or Utility Operator after installation.

5.4.6. Fire hydrants to be backfilled to proper grade line on hydrant.

5.5. Valves:

5.5.1. Valves 12-inches and smaller:

5.5.1.1. Shall be Clow F-6100 resilient wedge gate valve.

5.5.1.2. Comply with AWWA C509 (gray iron or ductile iron) or AWWA C515 (ductile iron) and NSF 61

- 5.5.2. Valves 14-inches and larger:
 - 5.5.2.1. Shall be Valmatic be gear-operated butterfly valves.
 - 5.5.2.2. Comply with AWWA C504 class 150B (gray iron or ductile iron) and NSF 61.
- 5.5.3. Manufacturer shall have a quality management system that is certified to ISO 9001:2000.
- 5.5.4. Valve extensions are not allowed.
- 5.5.5. Valve boxes to be inspected to ensure Utility Operator and/or Owner can get a key on the operating nut and that the box is square and level with finished grade.
- 5.5.6. Connections:
 - 5.5.6.1. Flanged end connections shall fully conform to ANSI B16.1 for Class 125, Class 260 Iron flanges, or AWWA C207 Class D. Both 125 and 250 flanges shall be flat faced.
 - 5.5.6.2. Mechanical joint end connections shall fully conform to ANSI/AWWA C111/A21.11.
 - 5.5.6.3. Wafer end connection shall be designed for installation between ANSI B16.1 Class 125 Iron flanges or ISO 7005-2 PN10 or PN16 flanges.
- 5.5.7. Design:
 - 5.5.7.1. Valve shafts shall be through type for sizes 3-inches to 24-inches.
 - 5.5.7.2. 30-inch and larger shall be stub-type.
 - 5.5.7.3. Shafts shall be locked to the disc by O-Ring sealed taper pins retained with stainless steel nuts.
 - 5.5.7.4. Valve discs shall be solid type without external ribs or vanes to obstruct flow.
 - 5.5.7.4.1. Resilient seats shall be located on the valve disc and shall provide a 360-degree, continuous, uninterrupted stainless steel body seat ring.
 - 5.5.7.5. Resilient seats shall be field adjustable and replaceable and shall not require hypodermic needles or pressure vessels to replace or adjust.
 - 5.5.7.6. Sleeve bearings shall be provided in the valve hubs and shall be Nylatron or woven Teflon, fiberglass backed, self-lubricating.
 - 5.5.7.7. Thrust bearings shall be provided and shall be adjustable on valves 30 inches and larger.
 - 5.5.7.8. Shaft seals shall be of the V-type and shall be replaceable without removal of the valve or shaft.
- 5.5.8. Materials:
 - 5.5.8.1. Body:

- 5.5.8.1.1. Class 150B valve bodies shall be ASTM A126, Class B gray iron or ASTM A536 Grade 65-45-12 ductile iron.
- 5.5.8.1.2. Class 250B valve bodies shall be ASTM A536 Grade 65-45-12 ductile iron.
- 5.5.8.1.3. Optional body material is ASTM A536, Grade 65-45-12 ductile iron.
- 5.5.8.2. Valve disc shall be ASTM A536 Grade 65-45-12 ductile iron.
- 5.5.8.3. Shafts:
 - 5.5.8.3.1. Shafts shall be ASTM A276 type 304, or ASTM A564, Type 630 stainless steel.
 - 5.5.8.3.2. Optional shaft material is ASTM A276, Type 316 stainless steel.
- 5.5.8.4. Resilient seat shall be Buna-N and mate to a Type 316 stainless steel body seat ring.
- 5.5.8.5. All seat-retaining hardware shall be Type 316 stainless steel.
- 5.5.8.6. Valve exteriors for above ground service shall be coated with a universal, alkyd primer.
- 5.5.8.7. Valve exteriors for buried service shall be coated with fusion bonded epoxy coating.
- 5.5.8.8. Valve interiors shall be coated with an ANSI/NSF 61 fusion bonded epoxy coating approved for potable water.
- 5.5.8.9. Provide manual, electric or cylinder actuation.
- 5.5.8.10. Valve boxes shall be East Jordan model number 8550. Valve box lids shall be East Jordan, labeled "University of Iowa, (with either) Domestic Water, or Fire Protection or Fire Hydrant."
- 5.5.8.11. T-bolts shall be fluorocarbon coated by Birmingham Fasteners.
- 5.5.8.12. Use manufacturer provided gasket unless the site is identified as an Iowa DNR Register UST site.
- 5.5.8.13. Design Professional shall determine the appropriate gasket required for contaminants.

5.6. Testing:

5.6.1. Disinfection - Domestic Water:

- 5.6.1.1. Disinfections shall be performed Monday through Thursday, starting between 8:00 AM and 9:00 AM.
- 5.6.1.2. Pipes shall be disinfected according to AWWA standards.
- 5.6.1.3. Disinfection shall take place over a period of twenty-four (24) hours (no longer or shorter).
- 5.6.1.4. Disinfection shall be performed before hydro testing.

- 5.6.1.5. Hydro testing shall not begin until bacteria results have been returned from the lab.
- 5.6.1.6. Constructor shall anticipate a three (3) working day turn-around time from the time that the sample is taken until the results are returned.

5.6.2. Method of Chlorination:

- 5.6.2.1. Piping shall be filled with water at a rate no greater than 1-foot per second within the main.
- 5.6.2.2. Precautions shall be taken to ensure that air pockets are eliminated.
- 5.6.2.3. Water shall remain in the pipe for twenty-four (24) hours.
 - 5.6.2.3.1. If the water temperature is below 41 degrees F, water shall remain in the pipe for forty-eight (48) hours.
- 5.6.2.4. Take Chlorine residue tests at each sampling point after the twenty-four (24) hour period.
- 5.6.2.5. Contractor shall report results to Owner and/or Utility Operator.
- 5.6.2.6. For Utility Operator projects:
 - 5.6.2.6.1. Utility Operator shall provide 5-g calcium hypochlorite required for dose of 50 mg/L.

5.6.3. Flush - Domestic Water:

- 5.6.3.1. Remove air relief vents after testing. Provide GPS locations for each vent.
- 5.6.3.2. Constructor shall supply all equipment and personnel required to perform flush.
- 5.6.3.3. Constructor shall contact the Owner and/or Utility Operator for water source.
- 5.6.3.4. Flushing shall be started between 8:00 AM and 9:00 AM, Monday through Thursday.
- 5.6.3.5. Systems shall be flushed two (2) times, with two (2) samples per flush.
- 5.6.3.6. Flushing shall continue until residual chlorine is verified by Technician (approximately four (4) hours).
- 5.6.3.7. Constructor shall install a temporary hydrant at the end of the water main for flushing purposes.
 - 5.6.3.7.1. The temporary hydrant shall be full-sized.
- 5.6.3.8. Constructor is responsible to route the flushed water to the storm sewer as indicated in the documents or directed by the Owner and/or Utility Operator.
- 5.6.3.9. Flush through fire hydrants.

- 5.6.3.9.1. Contractor to provide temporary fire hydrants as needed to meet phasing requirements.
- 5.6.3.10. Notify the Owner and/or Utility Operator of de-chlorination plan prior to disposal of heavily chlorinated water.
- 5.6.3.11. Neutralizing chemical shall be applied to the wastewater to neutralize thoroughly the residual chlorine.
- 5.6.3.12. Contact Federal, State, provincial, and local regulatory agencies to determine provisions for disposal of heavily chlorinated water.

5.6.4. Cleaning:

- 5.6.4.1. Piping shall be free of all foreign materials.
- 5.6.4.2. Joint surfaces shall be free of lumps and blisters.
- 5.6.4.3. Piping shall be power washed clean inside and out prior to installation.
- 5.6.4.4. Owner and/or Utility Operator shall witness cleaning.

5.6.5. Water Sampling - Domestic Water only:

- 5.6.5.1. Review water sampling requirements with Owner during design.
- 5.6.5.2. For Utility Operator projects:
 - 5.6.5.2.1. Water sampling shall be performed by the Utility Operator.
 - 5.6.5.2.2. The Owner/Utility Operator shall collect the sample, take the sample to the lab, and notify the Constructor of the results.
- 5.6.5.3. The Constructor shall supply equipment and personnel required to perform the tests.
- 5.6.5.4. Water sampling shall take place at approximately 11:30 AM.
- 5.6.5.5. Following the sampling, the Constructor shall allow three (3) days for laboratory processing before hydro test.
- 5.6.5.6. Testing shall be completed and passed prior to ~~connecting to any existing lines~~ final connections to existing systems.

5.6.6. Hydro Test:

- 5.6.6.1. Hydro test all piping.
- 5.6.6.2. Testing shall not begin until satisfactory biological test results have been received from the Owner and/or Utility Operator.
- 5.6.6.3. Tests shall be made against capped ends or new valves.
- 5.6.6.4. Test pressure shall be one-and-a-half (1½) times working pressure, and a minimum of one hundred fifty (150) pounds.
- 5.6.6.5. All piping shall be capped by mechanical caps and restraint joints.
- 5.6.6.6. Owner and/or Utility Operator shall witness all hydro tests.
- 5.6.6.7. Test shall be for four (4) hours. No tests started after 12:00 PM.
- 5.6.6.8. Test may only lose 5 psig.
- 5.6.6.9. For Utility Operator projects: Gauges shall be Utility Operator provided.

5.6.7. Final Connections to Existing Domestic Water Main:

- 5.6.7.1. Water mains and appurtenances shall be flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connection to the active distribution system.
- 5.6.7.2. Follow sanitary construction practices during final connection so that no foreign material or groundwater contamination enters the adjacent piping.

6. Natural Gas:

- 6.1. Natural gas piping upstream of the meter shall be coordinated with the Natural Gas Provider and Owner.
- 6.2. Natural gas piping downstream of meter shall be coordinated with the Owner and/or Utility Operator and shall not be buried.
- 6.3. Buried piping after the meter, approved by Deviation Request, shall have tracer wire. [Refer to colors in previous Utility Tracer Wire section for guidance.](#)
- 6.4. Gas Mains and services shall have a minimum of 24-inches of cover.
- 6.5. A shutoff valve shall be installed immediately downstream of the utility meter. This valve is in addition to the MidAmerican Energy shutoff valve installed upstream of the meter.

7. Chilled Water:

7.1. General:

- ~~7.1.1. The line of demarcation for chilled water supply on the Oakdale Campus between the Utility Operator and the University of Iowa is on the downstream side of the meter.~~
- ~~7.1.2. The line of demarcation for chilled water return Oakdale Campus between the Utility Operator and the University of Iowa is on the upstream side of the return temperature transmitter.~~
- ~~7.1.3. The line of demarcation for chilled water supply on the Main Campus between the Utility Operator and the University of Iowa is on the downstream side of the supply temperature transmitter and bypass assembly.~~
- ~~7.1.4. The line of demarcation for chilled water return on the Main Campus between the Utility Operator and the University of Iowa is on the upstream side of the return temperature transmitter and bypass assembly.~~
- ~~7.1.5-7.1.1.~~ See Appendices for Lines of Demarcation. [Utility Operator transmitter may be located on Building side of Line of Demarcation. Locate transmitter as directed by UI Utilities and Utility Operator.](#)
- ~~7.1.6-7.1.2.~~ Distribution mains shall be designed to a minimum velocity of 4 feet per second.
- ~~7.1.7-7.1.3.~~ Building services may be increased to 7 feet per second, depending on the building location and pressure differential at the building.
- ~~7.1.8-7.1.4.~~ The minimum pressure drop at buildings shall be 15 psi and the maximum pressure drop shall be 25 psi.

~~7.1.9-7.1.5.~~ Coordinate the utility distribution chilled water and building chilled water interface design and anticipated usage with Owner and Utility Operator.

~~7.1.9.1-7.1.5.1.~~ Confirm system return pressure at building outlet.

~~7.1.10-7.1.6.~~ Campus chilled water hydraulic model has been created and is maintained by Utility Operator ([i.e. peak design load avg operating load](#)).

~~7.1.10.1-7.1.6.1.~~ Provide necessary information to Utility Operator when modifications to the chilled water system impact the hydraulic model.

~~7.1.11-7.1.7.~~ Provide for the installation of control equipment and a communications pathway to support central chilled water interface monitoring and control, including the Utility PLC with 1-inch conduit to all metering and control devices.

~~7.1.12-7.1.8.~~ The Utility PLC shall be indicated on the floor plans.

~~7.1.13-7.1.9.~~ 3-way or on/off valves shall not be used.

~~7.1.14-7.1.10.~~ Size control valves for the entire range of flow, considering the maximum pressure drop possible.

~~7.1.14.1-7.1.10.1.~~ System pressure shall not be allowed to overpower any control valve.

~~7.1.14.2-7.1.10.2.~~ Use the flow coefficient provided by the manufacturer to determine the maximum allowable pressure drop for each valve.

~~7.1.15-7.1.11.~~ Verify final valve sizing with Owner and/or Utility Operator.

~~7.1.16. For University's Utility Operator~~

~~7.1.16.1. System Design:~~

~~7.1.16.1.1. Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping.~~

~~7.1.16.1.2. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.~~

~~7.1.17-7.1.12.~~ Operation of all valves, both new and existing, shall be by the Owner and/or Utility Operator, according to responsible entity.

~~7.1.18-7.1.13.~~ Owner/Utility Operator shall furnish, and Constructor shall install a PLC cabinet for chilled water interfaces and metering.

~~7.1.18.1-7.1.13.1.~~ Meter shall be provided by Utility Operator.

~~7.1.18.2-7.1.13.2.~~ Refer to UTILITY DISTRIBUTION PLC CABINET DETAIL in Appendices.

7.2. Piping:

- 7.2.1. Chilled water supply piping shall be installed on the right and chilled water return piping installed on the left.
 - 7.2.1.1. Orientation perspective assumes you are standing outside of the building, looking at the exterior wall.
- 7.2.2. Building services shall enter through walls and sealed with link seals.
- 7.2.3. Floor penetrations are not allowed.
- 7.2.4. Isolation valves and a bypass shall be located to the factory installed flange of the pipe penetrating the wall inside the building.
 - 7.2.4.1. Valving and bypass shall facilitate cleaning of building chilled water system.
- 7.2.5. Owner and/or Utility Operator shall confirm orientation of installed chilled water supply and return in field prior to any connections to the existing distribution system.
- 7.2.6. Ductile Iron piping shall be Class 53 restrained piping for all sizes Pipe shall comply with AWWA C151.
- 7.2.7. Pipe shall be cement lined according to AWWA C104 with seal coat.
- 7.2.8. Plain end fittings shall not be used.
- 7.2.9. Changes in direction shall be made with 45-degree, 22½-degree or 11¼-degree fittings.
- 7.2.10. 90-degree fittings shall not be use without written approval from the Owner.
- 7.2.11. Approved Manufacturers are US Pipe TR Flex, McWane TR Flex, and American Pipe Flex Ring.
- 7.2.12. Field cut joints shall use Mega Lug series 1100 restraint.
 - 7.2.12.1. Piping manufacturer’s field kits shall not be used.
- 7.2.13. Piping shall be encased in minimum 8 mils polyethylene sheathing.
- ~~7.2.14. Wall penetrations shall be sealed with Link Seal.~~
- ~~7.2.15.~~ 7.2.14. Anchor through wall and through floor penetrations:
 - ~~7.2.15.1.~~ 7.2.14.1. Refer to UTILITY DISTRIBUTION CHILLED, DOMESTIC AND FIRE PROTECTION WATER WALL PENETRATION DETAIL and UTILITY DISTRIBUTION CHILLED, DOMESTIC AND FIRE PROTECTION WATER FLOOR PENETRATION AND ANCHOR DETAIL in Appendices.

7.3. Accessories:

7.3.1. Valves:

7.3.1.1. Valves 12-inches and smaller:

- 7.3.1.1.1. Shall be Clow F-6100 resilient wedge gate valve or approved equal.

- 7.3.1.1.2. Shall comply with AWWA C509 (gray iron or ductile iron) or AWWA C515 (ductile iron) and NSF 61
- 7.3.1.2. Valves 14-inches and larger:
 - 7.3.1.2.1. Shall be Valmatic gear-operated butterfly valves.
 - 7.3.1.2.2. Shall comply with AWWA C504 class 150B (gray iron or ductile iron) and NSF 61.
- 7.3.1.3. Manufacturer shall have a quality management system that is certified to ISO 9001:2000.
- 7.3.1.4. Valve extensions are not allowed.
- 7.3.1.5. Valve boxes to be inspected to ensure Owner and/or Utility Operator can get a key on the operating nut and that the box is square and level with finished grade.
- 7.3.1.6. Valve boxes shall be East Jordan model number 8550 or approved equal.
 - 7.3.1.6.1. Valve box lids shall be East Jordan labeled "University of Iowa, (with either) Chilled Water Supply or Chilled Water Return."

~~7.3.2. Elbows:~~

~~7.3.2.1. Changes in direction shall be made with 45-degree, 22½-degree, or 11¼-degree bends.~~

~~7.3.2.2. 90-degree elbows are not allowed.~~

~~7.3.3.~~ 7.3.2. Building service piping shall have a strainer and chilled water meter installed at the point of entry into the building.

7.4. Testing:

- 7.4.1. All piping shall be cleaned prior to testing.
- 7.4.2. Disinfection is not required.
- 7.4.3. Cleaning shall be as follows:
 - 7.4.3.1. Piping shall be free of all foreign materials.
 - 7.4.3.2. Joint surfaces shall be free of lumps and blisters.
 - 7.4.3.3. Piping shall be power washed clean inside and out prior to installation.
 - 7.4.3.4. ~~Owner and/or~~ Utility Operator and/or Owner shall witness cleaning.
- 7.4.4. Chilled Water piping shall be video recorded to verify cleanliness prior to being filled for hydro test.
 - 7.4.4.1. Contractor shall submit video to Owner and ~~/or~~ Utility Operator for review.
 - 7.4.4.2. Piping to be jet cleaned if video inspection fails.

7.4.5. Hydro Test Requirements:

- 7.4.5.1. Hydro test all piping.
- 7.4.5.2. Test pressure shall be one hundred fifty (150) pounds.
- 7.4.5.3. Owner/Utility Operator shall witness all hydro tests.
- 7.4.5.4. Test shall be for four (4) hours.
- 7.4.5.5. Test may only lose 5 psig.
- 7.4.5.6. Gauges shall be provided by Owner/Utility Operator.

8. Steam and Condensate:

8.1. General:

~~8.1.1. The line of demarcation for steam between the Utility Operator and the University of Iowa is approximately 12 inches downstream of the Cashco valve.~~

~~8.1.2. The line of demarcation for condensate between the Utility Operator and the University of Iowa is at the exterior face of the building.~~

~~8.1.3-8.1.1.~~ See Appendices for Lines of Demarcation.

~~8.1.4-8.1.2.~~ All designs must conform to ASME Code for Pressure Piping, B31.1.

~~8.1.5-8.1.3.~~ Steam lines designated as a main Campus steam service shall be installed in a utility tunnel or pre-engineered buried piping as determined by the Owner.

~~8.1.6-8.1.4.~~ Design steam and condensate systems to 175 psig, and 500 degrees F.

~~8.1.7-8.1.5.~~ Maximum velocity in any steam main or service line shall not exceed ~~120100-~~ feet/second (6,000-feet/minute).

~~8.1.8-8.1.6.~~ Coordinate steam distribution system load design requirements, available steam distribution facilities and operational needs of the steam plant with Owner/Utility Operator.

~~8.1.9-8.1.7.~~ Provide provisions for pipe expansion based upon design pressure and temperature.

~~8.1.10-8.1.8.~~ Pipe stress analysis shall be completed for piping system modifications and additions.

~~8.1.11-8.1.9.~~ Design condensate systems to account for condensate load during steam startup.

~~8.1.12. For University's Utility Operator~~

~~8.1.12.1. System Design:~~

~~8.1.12.1.1. Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping.~~

~~8.1.12.1.2. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.~~

8.2. Weld Requirements:

8.2.1. Constructor shall submit welder certifications.

8.2.2. Each welder shall be assigned an identification number or letter.

8.2.2.1. This identification shall be etched or stamped on each weld after completion of the weld.

8.2.2.2. Any weld without an identification shall be rejected.

8.2.3. Stainless steel piping welds are to include a TIG root pass with inert gas backer.

8.2.3.1. This should include an inert gas purge (argon or nitrogen) with dams at each pipe end, or with backer products such as Solar Flux.

~~8.2.4.~~ Carbon steel piping welds are to include a TIG root pass only if hydro jet cleaning is not feasible on the pipe.

~~8.2.4.~~ 8.2.5. Welds shall be visually inspected by the Owner and/or Utility Operator.

8.3. Piping:

8.3.1. General:

8.3.1.1. The Design Professional shall furnish design pipe size and flow information to the Owner and Utility Operator.

8.3.1.2. Piping shall be (at a minimum) sloped down ½-inch per 100-inches (0.5%) in the direction of flow.

8.3.1.3. Where pipe slope in the direction of flow is not feasible, piping shall be (at a minimum) sloped 2-inches per 100- inches (2%) against the direction of flow.

8.3.1.4. Building services shall enter through walls and sealed with link seals.

8.3.1.5. Floor penetrations are not allowed.

8.3.1.6. Connections between dissimilar metals to occur at flanges, with the use of dielectric gasket kits.

8.3.1.7. For condensate pipe installation on the discharge of a pump set, coordinate with Utility Operator prior to filling the system with water.

8.3.1.8. Treatment may be required prior to resuming operation.

8.3.1.9. Provide for pipe expansion in vaults.

- 8.3.2. Steam - All Locations:
 - 8.3.2.1. 2-inches and smaller shall be Schedule 40 A106 Gr B seamless, threaded.
 - 8.3.2.2. 2 ½-inches and larger shall be STW A106 Gr B seamless, butt-weld.
- 8.3.3. Condensate:
 - 8.3.3.1. Design Professional, in consultation with the Owner and/or Utility Operator, to determine pipe material based on location and application.
- 8.3.4. Carbon Steel:
 - 8.3.4.1. 2-inches and smaller shall be Schedule 80 A106 Gr B seamless, threaded.
 - 8.3.4.2. 2 ½-inches and larger shall be Schedule 80 A106 Gr B seamless, butt-weld.
- 8.3.5. Stainless Steel:
 - 8.3.5.1. 2 ½-inches and larger shall be Schedule 10 ASTM A312 (Type 316L) seamless, butt-weld.
 - 8.3.5.2. All anchor locations shall be Schedule 40 ASTM A312 (Type 316L) seamless, butt-weld to extend 2-feet on all sides beyond anchor point.
- 8.3.6. PP-RCT:
 - 8.3.6.1. Only when approved in writing ~~Shall be preapproved~~ by Utility Operator.
 - 8.3.6.2. All sizes shall be Polypropylene CLIMA PP-RCT with Fiberglass filled layer, SDR 11, ASTM F2389.
 - 8.3.6.3. Design pressure: 50 psig
 - 8.3.6.4. Design temperature: 203 °F
 - 8.3.6.5. Where PP-RCT piping is near or enters vaults and tunnels, protection from flash steam is required.
 - 8.3.6.6. Steam traps shall not discharge into piping within 300-feet of the PP-RCT.
 - 8.3.6.7. Re-direct steam trap discharge or install vented condensate receiver to avoid flash steam entering the PP-RCT piping.
 - 8.3.6.8. Install tunnel wall placards along vault and tunnel walls to indicate this requirement.
 - 8.3.6.8.1. Placard to read 'DO NOT DISCHARGE STEAM TRAPS INTO CONDENSATE MAIN'.
- 8.3.7. Piping shall be sloped ¼-inch per 10-feet of pipe to a drip leg.
 - 8.3.7.1. Pipe shall be sloped down in the direction of steam flow.
- 8.3.8. Threaded pipe shall utilize piping thread compound suitable for service pipe conditions.

~~8.3.9. Welds shall be visually inspected by the Owner and/or Utility Operator.~~

~~8.3.10.8.3.9.~~ Flanges on screwed piping shall be back welded.

~~8.3.11.8.3.10.~~ Unions shall be Nicholson Uniflex Steel/Stainless. Pipe unions shall have replaceable gaskets.

~~8.3.12.8.3.11.~~ Elbows shall be long radius or equivalent approved by Owner.

~~8.3.13.8.3.12.~~ Direct Buried Steam and Condensate:

~~8.3.13.1.8.3.12.1.~~ Pre-insulated piping systems shall be Perma-Pipe Multi-Therm 750 or equivalent approved by Utility Operator.

~~8.3.13.2.8.3.12.2.~~ Steam and condensate shall be installed in separate casing pipes.

~~8.3.13.3.8.3.12.3.~~ Casing pipe shall be air pressure tested and soaped at field joints.

~~8.3.14.8.3.13.~~ Leak Detection:

~~8.3.14.1.8.3.13.1.~~ Owner and/or Utility Operator to determine if direct buried piping requires Leak Detection.

~~8.3.14.2.8.3.13.2.~~ Sensing cable to be installed between service pipe and casing pipe.

~~8.3.14.3.8.3.13.3.~~ Leak detection to be commissioned and proved operational by field service personnel.

~~8.3.14.4.8.3.13.4.~~ Include additional site visits if required to ensure proper start-up of the leak detection system.

~~8.3.14.5.8.3.13.5.~~ Field services shall be provided by a certified manufacturer's representative or company field service technician for prefabricated piping.

~~8.3.14.5.1.8.3.13.5.1.~~ Supervision, provided by the piping manufacturer, is required during installation, as faulty installation cannot be detected by any post-construction test methods.

~~8.3.14.5.2.8.3.13.5.2.~~ Visits to the site for this supervision shall be coordinated with the Utility Operator.

~~8.3.14.5.3.8.3.13.5.3.~~ Field technician shall provide written reports on work performed and specification compliance.

~~8.3.14.6.8.3.13.6.~~ Carrier pipe material shall conform to specifications listed above.

~~8.3.15.8.3.14.~~ Piping Penetrations:

~~8.3.14.1.~~ Piping penetrations shall be coordinated between contractors.

~~8.3.15.1.8.3.14.2.~~ Penetrations of walls shall be leak proofed with Link-Seal Modular Seal by GPT Industries or approved equal.

~~8.3.15.2-8.3.14.3.~~ Penetrations shall be compatible with existing waterproofing/drainage assemblies.

~~8.3.15.3-8.3.14.4.~~ The point of attachment for steam tunnels shall have a concrete, cast-in-place transition, with water-stopping material cast into the concrete.

~~8.3.15.4-8.3.14.5.~~ The water-stopping shall be embedded into the foundation wall according to the Manufacturer's recommendations.

~~8.3.15.5-8.3.14.6.~~ Individual penetrations of steam and condensate lines shall be installed as follows

~~8.3.15.5.1-8.3.14.6.1.~~ Sleeve penetration with a steel sleeve at least 6-inches beyond the penetration.

~~8.3.15.5.2-8.3.14.6.2.~~ Weld flange to the sleeve and to the pipe on the interior side of the foundation wall with a continuous, waterproof weld.

~~8.3.15.5.3-8.3.14.6.3.~~ The exterior side of the penetration shall have waterproofing material applied.

~~8.3.16-8.3.15.~~ Pipe Material Requirements:

~~8.3.16.1-8.3.15.1.~~ All piping shall be marked with an ASTM designation of material.

~~8.3.16.2-8.3.15.2.~~ Provide the Owner with the identification code.

~~8.3.16.3-8.3.15.3.~~ Owner and/or Utility Operator shall have the right to reject any pipe which cannot be readily identified with an ASTM designation.

8.4. Accessories:

8.4.1. Meter Stations:

8.4.1.1. Meter stations are required for steam system usage points at each building.

8.4.1.2. Each meter station shall consist of a V-cone steam flow meter and multi variable transmitter with Tri-Loop.

8.4.1.2.1. Project shall provide raceway from each steam flow meter to the utilities PLC cabinet.

8.4.1.2.2. Design Professional shall consult with Owner and Utility Operator to size the V-cone steam meter and include the final design sizing on the mechanical schedules.

8.4.1.2.3. The Utility PLC and Utilities Network cabinets shall be shown on the floor plans.

8.4.1.3. Review product specifications, sizing, manufacturer numbers and cabling with the Owner and Utility Operator.

8.4.2. Steam Trapping Stations:

- 8.4.2.1. There shall be no trap bypasses.
- 8.4.2.2. Discharge steam trap piping to vented condensate receivers where feasible.
- 8.4.2.3. Vented condensate shall be pumped back into distribution piping.
- 8.4.2.4. For pipe sloped with the direction of flow:
 - 8.4.2.4.1. Drip legs/trap stations must be spaced according to trap size and running condensate load, spaced at a maximum of 250-feet.
- 8.4.2.5. For pipe sloped against the direction of flow:
 - 8.4.2.5.1. Drip legs/trap stations must be spaced according to trap size and running condensate load.
 - 8.4.2.5.2. Reduced trap spacing should be considered.
- 8.4.2.6. Drip legs/trap stations are required at any elevation change.
- 8.4.2.7. Drip legs/trap stations are required upstream (within 20-feet) of any control valve or pressure regulator.
- 8.4.2.8. Install drip leg/trapping station on both sides of isolation valves located in the distribution piping mains.
- 8.4.2.9. Diameter of the drip leg shall be the same size as the steam line up to 12-inches diameter.
- 8.4.2.10. For pipe larger than 12-inches diameter, drip legs may be one pipe size smaller.
- 8.4.2.11. Depth of drip leg shall be one and a half (1½) times the diameter of the distribution piping or 18-inches, whichever is greater.
- 8.4.2.12. Depth is measured from bottom of distribution piping to outlet of the blowdown connection.
- 8.4.2.13. Direct-bury steam systems shall require steam vaults to access trapping stations.
- 8.4.2.14. Refer to UTILITY DISTRIBUTION STEAM TRAPPING STATION DETAIL in Appendices.
- 8.4.3. Blowdown Piping:
 - 8.4.3.1. Blowdown piping connection is to be installed on the bottom of the drip leg. Where this is not feasible, install as low as possible on the drip leg as approved by Utility Operator.
 - 8.4.3.2. Outlet of blowdown piping shall be visible from location of blowdown valve operation. Install pipe cap on outlet of pipe.
 - 8.4.3.3. Blow down piping on drip legs and strainers shall face away from the blow-down valve hand wheel and shall not discharge onto electrical equipment.

8.4.3.4. Blowdown pipe size to be line size, or 2" diameter, whichever is smaller.

8.4.4. Pressure Reducing Valves (PRV):

8.4.4.1. Every building shall have a dedicated PRV.

8.4.4.2. Coordinate PRV sizing with Owner and Utility Operator.

8.4.4.2.1. If large swings in steam demand are anticipated, install two (2) PRVs in parallel, with one (1) PRV accounting for one-third (1/3) of the total steam demand and the other PRV accounting for the remaining two-thirds (2/3) of the total steam demand.

8.4.4.3. PRVs shall be Cashco Ranger.

8.4.4.4. PRVs shall be installed with isolation valves.

8.4.4.5. Include drip leg/trap station before PRV isolation valve.

8.4.4.6. PRVs in the distribution system shall not contain a bypass.

8.4.4.7. Locate pressure gauges on both sides of PRV.

8.4.4.8. Install pressure transmitter downstream of PRV and provide a 1-inch conduit from the transmitter back to the nearest Utility PLC to connect the digital signal.

8.4.4.9. All PRVs shall be located and configured to allow for maintenance access.

8.4.4.9.1. Provide a minimum clearance of 24-inches in all directions.

8.4.5. Valves:

8.4.5.1. All valves on a project shall be by the same manufacturer and the same model.

8.4.5.2. Isolation valves 2 ½-inches and larger:

8.4.5.2.1. Manufacturers shall be Jamesbury.

8.4.5.2.1.1. 155 psig Steam shall be 300-pound class cast steel, flanged.

8.4.5.2.1.2. Model number 830 L 22 36 HB XZ

8.4.5.2.1.3. 20 psig Steam shall be 150-pound class cast steel, butt weld.

8.4.5.2.1.4. Model number 815 L 11 36 HB XZ

8.4.5.2.2. Valves shall have hard-faced seat rings.

8.4.5.2.3. All valves shall be equipped with operating devices to allow operation from the ground.

- 8.4.5.2.4. Valves may be butterfly, carbon steel body, and stainless-steel disk, complete with gear operator and locking device and manual hand wheel.
- 8.4.5.3. Isolation valves 2-inches and smaller:
 - 8.4.5.3.1. Manufacturer shall be Jamesbury, steam rated locking handle ball valves [Model NJ9FB2236XTB-Model NJ 9 FA 2236 XTB.](#)
 - 8.4.5.3.2. 155 psig Steam shall be 300-pound class screwed bronze.
 - 8.4.5.3.3. 20 psig Steam shall be 300-pound class screwed bronze.
 - 8.4.5.3.4. Condensate shall be 150-pound class screwed bronze.
 - 8.4.5.3.5. Rolled in stainless steel seat rings.
- 8.4.5.4. Safety Valves:
 - 8.4.5.4.1. Sized to State of Iowa Codes and ASME Section VIII Unfired Pressure Vessel Code, with a minimum of 10 pounds between set-point and maximum pressure.
 - 8.4.5.4.2. Multiple valves may be used in lieu of a single, larger valve.
 - 8.4.5.4.3. Valves 2½-inches outlet or smaller shall be Kunkle Figure 6010.
 - 8.4.5.4.4. Valves 3-inch outlet or larger shall be Kunkle Figure 300.
 - 8.4.5.4.5. The use of PRVs in series instead of a relief valve shall not be allowed.
 - 8.4.5.4.6. Each safety valve shall have an individual vent pipe to outside. Consult with the Owner and Utility Operator for vent routing.
 - 8.4.5.4.7. Safety valve shall not be hard piped to vent line.
 - 8.4.5.4.8. Install drip pan elbow on or near outlet of safety valve.
 - 8.4.5.4.9. Valves larger than 2-inches shall have Kunkle Figure 299 cast drip plates at the base of the vent pipe, with drain holes piped to a suitable drain.
 - 8.4.5.4.10. Vent lines from pressure powered pumps or condensate pumps shall not be connected to a relief vent pipe.
- 8.4.5.5. Check Valves:
 - 8.4.5.5.1. Check valves shall bronze or stainless-steel seats and discs.
 - 8.4.5.5.2. Bodies shall be bronze, cast steel or forged steel.
 - 8.4.5.5.3. Cast iron bodies are not acceptable.
 - 8.4.5.5.4. Valves 2 ½-inches and larger:

8.4.5.5.4.1. 155 psig Steam shall be 300-pound class, flanged.

8.4.5.5.4.2. 20 psig Steam shall be 150-pound class, flanged.

8.4.5.5.4.3. Condensate shall be 150-pound class, flanged.

8.4.5.5.5. Valves 2-inches and smaller:

8.4.5.5.5.1. 155 psig Steam shall be 300-pound class, screwed bronze.

8.4.5.5.5.2. 20 psig Steam shall be 150-pound class, screwed bronze.

8.4.5.5.5.3. Condensate shall be 150-pound class, screwed bronze.

8.4.6. Supports and Anchors:

8.4.6.1. All piping hangers and anchors shall be properly designed to avoid excessive stress in any pipe section.

8.4.6.2. Support and anchoring details shall be provided for all steam and condensate piping.

8.4.6.3. Portions of pipe stanchions within 12-inches of concrete shall be 316L stainless steel.

8.4.6.4. Anchoring devices drilled or cast into structures shall be 316L stainless steel.

8.4.6.5. All anchor points shall be reviewed by a Professional Engineer knowledgeable in the design of pipe anchors.

8.4.7. Pipe Expansion:

8.4.7.1. Pipe expansion is preferred to be accommodated with expansion loops.

8.4.7.2. Where loops are not feasible, install expansion joints within vaults and tunnels.

8.4.7.3. Expansion joints shall be piston type and shall be detailed on the drawings.

8.4.7.4. Provide pressure and temperature gauges on steam pipe in each vault and at each building takeoff in utility tunnels and vaults.

8.4.7.5. Provide pressure and temperature gauges on either side of steam main isolation valves Include valves to isolate gauges.

8.4.8. Meters:

8.4.8.1. Shall be provided by Utility Operator.

8.4.8.2. Refer to UTILITY DISTRIBUTION STEAM METER AND TAPS in Appendices.

8.4.9. Strainers:

8.4.9.1. Strainers shall have bronze, cast steel or forged steel bodies.

8.4.9.1.1. Cast iron is not acceptable.

- 8.4.9.2. Strainers shall have 1/32-inch screens.
- 8.4.9.3. The blow down port of each strainer shall have a pipe nipple with a full port-sized gate valve and threaded cap.
- 8.4.9.4. Any strainer on 155-psig steam system shall be 300-pound class.
- 8.4.9.5. Any strainer on 20 psig steam system shall be 150-pound class.
- 8.4.9.6. Any strainer on condensate system shall be 150-pound class.
- 8.4.9.7. Strainers shall be Y-pattern, rated for steam, with stainless steel baskets.
- 8.4.9.8. Manufacturers shall be Armstrong, Spirax Sarco, or Hoffman.

8.4.10. Expansion Joints:

- 8.4.10.1. Fitting shall be ATS Model TP2W-131-12-350H-BRZ-A, piston-type expansion joint with 12-inch traverse, for 300-pound steam at 500 degrees F, weld ends, steel body, chromium plated steel slips, with no anchor foot, installed per manufacturer's specifications.
- 8.4.10.2. Comply with ASTM F 1007.
- 8.4.10.3. Joints shall have internal and external guides, integral with joint gland and body. Joints shall be equipped with limit stop.
- 8.4.10.4. Joint shall allow the addition of new packing while joint is in service under full line pressure.
- 8.4.10.5. The packing ram shall be steel, with no shutoff valve.
- 8.4.10.6. Base joint travel on 550 degrees F operating temperature.
- 8.4.10.7. Joints shall be pre-pressed to allow shrinkage down to 0 degrees F.

8.4.11. Gauges:

- 8.4.11.1. Provide McDaniel Pressure Gauges or approved equal.
- 8.4.11.2. Provide Ashcroft Temperature Gauges or approved equal.
- 8.4.11.3. Face Style shall be 4-inches or larger.
- 8.4.11.4. Mounting shall be standard bottom connection.
- 8.4.11.5. Pressure Range Selection:
 - 8.4.11.5.1. Condensate system gauges shall be 0 to 30 (psig)
 - 8.4.11.5.2. 20 psig system gauges shall be 0 to 30 (psig).
 - 8.4.11.5.3. Medium pressure (20 to 90 psig) gauges shall be 0 to 100 (psig).

- 8.4.11.5.4. 155 psig system gauges shall be 0 to 200 (psig).
- 8.4.11.6. Temperature Range Selection:
 - 8.4.11.6.1. Condensate system gauges shall be 0 to 500°F
 - 8.4.11.6.2. 20 psig system gauges shall be 0 to 500°F
 - 8.4.11.6.3. Medium pressure (20 to 90 psig) gauges shall be 0 to 500°F
 - 8.4.11.6.4. 155 psig system gauges shall be 0 to 500°F
- 8.4.12. Equipment:
 - 8.4.12.1. Install air vents and vacuum breakers on steam equipment.
- 8.4.13. Condensate Pumps:
 - 8.4.13.1. Pumps shall be electric, duplex-type.
 - 8.4.13.2. Approved Manufacturers are Sterling, Spirax Sarco, or Skidmore.
 - 8.4.13.3. Pump shall be installed per manufacturer's specifications.
 - 8.4.13.4. Condensate tanks shall be vented with two (2) full size vents.
 - 8.4.13.5. Discharge vent outside where possible.
- 8.4.14. Steam Trapping Stations:
 - 8.4.14.1. Steam traps on mechanical distribution piping shall be Armstrong 2011 series or Spirax Sarco UIV30 Series, modular stainless steel inverted bucket traps.
 - 8.4.14.2. Each trap shall have an upstream block valve, test valve, and strainer, a downstream swing check valve, a test valve, and a block valve.
 - 8.4.14.3. There shall be no trap bypasses.
 - 8.4.14.4. Trapping station piping and fittings shall be flanged or threaded. Welded fittings are not allowed. Socket weld the steam trap piping to the steam drip leg.
 - 8.4.14.5. Traps shall be piped from drip legs. Drip leg diameter shall be full-size. Length of the drip legs shall be one and a half (1½) times the diameter of the pipe, with a minimum of 12-inches.
 - 8.4.14.6. Drip legs shall be equipped with blow-down valves on the bottom of the drip leg, equal to the smaller of line size or 2-inches.
 - 8.4.14.7. Blow-down valves shall be piped from the bottom of the drip leg cap where possible.
 - 8.4.14.8. Blow down piping on drip legs and strainers shall face away from the blow-down valve hand wheel and shall not discharge onto electrical equipment.

8.4.15. Insulation:

8.4.15.1. General:

- 8.4.15.1.1. Installation of insulation on steam and condensate piping shall be as per the following table.
- 8.4.15.1.2. Thickness and installation method is based on the use of fiberglass.
- 8.4.15.1.3. Steam and condensate piping in tunnels shall be 850 CertainTeed fiberglass.
- 8.4.15.1.4. Closed cell foam insulation shall not be used.
- 8.4.15.1.5. Insulation shall be non-asbestos containing
- 8.4.15.1.6. Insulation shall not be installed on condensate return pumps
- 8.4.15.1.7. Condensate insulation shall include a vapor barrier jacket.

SERVICE		SIZE	INSTALLATION METHOD	TOTAL THICKNESS
High Pressure Steam	Over 20 pounds	All Sizes	2-inches first layer, 1½-inches second layer. Staggered joints.	3 ½ inches
Low Pressure Steam	Under 20 pounds	All Sizes	1 ½ inches first layer, 1 inch second layer. Staggered joints.	2 ½ inches
Condensate		All Sizes	Installed in 1 layer	1 inch

- 8.4.15.1.8. Where pipe is held in place with a spider guide that does not allow at least ¼-inch clearance between the insulation and the outer ring, the following procedures shall be used:
 - 8.4.15.1.8.1. The insulation shall neck down to a single layer approximately 6-inches before and after the guide.
 - 8.4.15.1.8.2. The top layer of insulation shall be beveled at a 45-degree angle to allow for a smooth transition to a single layer.
 - 8.4.15.1.8.3. The individual pieces of insulation that are placed between the legs of the spider guide shall extend past the spider legs so that they may be bound firmly into place with aluminum jacket with bands wrapped around the pipe.

8.4.15.2. Jacket:

- 8.4.15.2.1. Jacketing is required on all steam and condensate piping in tunnels, vaults, and exterior installations.
- 8.4.15.2.2. All piping exposed in buildings to the point of demarcation, within 6 feet above finished floor, shall have jacket installed.
- 8.4.15.2.3. Perforated aluminum jacket should be used over [hydrophobic insulation](#) when used in flood prone areas.
- 8.4.15.2.4. Jackets shall be 0.019-inch aluminum except where piping is exposed to salts. In locations where piping may be exposed to salts such as under hatches or grates, jacket shall be 0.019 stainless steel.
- 8.4.15.2.5. All seams shall face downward.
- 8.4.15.2.6. PVC shall not be used for this jacket.

~~8.4.15.2.7~~ [8.4.15.3.](#) Steam Meter, Valve Traps, Condensate Return Tanks and Pumps, and Expansion Joint Insulation:

~~8.4.15.2.8~~ [8.4.15.3.1.](#) Meters, valves, traps, condensate return tanks and pumps (excluding motors) and expansion joints shall have removable/reusable insulation covers. Do not cover impulse legs, transmitters, or other instrumentation that may be damaged by excess heat.

~~8.4.15.2.9~~ [8.4.15.3.2.](#) Covers for bodies 6-inches and below shall be 1-piece.

~~8.4.15.2.10~~ [8.4.15.3.3.](#) Covers for bodies 8-inches to 12- inches shall be 2-piece.

~~8.4.15.2.11~~ [8.4.15.3.4.](#) Covers for bodies 14-inches and larger shall be 3-piece.

~~8.4.15.2.12~~ [8.4.15.3.5.](#) Valve covers shall span 4-inches beyond welds or flanges.

~~8.4.15.2.13~~ [8.4.15.3.6.](#) Expansion joint covers shall be sized to accommodate thermal expansion.

~~8.4.15.2.14~~ [8.4.15.3.7.](#) Outer jacket, inner jacket, and gussets to be PTFE coated fiberglass, not less than 16 ½-ounces per square yard.

~~8.4.15.2.15~~ [8.4.15.3.8.](#) Insulation thickness shall be:

~~8.4.15.2.15.1~~ [8.4.15.3.8.1.](#) All steam and condensate piping 6-inches and below shall be 1-inch-thick type-E needled fiberglass, 6-to-8-pound density.

~~8.4.15.2.15.2~~ [8.4.15.3.8.2.](#) All steam and condensate piping 8-inches or larger shall be 1-inch-thick Pyrogel blankets.

~~8.4.15.2.16~~ [8.4.15.3.9.](#) The sewing thread shall be 10-strand 304 stainless steel.

~~8.4.15.2.17-8.4.15.3.10.~~ Fastener belt shall be PTFE coated fiberglass with double D-rings and Velcro closure.

~~8.4.15.2.18-8.4.15.3.11.~~ ID tags shall be 304 stainless steel, embossed lettering, riveted to blanket. ID tag to contain the tunnel, tunnel stationing, size of pipe, identification of LPS, HPS, or condensate, and serial number.

~~8.4.15.2.19-8.4.15.3.12.~~ All hardware shall be 304 stainless-steel.

~~8.4.15.2.20-8.4.15.3.13.~~ Hog ring or staple construction shall not be used.

~~8.4.15.2.21-8.4.15.3.14.~~ Provisions shall be made for the packing cylinders to ensure a snug fit along the entire expansion joint.

~~8.4.15.2.22-8.4.15.4.~~ Refer to UTILITY DISTRIBUTION STEAM METER AND TAPS DETAIL in Appendices.

8.4.16. Testing:

8.4.16.1. Clean new distribution steam lines with hydro-jetting.

8.4.16.2. Pressure pipe welding requirements:

8.4.16.2.1. Pressure piping shall be examined and tested in accordance with ASME B31.1 and AWS B1.11.

8.4.16.2.2. Additional weld testing beyond visual inspections of welds may be performed including but not limited to radiography, ultrasonic, liquid penetrate and magnetic particle methods.

8.4.16.3. Piping shall be hydrostatically tested to a minimum 225-pounds of pressure. Test pressure shall be held for four (4) hours with 5-pound maximum loss.

8.4.16.4. No tests shall begin after 12:00 PM (Noon).

8.4.16.5. Piping shall have high point vents to allow complete filling of pipe for the hydrostatic test. Remove Air relief vents after testing.

8.4.16.5.1. Provide GPS locations for each vent.

~~8.4.16.6. Steam pipe cleaning shall be conducted using hydro-jetting.~~

9. Compressed Air:

9.1. General:

9.1.1. The line of demarcation for compressed air between the Utility Operator and the University of Iowa is on the upstream side of the Utility Operator's steam PRV.

9.1.2. Any building service teed ~~off of~~ this distribution service within the building shall be maintained by the University of Iowa. See Appendix for Lines of Demarcation.

- 9.1.3. Utility Operator will coordinate the supply of compressed air to all utility valves that require it to operate.

~~9.1.3.1. For University's Utility Operator~~

~~9.1.3.1.1-9.1.3.1. System Design:~~

- ~~9.1.3.1.1.1-9.1.3.1.1. Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping.~~

- ~~9.1.3.1.1.2-9.1.3.1.2. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance--like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.~~

9.2. Piping:

- 9.2.1. Compressed air piping to be Type K copper.
- 9.2.2. Consult with Owner and/or Utility Operator for piping joint connection type.
- 9.2.3. Provide ball valves suitable for service on either side of new take-offs. Provide ball valve in the branch line near the main.

10. Utility Tunnels:

10.1. General:

- 10.1.1. Slope roof a minimum 2% to drain off structure.
- 10.1.2. Tunnels and Vaults shall be designed for AASHTO H-20 Traffic Loads
- 10.1.3. Tunnel floors shall be positively sloped towards a drain and sumps with sump pumps and discharge piping installed.

10.2. Sump Pumps and Drainage:

- 10.2.1. Floors shall be positively sloped towards a drain or sump.
- 10.2.2. Sump pumps and discharge piping shall be installed in steam tunnels and vaults where sump pits are used. Sump pump alarming connected to the utility network is desired wherever telemetry is available.

~~10.2.3. Electrical pulling vaults shall have sump pits but do not require pumps, discharge piping, or pit covers.~~

~~10.2.4. Sump pits in these vaults shall be 18 inches in diameter and 10 inches deep.~~

~~10.2.5. Place pit below the manhole, 1 foot beyond the manhole ring, for a pump to be dropped in for future maintenance.~~

~~10.2.6. Electrical vaults with equipment located within, require a permanent sump pump and discharge piping.~~

~~10.2.7-10.2.3.~~ Gravity drains are preferred where feasible.

~~10.2.8-10.2.4.~~ Structures located within the 500-year floodplain shall be pumped with backflow prevention.

~~10.2.9-10.2.5.~~ Sump pits with pumps shall be 24-inches in diameter and 24-inches deep.

~~10.2.10-10.2.6.~~ Sump pit shall have a removable, light weight composite perforated cover.

10.2.7. Sump pump alarm to be connected to utility network where possible.

10.2.8. Electrical pulling vaults shall have sump pits but do not require pumps, discharge piping, or pit covers.

10.2.8.1. Sump pits in these vaults shall be 18-inches in diameter and 10-inches deep.

10.2.8.2. Place pit below the manhole, 1-foot beyond the manhole ring, for a pump to be dropped in for future maintenance.

Electrical vaults with equipment located within, require a permanent sump pump and discharge piping.

~~10.2.11.~~

10.3. Access:

10.3.1. Design structures to allow maintenance access.

10.3.2. At tunnel locations where serviceable items are located, tunnel chambers shall be installed with surface access within 50-feet of serviceable item and within 20 feet of dead ends.

10.3.3. Vault/Tunnel access shall not be placed within roadways.

10.3.4. Hatches for Utility Vault/Tunnels (except Electrical) shall be hinged, spring assisted, Bilco Aluminum Traffic Rated hatches.

10.3.5. Manhole covers are not acceptable.

10.3.6. No key shall be required to open door from inside the tunnel or vault, and an exit lever shall be easily accessible.

10.3.7. Electrical vault access shall be cast iron manholes or Bilco hatches matching the requirements above.

10.3.7.1. Coordinate with Utility Operator for type of access.

10.3.8. Hatches shall be installed with hinges on opposite wall of ladder (hinges 180° from ladder)

10.3.9. Manholes and hatches located below the 500-year flood plus 2' elevation shall be watertight. Hatches shall be Bilco Flood-Tight door.

10.3.10. Tunnel bulkhead doors shall be Presray. No substitutions allowed.

- 10.3.11. Size access points to allow the largest equipment in and out.
- 10.3.12. Tunnel Egress shall be provided within 20-feet of dead ends.
- 10.3.13. Maximum tunnel egress spacing to be 200 feet.
- 10.3.14. Locate access hatches/manholes outside of drainage paths and roof overflow drainage.
- 10.3.15. All tunnel entrances shall have aluminum OSHA notice signs furnished by Utility Operator.
- 10.3.16. Coordinate access location for electrical vaults to facilitate pulling of cable with Utility Operator.
- 10.3.17. Ladders:
 - 10.3.17.1. Ladders shall be wall mounted.
 - 10.3.17.2. Entire ladder to be galvanized.
 - 10.3.17.2.1. Bottom 3-feet shall be stainless steel plate and rungs.
 - 10.3.17.3. Ladders shall be equipped with a Ladder-Up device by Bilco Company.
 - 10.3.17.4. Ladder shall be constructed of minimum 3/8-inch by 2 ½-inch side rails spaced 1-foot 4-inches, minimum.
 - 10.3.17.5. Rungs shall be no more than 12-inches from top surface and floor surface and spaced at 12-inches on center.
 - 10.3.17.6. Rungs shall be McNichols Grip Strut for non-stainless-steel segment of ladder.
 - 10.3.17.7. Stainless steel rungs to be 2-inch stainless steel channel or tube with Safeguard Anti-Slip Hi-Traction Rung Covers
 - 10.3.17.8. Wall standoff brackets shall be 3/8-inch by 3-inches L or T brackets, spaced 4-feet 0-inches on center. Use ½-inch diameter stainless steel expansion anchors to fasten to wall.
 - 10.3.17.9. Ladders are not required in electrical pulling vaults.

10.4. Power and Lighting:

- 10.4.1. Provide lighting LED light fixture rated for high ambient temperature at 20-foot intervals (maximum).
- 10.4.2. Provide minimum of two (2) separate lighting circuits on alternating lighting so that failure in one (1) circuit will not leave a tunnel dark.
- 10.4.3. Emergency lighting is not required.
- 10.4.4. Provide GFCI maintenance receptacle at 100-foot intervals.
- 10.4.5. Provide a minimum of two (2) receptacle circuits in all tunnels.

- 10.4.6. Provide a minimum of two (2) duplex per vault.
- 10.4.7. Sump pumps shall not be connected to GFCI circuit.
- 10.4.8. Power and lighting are not required in electrical pulling vaults.
- 10.4.9. Place light switch and GFCI in riser of tunnel/vault access.
- 10.4.10. Coordinate light switch locations and spacing in tunnels with Utility Operator.
- 10.4.11. Place light switch and GFCI at each tunnel egress.
- 10.4.12. Conduit shall be steel RMC. PVC, plastic pipe, or conduit is prohibited in tunnels and vaults.
- 10.4.13. No plastic expansion anchors shall be used in the tunnel, including conduit.
- 10.4.14. Lights shall be Hubbell Killark VSL-13-30-NN-H-G.

10.5. Ventilation:

- 10.5.1. Tunnels shall be ventilated with supply and exhaust fan with thermostat control, freeze stat, and On-Off-Auto switch.
- 10.5.2. RTD for Space Temp with breakout box no higher than 6-feet.
- 10.5.3. Box specified by Utility Operator Meters and Controls.
- 10.5.4. RTD shall be installed no closer than 40-feet from the nearest fan.
- 10.5.5. Vaults shall have a single speed supply fan with thermostat control, freeze stat, and On-Off-Auto switch.
- 10.5.6. All vault air ducts to louvered penthouses shall be ductile iron (push joint).
- 10.5.7. Provide motorized damper with each fan with end switch external to duct.
 - 10.5.7.1. Provide access panel for access to damper components.
- 10.5.8. All fans shall be connected to Utilities PLC to indicate fan run status.
- 10.5.9. Coordinate instrumentation and controls cables with Utility Operator.
- 10.5.10. Terminations at PLC are completed by Utility Operator.
- 10.5.11. Vaults and tunnels to have minimum of twelve (12) air changes per hour.
- 10.5.12. Fans may be belt driven or ~~Provide direct drive_s on fan motors.~~
- 10.5.13. Provide insulated aluminum fan housing.
- 10.5.14. All ventilation components shall be able to withstand 120 °F ambient and airstream temperatures.

10.5.15. Electrical vaults do not require ventilation.

10.6. Waterproofing:

- 10.6.1. Wall piping penetrations shall be sealed with Link-seals where conduits enter vaults individually or duct banks enter existing vaults.
- 10.6.2. Where new duct banks are installed through new vault walls, pour end bells flush with interior wall during wall installation.
- 10.6.3. Entire perimeter of tunnels and vaults shall be waterproofed including underside of floor slab, top of roof slabs, and exterior face of walls.
- 10.6.4. Electrical vaults do not require underside of floor slab waterproofing.
- 10.6.5. Concrete shall contain integral waterproofing admixture, Xypex or approved equal.
- 10.6.6. Joints between new and existing concrete, including construction joints shall contain water stop. Adcor ES Hydrophilic Non-Bentonite ES is preferred.

11. Electric Distribution:

11.1. General:

- 11.1.1. The line of electrical demarcation for Utility Operator and the University of Iowa is the load side terminals of the secondary service protector.
- 11.1.2. The University of Iowa will provide secondary cabling and make terminations at Utility Operator's secondary service protector.
- 11.1.3. See Appendices for Lines of Demarcation.

11.2. High Voltage Equipment and Cable Vault Information:

- 11.2.1. Primary transformer/switchgear/cable installations shall be designed using concrete equipment vault.
- 11.2.2. Structure to comply with Utility Tunnel and Vaults section 15 above and associated details in the appendix.
- 11.2.3. Vault minimum interior dimensions shall be 8-feet in all directions. Cable vault size dependent on number of cables and shall be approved ~~by Owner~~by Owner and Utility Operator.
- 11.2.4. Vault dimensions shall be increased in size from minimum stated above to accommodate all equipment per manufacturers recommendations.
- 11.2.5. Switchgear in a room or vault shall be installed on a 3 ½-inches or taller concrete housekeeping pad.
- 11.2.6. Vault equipment room height shall be coordinated with Owner and Utility Operator, depending on equipment and conduit configuration, as a minimum, 5' clearance above top of gear.
- 11.2.7. Vault grounding system shall be as follows:

- 11.2.7.1. Minimum of four (4) ¾-inch by 10-foot copper clad steel ground rods to be driven exterior to vault before backfilling connected with #4/0 minimum copper cable.
- 11.2.7.2. Minimum #4/0 copper ground cable to be installed on inside perimeter of vault wall, no less than 24-inches above floor.
- 11.2.7.3. Cable shall be bonded to all metallic ladders, hatches, lids and other structural fittings, interior to the vault, as well as end bells of all rigid conduits in ductbanks.
- 11.2.7.4. Cable shall be bonded to exterior ground grid and connecting the ground rods through a sealed penetration into the vault wall no less than 24-inches above the vault floor.
- 11.2.7.5. No penetrations of ground cables or ground rods shall be allowed into floors of vaults.
- 11.2.7.6. All ground cables shall be bonded to adjoining duct bank and building ground grids.
- 11.2.7.7. All ground cable bonding shall be made by irreversible compression.

11.2.8. Vault pulling eyes shall be installed in vaults as follows:

- 11.2.8.1. Use minimum ¾-inch stainless steel rod bent and tied into vault wall reinforcing to withstand no less than 7500-pound load.
- 11.2.8.2. Pulling eyes shall be placed 24-inches above vault floor in the walls opposite of all ductbanks and major conduits (4-inches and larger) entering a vault.
- 11.2.8.3. Refer to Appendices for details.

11.3. Ductbank:

- 11.3.1. Provide type-EB PVC 5-inch duct equal to Carlon number 68716 and EB PVC 2-inch duct equal to Carlon number 68711.
- 11.3.2. Grounding bushings on conduits to be Burndy GC XXA or approved equal.
- 11.3.3. Ductbanks shall contain a minimum of two (2) 2-inch conduit for meters and controls. Confirm count with Owner and/or Utility Operator.
- 11.3.4. Secondary ductbank from substation to electric room inside building shall contain a minimum one (1) 2-inch meters and controls conduit. Confirm count with Owner and/or Utility Operator.

~~11.3.5. Bottom of ductbank shall be formed.~~

~~11.3.5.1. Earth forming is not permitted.~~

~~11.3.6.~~ 11.3.5. All duct banks shall be concrete encased

~~11.3.7.~~ 11.3.6. Provide formed and reinforced concrete base (mud sill), earth forming is not permitted.

~~11.3.7.1~~~~11.3.6.1~~. Expanded stay-in-place forms may be used for mud sill and/or duct bank forming.

~~11.3.7.2~~~~11.3.6.2~~. Mud sill shall be poured with edges extending a minimum 2-inches beyond the width of the duct bank it is supporting.

~~11.3.7.3~~~~11.3.6.3~~. Mud sills must be installed and inspected prior to remaining concrete being installed.

~~11.3.7.4~~~~11.3.6.4~~. Mud sill shall be capable of resisting all of the superimposed loads in the final configuration and support no less than self-weight of mud sill and concrete encased conduits above for a clear span of at least 10-feet without considering any strength offered by concrete encasement or conduits.

~~11.3.7.5~~~~11.3.6.5~~. Slabs shall have adequate strength and stiffness to support loads defined above without damage to the concrete encasement or conduits.

~~11.3.7.6~~~~11.3.6.6~~. Loads to consider above include but are not limited to vehicles, pavement, soils foundations, etc.

~~11.3.8~~~~11.3.7~~. Where concrete encased duct banks are not possible or cost effective to install via open trench methodology, such as crossing railroads, roadways, waterways or other obstructions, the specified PVC conduits or approved HDPE conduits may be installed via horizontal directional drilling or with bore and jack installation with a steel casing pipe. Such installations are to be approved by the Utility Operator and Owner during the Design Development phase of the project.

~~11.3.9~~~~11.3.8~~. Conduits shall terminate 2-inches inside walls with end bells equivalent to O-Z Gedney Type TNS when installing new ducts into existing vault walls.

~~11.3.10~~~~11.3.9~~. Cast end bells into concrete when installing ducts into new walls.

~~11.3.11~~~~11.3.10~~. Conduits shall be installed with grounding bushings.

~~11.3.12~~~~11.3.11~~. Rigid steel conduits are required as follows:

~~11.3.12.1~~~~11.3.11.1~~. Within 10-feet of vaults, manholes, and buildings.

~~11.3.12.2~~~~11.3.11.2~~. At construction joints where concrete pours are interrupted during installation.

~~11.3.12.3~~~~11.3.11.3~~. All sweeps used for changes in direction and shall be long sweep.

~~11.3.12.4~~~~11.3.11.4~~. At locations where cover is less than 1-foot.

~~11.3.13~~~~11.3.12~~. Under roadways, Duct run shall pitch a minimum of 3-inches per 100-feet, with no more than 350-feet between manholes and shall be decreased by 50-foot for each 90° or fraction thereof.

~~11.3.14~~~~11.3.13~~. Ducts with more than 180° of bends shall be approved by the Owner and/or Utility Operator.

~~11.3.15.~~11.3.14. Base and intermediate spacers basis of design are Carlon catalog numbers S288PL and S289PL.

~~11.3.16.~~11.3.15. Spacers shall be provided on maximum 5-foot centers, minimum.

~~11.3.16.1.~~11.3.15.1. Other spacer designs would require submittal of spacer with documentation that spacer meets or exceeds the design requirements of the spacer system.

~~11.3.17.~~11.3.16. Duct and conduit couplings shall be watertight.

~~11.3.18.~~11.3.17. Duct shall be installed in such a manner to prevent accumulation of water.

~~11.3.19.~~11.3.18. Duct run shall pitch a minimum of 3-inches per 100-feet with no more than 350-feet between manholes.

~~11.3.20.~~11.3.19. All conduits shall be evenly spaced and aligned with each other.

~~11.3.21.~~11.3.20. Minimum reinforcing of the concrete shall be as follows:

~~11.3.22.~~11.3.21. Minimum size #4 with no epoxy coating.

~~11.3.23.~~11.3.22. Reinforcing shall be installed longitudinally, at each corner of the duct (in cross section) and along the top, bottom, and sides at a maximum of 6-inches on center.

~~11.3.24.~~11.3.23. All ductbank reinforcing steel shall have a minimum concrete cover of 1½-inch and shall be increased to 2-inches when ductbanks are installed under surfaces used for motor vehicle travel.

~~11.3.25.~~11.3.24. Reinforcing shall be installed latitudinal, as needed to hold the reinforcing steel in place during concrete placement.

~~11.3.26.~~11.3.25. Each section of line (from manhole to manhole or from manhole to building) is intended to be poured complete in one (1) operation.

~~11.3.27.~~11.3.26. Construction joints shall not be permitted between manholes unless approved by Owner and/or Utility Operator.

~~11.3.28.~~11.3.27. The top of the concrete encasement shall be a minimum of 24-inches below final grade.

~~11.3.29.~~11.3.28. Concrete:

~~11.3.29.1.~~11.3.28.1. Owner and/or Utility Operator shall inspect ductbank prior to installation of concrete.

~~11.3.29.2.~~11.3.28.2. Concrete shall cover the duct a minimum of 3-inches in all directions, and a maximum of 6-inches.

~~11.3.29.3.~~11.3.28.3. Concrete shall be 4,000 psi and shall have the color additive "Colorcron - Tile Red" as manufactured by Masterbuilders, Solomon Grind Chemical Services number 140 Red.

~~11.3.29.4~~11.3.28.4. The color additive shall have a minimum concentration of 9-pounds per bag of cement and shall be mixed throughout the duct bank concrete.

~~11.3.29.5~~11.3.28.5. Maximum aggregate size shall be ¾-inch.

~~11.3.29.6~~11.3.28.6. Concrete shall not be placed with the aid of a mechanical vibrator.

~~11.3.30~~11.3.29. After duct encasement is placed, and before backfilling is installed, pull a mandrel or leather wipe through the ducts ¼-inch in diameter less than the ducts.

~~11.3.31~~11.3.30. If this test indicates there are obstructions or there is water in the duct system, that section of the system shall be removed and a new section installed at no additional cost to the Owner and/or Utility Operator.

~~11.3.32~~11.3.31. Duct bank penetrations into manholes shall continue completely through the wall of the manhole using a single penetration.

~~11.3.33~~11.3.32. Where the concrete must stop outside the manhole, it shall be pinned to the manhole with steel pins to prevent differential settlement.

~~11.3.34~~11.3.33. Install synthetic pulling / measuring tape with minimum 2500-pound tensile strength in all unused duct cells, for future use.

~~11.3.35~~11.3.34. Duct bank penetrations of foundation wall shall comply with the following:

~~11.3.35.1~~11.3.34.1. Concrete encased duct banks shall terminate at the exterior surface of the foundation wall.

~~11.3.35.2~~11.3.34.2. The conduit shall make individual penetrations of the foundation wall.

~~11.3.35.3~~11.3.34.3. Duct banks shall be attached to the foundation wall in one (1) of two (2) manners.

~~11.3.35.3.1~~11.3.34.3.1. In new construction, the reinforcing steel of the foundation wall may be extended into the concrete encasement of the duct bank at the time of placement.

~~11.3.35.3.2~~11.3.34.3.2. In existing construction, drill and extend reinforcing using Hilti epoxy capsules.

~~11.3.35.4~~11.3.34.4. The conduit shall penetrate the foundation wall in the following manner:

~~11.3.35.4.1~~11.3.34.4.1. In new construction, install steel sleeve.

~~11.3.35.4.2~~11.3.34.4.2. In existing construction, core drill.

~~11.3.35.4.3~~11.3.34.4.3. Sufficient space shall remain between the penetrations to maintain the structural integrity of the foundation wall.

~~11.3.35.4.4~~11.3.34.4.4. Size sleeve or core opening per seal Manufacturer's recommendations.

~~11.3.35.4.5~~11.3.34.4.5. Provide Link-Seal near the interior surface of the foundation wall.

~~11.3.35.4.6~~11.3.34.4.6. Provide waterproofing installed on the exterior side of the rubber seal.

~~11.3.35.4.7~~11.3.34.4.7. Grouting is prohibited.

12. Communications Distribution:

12.1. General:

- 12.1.1. Number and type of fiber shall be specified by ITS EI - Physical Infrastructure.
- 12.1.2. Fiber shall be installed in inner duct within conduits.
- 12.1.3. Multiple fibers shall be pulled in the same inner-duct whenever possible.
- 12.1.4. Fiber shall be installed in one (1) continuous piece unless prior approval is given by ITS EI - Physical Infrastructure.
- 12.1.5. Excess fiber shall be coiled neatly and secured to a wall above the plywood backboard out of the way of normal traffic and not subjected to unusual flexing.

12.2. Underground Pathways:

- 12.2.1. Exterior underground conduit shall be directional drilled.
- 12.2.2. HDPE conduit shall meet ASTM 3035 specifications:
 - 12.2.2.1. 4-inch diameter to be SDR 13.5
 - 12.2.2.2. 2-inch diameter to be SDR 11.
 - 12.2.2.3. Telecommunications conduit shall be orange in color.
 - 12.2.2.4. Connections shall be electro-fusion welded and witnessed by ITS EI – Physical Infrastructure.
- 12.2.3. Conduit shall meet American National Standards Institute (ANSI) and Federal Specifications (FS) standards HDPE conduit ASTM F2160, UL-651.
- 12.2.4. Install a minimum of six (6) 4-inch ducts or nine (9) 2-inch ducts between manholes.
- 12.2.5. Install one (1) 4 inch or a three (3) 2-inch ducts into a building.
 - 12.2.5.1. Install conduit 30-inches (minimum) below grade to the top of the structure.
 - 12.2.5.2. Install conduit 36-inches (minimum) below grade under roadways.

- 12.2.5.3. Changes in direction, either vertical or horizontal, shall be accomplished with bends of the appropriate angle (90, 45, 22½ or 11-degrees) to provide a smooth transition and mild pulling radius.
- 12.2.5.4. The aggregate total of bends between structures (i.e., manhole to manhole, manhole to pole, building or pad) shall not exceed 180-degrees.
- 12.2.5.5. All bends shall have a minimum radius of 60-inches.
- 12.2.5.6. A pull-line, with a minimum tensile strength of ~~1200-pounds to~~ 1800-pounds and composed of a non-degradable material, shall be placed in all conduits.

12.3. Building Entrance Pathway:

- 12.3.1. Conduit from a manhole to a building shall consist of a 1-by-3, flat configuration of three (3) 4-inch PVC conduits encased in concrete.
- 12.3.2. At the point of entry, into either a building or manhole wall, steel reinforcing bars shall be placed along the conduit within the concrete to extend within the foundation or manhole wall.
- 12.3.3. Conduit to transition to a full 10-foot section of RGS at penetration to prevent shear.
- 12.3.4. The 4-inch conduits shall terminate inside the room equipped with bell-end fitting.
- 12.3.5. The 4-inch conduit entering the building beyond the point of penetration shall be installed in compliance with the National Electrical Code (NEC).
- 12.3.6. ~~All conduits shall be sealed with rubber conduit plugs, Jackmoon U.S.A. Inc., part number 50D535U, Carlon Telecom Systems, part number MAEPG8, General Machine Products Co. Inc., part number 66638. Appropriate sized plugs shall be used on all conduits.~~

12.4. Communication Manholes/Handholes:

12.4.1. Precast Manholes:

- 12.4.1.1. The standard manholes for Campus applications shall be precast concrete, minimum size shall be 5-feet wide by 8-feet long by 7-feet head room, industry standard type 38Y, available in type-A and type J, L, and T.
- 12.4.1.2. Local conditions may dictate a different size or configuration for manhole, in which case it shall be approved by ITS EI - Physical Infrastructure.
- 12.4.1.3. Manholes shall be set with a minimum 2-foot of cover to top of concrete roof and, where possible, placed off roadways in grass plots, medial strips, or lawn areas.

12.4.2. Cast-in-place Manholes:

- 12.4.2.1. All cast in place manholes shall meet the American Association of State Highway and Transportation Officials (AASHTO) specifications.
- 12.4.2.2. All conduits entering or exiting manholes shall be placed the same elevation to permit pull-through cable placement.

12.4.2.3. Provide one (1) 30-inch Type-B Neenah number R-1750-C1B, cast iron frame, cover, and racking as specified in the equipment section of this standard.

12.4.2.4. Provide a 12-inch round or 12-inch square by 8-inch-deep sump hole in the floor under the lid. The floor shall slope to the sump hole.

12.4.2.5. Innerduct shall be brought up into handhole, extending twelve inches up from the bottom of the box.

12.4.2.6. Innerduct must be capped during installation to keep gravel and dirt out of innerduct.

12.4.2.7. Leave sufficient slack in wire coiled up in handhole to extend a minimum of two feet above final grade.

12.4.2.8. Handhole shall sit on a minimum of 6-inches of clean gravel.

12.4.2.9. Clean gravel shall fill the bottom 2-inches of handhole

~~12.4.2.4.~~12.4.2.10. Coordinate all handhole sizes and location with EI-Physical Infrastructure during design.

12.4.3. Communication Manhole Equipment:

12.4.3.1. All manholes shall be equipped with 30-inch cast iron frames and covers.

12.4.3.2. The castings shall be set in concrete collars purged to seal.

12.4.3.3. Manholes shall be racked with all galvanized hardware.

12.4.3.4. Cast-in-place and nonstandard manholes shall have inserts cast in the walls.

12.4.3.5. Provide pulling in irons cast in the walls directly opposite the various duct entrances.

12.4.4. Frame and Cover Adjustments:

12.4.4.1. Provide extension rings to extend manhole openings to grade.

12.4.4.2. Rings shall be ordered to fit the appropriate diameter (36-inch, 30-inch, or 27-inch) and the appropriate rise required (1½-inch, 2-inch, or 3-inch).

12.4.4.3. An epoxy-based cement be used on the contact surfaces of the extension ring.

12.4.4.4. ITS EI - Physical Infrastructure shall determine the use of utilizing extension rings or requiring resetting of the frame.

12.4.5. Termination, Splicing, and Testing:

12.4.5.1. Fiber shall be terminated in a Corning Closet Connector Housing (CCH) at each end to facilitate cross-connections.

12.4.5.2. Fiber shall be terminated with the following type connectors:

12.4.5.2.1. Corning CCH Pigtail Cassette CCH-CS12-~~B359~~-POORE.

12.4.5.2.2. Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-~~B359~~-POORE cassette loaded with ~~LC/APCSC~~ connectors.

12.4.5.3. Constructor shall provide Owner with the following documentation:

12.4.5.3.1. OTDR trace from each end at ~~850 nm or 1300 nm~~-1310 nm 1550 nm.

12.4.5.3.2. Power meter loss measurements in both directions at a wavelength of ~~850 nm or 1300 nm~~-1310nm 1550 nm.

12.4.5.3.3. A printed copy of all fiber cable test results.

12.4.6. Testing:

12.4.6.1. Test all underground pathways by drawing an appropriately sized mandrel through each duct to assure the integrity.

12.4.6.2. Testing shall be witnessed by Owner.

34) through 41) NOT USED

42) WATER PLANT

1. General:

- 1.1. All materials in contact with raw, partially treated, or finished water or chemicals that will be introduced into the water shall be NSF 61 certified for potable water contact or current applicable standard.
- 1.2. Iowa DNR design standards <https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Supply-Engineering/Construction-Permits>
- 1.3. Recommended Standards for Water Works (Ten State Standards), 2012 edition.
- 1.4. American Water Works Association (AWWA) Standards as adopted through 2016.
- 1.5. 567 of the Iowa Administrative Code (IAC) subrules 43.3(7) to 43.3(9).
- 1.6. To the extent of any conflict between the Ten States Standards and the American Water Works Association Standards and IAC 567--43.3(7) to 567--43.3(9), the Ten States Standards, IAC 567--43.3(2), and IAC 567--43.3(7) to 43.3(9) shall prevail.
- 1.7. System design: Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance--like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.
- 1.8. Corrosion resistant and/or explosion rated materials and equipment such as doors, hardware, electrical fixtures, and devices, etc. shall be used in corrosive and/or explosive-risk areas.

2. Process Systems:

- 2.1. Process systems include raw water, treated water, sludge piping and excludes chemical systems.
- 2.2. Ductile Iron Process piping, 3-inches and larger:
 - 2.2.1. Shall be ductile iron, unless otherwise noted.
 - 2.2.1.1. Exception: Some of the piping around the Reverse Osmosis system is stainless steel and Schedule 80 PVC.
 - 2.2.2. Liquid and air (from filter backwash blower) service pipe: AWWA C151, ductile iron.
 - 2.2.3. Liquid service pipe: Cement lining and seal coat shall be in accordance with AWWA C104.
 - 2.2.4. Pipe and fittings for air service from filter backwash blower shall be unlined.
 - 2.2.5. Joints:
 - 2.2.5.1. Liquid and air service in buried locations shall be mechanical or push-on joint. All buried piping, fittings, and valves shall be restrained joint.

2.2.5.2. Liquid and air service in locations other than buried shall be flanged end joint.

2.2.5.3. All air service gaskets (mechanical or flashed joint) shall be Viton for 300 degrees F.

2.2.6. All sample taps shall be smooth nosed.

2.2.7. Pressure Testing and Disinfection:

2.2.7.1. The test pressure shall be 150 psi, or not less than 1.25 times the working pressure at the highest point along the test section and not less than 1.5 times the working pressure at the point of testing.

2.2.7.2. Test pressure must be a minimum of 25 psi.

2.2.7.3. Observe each test section for leakage at end of test period. Test fails if leakage observed, or pressure drop exceeds 1 psi over 2 hours.

2.2.7.4. Disinfect required piping systems as per ANSI/AWWA C651.

2.2.7.5. Provide bacteriological sampling and reporting as per ANSI/AWWA C651.

2.3. Process Valves:

2.3.1. Butterfly Valves:

2.3.1.1. Flanged body per AWWA C504

2.3.1.2. Wafer or lug body may be acceptable for applications such as equipment skids with Utility Operator approval.

2.3.1.3. Acceptable manufacturers:

2.3.1.3.1. Pratt 2FII

2.3.1.3.2. Dezurik BAW

2.3.2. Gate Valves:

2.3.2.1. Resilient seated per AWWA C509 or C515.

2.3.2.2. Provide for buried service and above-grade as approved by Utility Operator.

2.3.2.3. Acceptable manufacturers:

2.3.2.3.1. Clow

2.3.2.3.2. Kennedy

2.3.2.3.3. Mueller

2.3.3. Swing and Swing-Flex Check Valves:

2.3.3.1. Integral flanged joint ends per ANSI B16.1 Class 125.

2.3.3.2. Provide check valves for all pump discharges and as identified by Utility Operator.

2.3.3.3. Acceptable manufacturers:

2.3.3.4. Kennedy.

2.3.3.5. GA Industries.

2.3.3.6. Milliken.

2.3.3.7. Val-Matic (swing-flex).

2.3.4. Silent Check Valves:

2.3.4.1. Globe style with flanged joint ends.

2.3.4.2. Provide check valves for all pump discharges and as identified by Utility Operator.

2.3.4.3. Silent check valves shall not be used for applications where solids are present such as raw water or sludge.

2.3.4.4. Acceptable manufacturers:

2.3.4.4.1. APCO.

2.3.4.4.2. GA Industries.

2.3.4.4.3. Val-Matic.

2.3.4.4.4. Milliken.

2.3.5. Air Release and Combination Air/Vacuum Release Valves:

2.3.5.1. Shall meet the full requirements of AWWA C512.

2.3.5.2. Provide at intermediate and global high points, at locations to prevent vacuum conditions, and as identified by Utility Operator.

2.3.5.3. Acceptable manufacturers:

2.3.5.3.1. APCO.

2.3.5.3.2. GA Industries.

2.3.5.3.3. Val-Matic.

2.3.6. Valve Actuators:

2.3.6.1. Electric, motor-driven valve actuators.

2.3.6.2. Acceptable manufacturers:

2.3.6.2.1. Bettis XTE3000 Series.

2.3.6.2.2. AUMA 2000 Series.

~~2.3.6.2.3. Rotorck.~~

2.3.6.3. Pneumatic valve actuators may be allowed with approval by the Utility Operator.

3. Chemical Systems:

3.1. Liquid Chemical Solution Piping:

3.1.1. Ferric sulfate, chlorine solution, fluoride:

3.1.1.1. Schedule 80 PVC

3.1.1.2. Provide unions at all tank connections.

3.1.1.3. Coordinate with Utility Operator for double-walled piping requirements and locations.

3.1.2. CO₂ gas piping:

3.1.2.1. 316L SS.

3.1.3. CO₂ solution piping:

3.1.3.1. Schedule 80 PVC or 316L SS.

3.1.4. Gas chlorine system materials of construction per the Water Plant's Process Safety Management Risk Management Plan.

3.1.5. Ball Valves:

3.1.5.1. Material of construction: PVC.

3.1.5.2. Valve ends shall be Full/True Union.

3.2. Liquid Chemical Feed Pumps:

3.2.1. Diaphragm metering type pump with 4-20 mA input.

3.2.2. Acceptable Manufacturers:

3.2.2.1. Grundfos DDA with E-box.

~~3.2.2.2. ProMinent.~~

3.3. Chemical Scales:

3.3.1. Minimum of four load cells.

3.3.2. SS platform.

3.3.3. 4-20 mA output

3.3.4. Accuracy shall be within 1% of full scale

3.3.5. Acceptable Manufacturers:

3.3.5.1. Mettler Toledo

~~3.3.5.2.~~ Rice Lake

~~3.3.5.2.~~ ~~3.3.5.3.~~ Force Flow

3.4. Chemical Storage:

3.4.1. A secondary containment curb with a minimum volume of 110% of the largest tank shall be provided.

3.4.2. Double-walled tanks are not acceptable.

4. Pumps:

4.1. River intake pumps shall be vertical turbine pumps.

4.1.1. Acceptable Manufacturers:

4.1.1.1. Flowserve

4.1.1.2. Fairbanks

4.1.1.3. Layne and Bowler, Inc.

4.1.1.4. Floway

4.1.1.5. Peerless

4.2. High service, filter backwash, and CT tank transfer pumps shall be horizontal split case centrifugal pumps:

4.2.1. Acceptable Manufacturers:

4.2.1.1. Peerless

4.2.1.2. Paco

4.2.1.3. Flygt

4.2.1.4. Crane Deming

4.2.1.5. Fairbanks

4.2.1.6. Flowserve

4.3. Reverse Osmosis Pumps:

4.3.1. Acceptable Manufacturers:

4.3.1.1. Goulds Pumps Match existing.

4.4. Motors:

4.4.1. Shall be inverter duty, suitable for use with a variable frequency drive.

4.4.2. TEFC.

4.4.3. Premium efficiency design.

4.4.4. 1.15 service factor.

4.4.5. Manufacturer shall have a service center within 150 miles of the Water Plant.

5. Water Tanks and Towers:

5.1. Cleaning, surface preparation, environmental conditions, coating system and inspection services must be approved by Utility Operator.

6. Well Rehabilitation:

6.1. Well rehabilitation shall be in accordance with *Recommended Standards for Water Works* (Ten State Standards), 2012 edition.

~~6.1.6.2.~~ Must meet Iowa DNR standards of compliance.

7. Identification/Labeling Convention:

7.1. Match current Water Plant tag naming as approved by Utility Operator.

7.2. Use color coding, flow arrows and fluid names in accordance with the latest edition of ANSI/ASME A13.1.

7.3. Use a combination of Ten States and UI Color Coding.

7.4. UI has additional pipe types listed compared to Ten States as follows (Ten States takes precedence if conflicting):

7.4.1. An additional color for softened and recarbonated water – very light blue

7.4.2. An additional color for carbon dioxide - white with a green stripe

7.4.3. An additional color for steam – orange with white band

7.4.4. An additional color for condensate – orange with blue band

8. Instrumentation (manufacturers shown to show level of quality and to provide consistency within the plant):

8.1. Turbidimeters:

8.1.1. Acceptable Manufacturers:

8.1.1.1. Hach. Unless approved by Utility Operator.

8.2. Chlorine Analyzers:

- 8.2.1. Acceptable Manufacturers:
 - 8.2.1.1. Hach.
- 8.3. Ultrasonic Level Measuring System:
 - 8.3.1. Acceptable Manufacturers:
 - 8.3.1.1. Emerson Rosemount.
- 8.4. Pressure Transmitters:
 - 8.4.1. Acceptable Manufacturers:
 - 8.4.1.1. Emerson Rosemount.
- 8.5. Orifice Plate Flow Meters:
 - 8.5.1. Acceptable Manufacturer:
 - 8.5.1.1. Emerson Rosemount.
- 8.6. Limit Switch:
 - 8.6.1. Acceptable Manufacturers:
 - 8.6.1.1. Honeywell.
- 8.7. Ultrasonic Media Level, Media Expansion and Backwash Turbidity Instrument:
 - 8.7.1. Entech Design FilterSmart Media Expansion and Backwash Turbidity Analyzer.
- 9. Controls and Electrical:
 - 9.1. All controls shall be capable of being integrated into the existing GE Cimplicity plant SCADA system for monitoring and control.
 - 9.2. The Utility Operator will contract directly with their preferred SCADA programmer (Frank Painter, Procom Systems).
 - 9.3. PLC:
 - 9.3.1. Acceptable Manufacturers:
 - 9.3.1.1. [Emerson PACGE](#).
 - 9.4. HMI:
 - 9.4.1. Industrial computer.
 - 9.4.2. Acceptable Manufacturers:

9.4.2.1. Neusys Technology.

9.4.3. Touchscreen monitor.

9.4.4. Acceptable Manufacturers:

9.4.4.1. Hope Industrial Systems.

9.5. Enclosures:

9.5.1. UL-508A.

9.6. Variable Frequency Drives:

9.6.1. Four quadrants.

9.6.2. Power loss ride-through functionality.

9.6.3. Acceptable Manufacturers:

~~9.6.3.1.~~ [Emerson PAC unless approved by Utility Operator.](#)

~~9.6.3.1.~~~~9.6.3.2.~~ Toshiba.

~~9.6.3.2.~~~~9.6.3.3.~~ Yaskawa.

[9.7.](#) Raceways shall be suitable for the environment in which they are installed. PVC coated rigid steel conduit shall be used in chemical rooms/areas where corrosive environment exists.

[9.8. Profinet Control Network](#)

[9.8.1. Fiber](#)

[9.8.1.1. Multimode 50 um](#)

[9.8.2. Patch Panels](#)

[9.8.2.1. Belden MIPP](#)

[9.8.3. Network Switches](#)

~~9.7.~~~~9.8.3.1.~~ [Hirschmann RS40 Managed 1 Gig Switch](#)

43) NOT USED

44) POWER AND CHILLED WATER PLANTS

1. Mechanical:

1.1. The following information is provided as a general guideline in establishing Mechanical Engineering design requirements for the University of Iowa Plant Utility Systems at the Main Power Plant, Main Campus chilled water plants, and Oakdale Campus plants.

1.2. Scope of Utility Plant Design Guidelines and Standards: The utility plant systems include all equipment, piping, and auxiliaries within the limits of each of the utility plants on the Main Campus and Oakdale Campus. For utility piping distributed throughout the campus in utility tunnels or direct buried, refer to specific utility distribution requirements.

1.3. Identification:

1.3.1. The Design Professional will clearly indicate the required wording of all labels.

1.3.2. Specify equipment, piping, instrument, and valve labels on all systems

1.3.3. Piping labels shall identify system (i.e., high-pressure steam, low-pressure steam, chilled water supply and return, condenser water supply and return, hot water supply and return, potable water supply, etc.), directional flow arrows, and non-asbestos-based insulation.

1.3.4. Color and lettering shall be in accordance with ASME A13.1.

1.3.5. Maximum spacing of piping system labels is 30 feet in all plants.

1.3.6. Unique tag numbers shall be given for each valve, instrument, and control device installed. Tagging for main valves is identified on the Drawings. Coordinate small bore valves not shown on Drawings with plant's numbering system.

1.4. Utility Plant Piping Systems:

1.4.1. General:

1.4.1.1. The University of Iowa utility plant piping and valve standards cover piping, fittings, valves, insulation, and accessories for process piping systems.

1.4.1.2. Utility plant piping systems shall comply with ASME Power Piping Code, ASME B31.1 and appendices, and where applicable ASME "Boiler and Pressure Vessel Code." All pipe supports shall comply with ANSI/MSS SP-58 and MSS SP-69.

1.4.1.3. Large bore piping is defined as piping detail routed on Drawings, generally 2 ½" and larger in diameter unless indicated otherwise.

1.4.1.4. Small bore piping is defined as piping not detail routed on Drawings, generally 2" and smaller in diameter. Small bore piping is typically field routed based upon requirements of Piping and Instrumentation Diagrams (PIDs) unless indicated otherwise. In congested areas of the utility plants, it is often required to detail route small bore piping.

- 1.4.1.5. Use long-radius fittings except where space limitations require use of short-radius fittings and at the discretion of the Utility Operator and Design Professional. This determination will be made on a Project-by-Project basis. Mitering of pipes and notching pipes to form tees is not acceptable.
- 1.4.1.6. Instrumentation and control piping shall be provided for the service and pressure characteristics of the systems to which they are connected. Requirements of piping Specifications shall apply from main piping line through first isolation (root) valve on instrumentation taps, instrument air connections, test ports, and other piping taps.
- 1.4.1.7. Design Professional will design pipe supports, anchors, flexible couplings, and expansion joints for all piping systems.
- 1.4.1.8. System design: Design of pipe routing will be such that valves can safely be accessed from a standing position on the floor by getting the valves out from in/under/behind other piping. Where not possible, a combination of strategies of routing and platforms may be used. This includes any equipment that require hands-on maintenance--like meter sets, trap stations, PRVs, CW interfaces, control valves, relief vent valves, etc.

1.4.2. Utility Plant Piping, Valve, and Insulation Standard Specifications

- 1.4.2.1. The pressure ratings and materials specified represent minimum acceptable standards for piping systems. The piping systems shall be suitable for the services specified and intended. Each piping system shall be coordinated to function as a unit.
- 1.4.2.2. Piping, joints, fittings, and valves for utility and auxiliary systems at the Main Power Plant shall be in accordance with the University of Iowa Main Power Plant (MPP) Piping and Valve Standard Specifications. For a list of MPP utility and auxiliary systems, the associated design and operating conditions, and each associated piping and valve Specification, refer to "University of Iowa Main Power Plant (MPP) Piping and Valve Standard Specifications" within the Appendix.
- 1.4.2.3. Piping, joints, fittings, and valves for utility and auxiliary systems at the Main Campus chilled water plants shall be in accordance with the University of Iowa Chilled Water Plant Piping and Valve Standard Specifications. For a list of chilled water plant utility and auxiliary systems, the associated design and operating conditions, and each associated piping and valve Specification, refer to "University of Iowa Chilled Water Plant Piping and Valve Standard Specifications" within the Appendix.
- 1.4.2.4. Piping, joints, fittings, and valves for utility and auxiliary systems at the Oakdale Campus utility plants shall be in accordance with the University of Iowa Oakdale Campus Utility Plant Piping and Valve Standard Specifications. For a list of chilled water plant utility and auxiliary systems, the associated design and operating conditions, and each associated piping and valve Specification, refer to "University of Iowa Oakdale Campus Utility Plant Piping and Valve Standard Specifications" within the Appendix.

- 1.4.2.5. Where multiple material specifications (i.e., carbon steel, stainless steel, ductile iron, etc.) are acceptable for a given utility system within the Piping and Valve Standard Specifications, Design Professional shall select appropriate specification to meet the needs of the project (interior versus exterior location, design conditions, etc.), in coordination with the Utility Operator's Representative.
- 1.4.2.6. Threaded piping and valve connections shall only be allowed where required for equipment or instrumentation connections.
- 1.4.2.7. Threaded connections shall not be installed on stainless steel piping systems unless specifically allowed by the Utility Operator.
- 1.4.2.8. All valves shall operate with 50 pounds or less rim pull force to operate the valve under full design pressure and temperature and under ambient conditions.
- 1.4.2.9. Utility plant insulation and jacketing systems at ALL utility plants shall be in accordance with the University of Iowa Insulation Standard Specifications. Refer to "University of Iowa Insulation Standard Specifications" within the Appendix.

2. Central Chilled Water Plants:

2.1. General

2.1.1. Piping:

2.1.1.1. Piping systems shall be designed in accordance with the latest edition of ASHRAE Handbook – Fundamentals.

2.1.1.2. For pipe sizing, the design water velocity shall not exceed 10 feet/second within chilled water plants and the maximum design pressure drop shall not exceed 4 feet/100 feet of equivalent pipe length.

~~2.1.1.3. When possible, locate automated valves, manual valve, instrument taps, flow element, vent, and drain valves accessible from operating floor, platforms, or catwalks.~~

2.1.2. Water-cooled system shall use chilled water. The use of once-through cooling of any equipment is prohibited.

2.1.3. Chilled water quality is the responsibility of both the plant and building systems. New building system chilled water piping shall be cleaned in coordination with [Utility Operator](#) chilled water plant operations protocol.

2.2. Site Environmental Conditions

2.2.1. Operating Floor Elevation:

2.2.1.1. Chilled Water Plant 1:

2.2.1.1.1. Plant datum: 115'.

2.2.1.1.2. Elevation above mean sea level: 703.27'.

2.2.1.2. Chilled Water Plant 2 (West):

2.2.1.2.1. Plant datum: 115’.

2.2.1.2.2. Elevation above mean sea level: 703.27’.

2.2.1.3. Newton Road Ramp:

2.2.1.3.1. Elevation above mean sea level: 678.00.

2.2.1.4. North Campus Parking and Chilled Water Facility:

2.2.1.4.1. Plant datum: 86’-6”.

2.2.1.4.2. Elevation above mean sea level: 674’-9”.

CONDITION	PLANT
Mean barometric pressure	28.99 in Hg
Maximum outdoor dry bulb temperature	93.0°F
Maximum outdoor wet bulb temperature	78.0°F
Relative humidity	25 to 100%
Minimum outdoor dry bulb temperature	-11°F
Maximum plant interior temperature	104°F
Minimum plant interior temperature	65°F

2.3. Chillers

2.3.1. Design:

2.3.1.1. Chillers shall allow variable chilled water flow through the evaporator in a variable-primary pumping configuration.

2.3.1.2. Chiller selection shall be based on meeting full load capacity with a leaving water temperature of 42.0°F for chilled water ΔT range 9 to 20°F.

2.3.1.3. Evaluate the total cost of ownership of equipping the unit with steam verses electric primary driver.

2.3.1.4. Evaluate the total cost of ownership of equipping the unit with constant speed verses variable speed compressors.

2.3.1.5. Evaluate the requirements for low load operation including optional equipment such as hot gas bypass.

2.3.1.6. Evaluate the requirements for automatic tube cleaning systems.

2.3.1.7. Determine the need for working platforms to access all parts of the machine needed for regular maintenance. Platforms shall be considered for lubricating compressors and motors, motor water coolers, refrigerant safety valves, or any other required chiller system component not accessible from the chiller plant floor.

2.3.1.8. Include provisions for replacing compressor, motor water coolers, and motors.

2.3.1.9. Include ability to transfer and store refrigerant to and from chiller.

2.3.2. Evaporator and Condenser:

2.3.2.1. Design, construct, test, and stamp refrigerant and water side of evaporator in accordance with ASME Boiler and Pressure Vessel Code Section VIII, Division 1.

2.3.2.2. Tubes shall be seamless copper alloy with enhanced surface a minimum outside diameter of 3/4", minimum wall thickness of 0.035" on rolled tube sheets, and a fouling factor of:

2.3.2.2.1. Evaporator: 0.00010 Hr-Ft²-°F/Btu (overall heat transfer coefficient).

2.3.2.2.2. Condenser: 0.00025 Hr-Ft²-°F/Btu (overall heat transfer coefficient).

2.3.2.3. Water velocities through tubes shall not exceed 12 fps and be no less than 3 fps.

2.3.2.4. Water boxes shall be marine type welded steel design with hinged access covers. The water boxes shall permit access to tubes for inspection and cleaning without removal of piping nozzle connections.

2.3.2.5. Provide re-seating type and pressure relief valve in accordance with ASHRAE Standard 15 design for chillers using a high-pressure refrigerant.

2.3.3. Compressors:

2.3.3.1. Centrifugal compressors shall be single- or multi-stage, force-fed oil lubricated, speed increasing.

2.3.3.2. Bearings:

2.3.3.2.1. Provide oil-lubricated bearing for compressor(s) and gearbox (if used) with temperature gauges to indicate temperature of bearings or lubricating oil.

2.3.3.2.2. Bearings shall be designed for a minimum life expectancy of 200,000 hours or life of the machine.

2.3.3.2.3. Open-drive motor design: Insert-type, oil-lubricated, journal bearings designed for radial and thrust load and fabricated of aluminum alloy, precision bored and axially grooved.

2.3.3.2.4. Hermetic motor design: Self-aligning, pressure-lubricated, split-sleeve, Babbitt-lined journal bearings.

2.3.3.3. Chiller shall be capable of modulation from 100% to 10% of full unit rated capacity without unstable compressor operation.

2.3.4. Motors:

- 2.3.4.1. Motors shall be totally enclosed water-to-air-cooled (TEWAC), semi-hermetic, or hermetic squirrel cage induction.
- 2.3.4.2. For TEWAC motors, chilled water return from the distribution system shall be used as the cooling source. Condenser water shall not be used.
- 2.3.4.3. Motors shall be equipped with oil lubricated sleeve bearings.
- 2.3.4.4. Refer to "University of Iowa Utility Plant Electrical Systems" for additional requirements.

2.3.5. Controls:

- 2.3.5.1. Controller shall be capable of operating chiller without nuisance trips on low water temperature with a chilled water outlet temperature as low as 36°F.
- 2.3.5.2. Provide ability to automatic restart unit to normal operation after a power failure.
- 2.3.5.3. Include necessary hardware and software for communication with plant process control system to allow permissive control, monitoring, and trending of chiller operation and parameters. Communication protocol shall be a Modbus TCP standard open protocol.

2.3.6. Source Quality Control:

- 2.3.6.1. Chiller shall undergo a series of standard factory shop tests to confirm the unit is leak tight. Tests shall be in accordance with AHRI Standard 550/590, ASHRAE Standard 15, and Seller's standard quality control/quality assurance tests. Seller shall provide all equipment, piping, valves, instruments, and accessories necessary to complete testing.
- 2.3.6.2. Perform factory performance test to demonstrate each chiller meets the specified performance guarantees.
- 2.3.6.3. Performance testing shall be completed in accordance with methodology outlined in AHRI Standard 550/590.
- 2.3.6.4. Tests shall confirm all performance guarantees, including design capacity, minimum capacity, full load efficiency, and NPLV.
- 2.3.6.5. Conduct part load testing at 10% and 50% of design capacity. Part load shall be simulated through adjustment to the chilled water supply (outlet) temperature. Testing shall be repeated for condenser water temperatures of 85°F and 55°F.
- 2.3.6.6. Testing shall compensate for chilled water return (inlet) temperature less than design by increasing chilled water flow rate through the evaporator.

2.4. Refrigerant Transfer Unit and Receivers:

- 2.4.1. Refrigerant transfer unit and pump-out receiver shall be in accordance with AHRI 740.

- 2.4.2. Receiver shall be horizontal tank constructed of welded carbon steel plate and shall be in accordance with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for working pressure of refrigerant.
 - 2.4.3. Receiver shall be capable of storing entire charge of refrigerant from supplied chiller when 80% filled at 122°F.
 - 2.4.4. Pressure relief valves shall be re-seating type in accordance with ASHRAE Standard 15 design for chillers using a high-pressure refrigerant.
 - 2.4.5. Water cooled transfers units shall utilize chilled water as the primary source of cooling. Provide provisions for domestic water as backup when chilled water is not available. If domestic water is utilized, consider piping water to cooling tower rather than sending to sanitary sewer.
- 2.5. Free Cooling Heat Exchangers:
- 2.5.1. The free cooling circuit shall utilize a heat exchanger to transfer heat from chilled water to condenser water without a refrigerant loop during low ambient wet-bulb temperature conditions.
 - 2.5.2. Design:
 - 2.5.2.1. Evaluate the total cost of ownership of equipping the plant with free cooling system.
 - 2.5.2.2. When possible, size plate and frame heat exchanger to utilize plant chilled water distribution and condenser water pumps.
 - 2.5.3. Heat Exchanger:
 - 2.5.3.1. Utilize plate and frame heat exchanger, 316L stainless steel.
 - 2.5.3.2. Provide strainers on condenser water supply.
 - 2.5.3.3. Selection shall be based on:
 - 2.5.3.3.1. Condenser water entering temperature of 40.0°F.
 - 2.5.3.3.2. Condenser water leaving temperature of 49.0°F.
 - 2.5.3.3.3. Approach temperature of 4.0°F.
 - 2.5.3.3.4. Excess surface area to account for system fouling: 20%.
- 2.6. Chilled Water Piping and Pumps:
- 2.6.1. Design:
 - 2.6.1.1. Chilled water piping systems shall be variable-primary pumping scheme. Chilled water distribution pumps shall be equipped with variable frequency drives. These pumps shall pump chilled water return from campus through the chillers and the campus distribution system on the Main Campus.

2.6.1.2. Systems shall be configured with commonly headered chilled water distribution pumps and chillers piped in parallel such that any pump can serve any chiller.

2.6.1.3. Design to include a standby chilled water distribution pump. (N+1 redundancy).

2.6.1.4. Size piping based on chilled water ΔT of 12°F with operating chilled water ΔT range from 9 to 20°F.

2.6.1.5. Include minimum flow bypass valve between chilled water supply and chilled water return from campus.

2.6.1.6. Include total plant chilled water recirculation to allow the chemically treated, chilled water to be circulated through the plant when not in service.

2.6.1.7. Include provisions to utilize minimum flow bypass and chilled water recirculation to precool chilled water internal to the plant prior to connecting to the chilled water distribution system.

2.6.2. Chilled water distribution pumps:

2.6.2.1. Pumps shall be horizontal, split case, centrifugal pumps.

2.6.2.2. Equip units with John Crane 5610 Single Cartridge seals.

2.6.2.3. Pumps shall employ an API Plan 11 for seal flushing.

2.6.2.4. Equip units with spacer drop-out type coupling to allow disassembly and removal of bearing housings and mechanical seals without removing motor.

2.6.2.5. Both pumps and motors shall utilize oil-lubricated bearings. Bearings shall be designed for a minimum life expectancy of 200,000 hours or life of the machine.

2.6.2.6. Design motors for inverter duty operation with variable frequency drive starters and squirrel cage induction type and shall be non-overloading at any point on pump curve without using motor's service factor.

2.6.2.7. Motors shall be totally enclosed fan cooled (TEFC).

2.6.2.8. Refer to "University of Iowa Utility Plant Electrical Systems" for additional requirements.

2.6.2.9. Design pump base such that the pump, coupling, and motor do not overhang base.

2.7. Cooling Towers

2.7.1. Design:

2.7.1.1. Thermal criteria:

2.7.1.1.1. Entering condenser water temperature:

2.7.1.1.1.1. Electric chiller: 95.0 °F.

2.7.1.1.1.2. Steam turbine with surface condenser: 101.5 °F.

2.7.1.1.2. Leaving condenser water temperature: 85.0 °F.

2.7.1.1.3. Design wet bulb temperature: 80.0 °F.

2.7.1.1.4. Maximum drift as percent of flow rate: 0.0005%.

2.7.1.2. Noise criteria:

Frequency										
Distance*	31.5	63	125	250	500	1000	2000	4000	8000	Overall dBA
50 ft	63.0	63.2	66.0	66.9	62.3	67.5	62.5	61.1	61.0	70.8
150 ft	53.4	53.6	56.5	57.7	52.7	57.9	52.9	51.6	51.5	63.1

Distance shall be measured from bottom edge of air inlets facing outwards.

2.7.1.3. Cooling tower structural, components, and anchorage shall be designed to meet the requirements of the 2015 International Building Code, ASCE 7-05, all CTI Guidelines or the following requirements, whichever are more stringent:

2.7.1.3.1. Snow load: Structures, along with all components, shall be designed for snow load in accordance with ASCE 7-05. Parameters for snow load calculations are as follows:

2.7.1.3.1.1. Ground snow load (p_g): 30 psf.

2.7.1.3.1.2. Importance factor (I): 1.10.

2.7.1.3.1.3. Thermal factor (C_t): 1.2.

2.7.1.3.1.4. Exposure factor (C_e): 1.10.

2.7.1.3.2. Seismic load: Structures, along with all components, shall be designed for seismic loads in accordance with ASCE 7-05. Parameters for seismic loading calculations are as follows:

2.7.1.3.2.1. Seismic design category: B.

2.7.1.3.2.2. Site class: D.

2.7.1.3.2.3. Importance factor (I): 1.25.

2.7.1.3.3. Live loads:

2.7.1.3.3.1. Maintenance platforms, walkways, and ladders shall be

designed for a minimum live load of 50 psf and a 300-pound concentrated load.

2.7.1.3.3.2. Fill shall be designed for a minimum live load of 50 psf and a 300-pound concentrated load.

2.7.1.3.3.3. Handrails and guardrails shall be designed for a minimum 200-pound concentrated load applied in any direction at any point along the top rail and be in accordance with OSHA guidelines.

2.7.1.3.4. Dead loads:

2.7.1.3.4.1. Fill and fill supports shall be designed for a dead weight equal to the dry weight of fill, water hold-up weight, and a 15% allowance for clogging.

2.7.1.3.4.2. Drift eliminators and supports shall be designed for a dead weight equal to the dry weight of drift eliminators and the weight of the water eliminated from air discharge.

2.7.1.3.5. All access equipment (platforms, ladders, guard rails) shall be in accordance with OSHA guidelines.

2.7.1.4. Cooling tower shall meet the requirements of CTI STD-203.

2.7.1.5. Thermal performance and capacity in accordance with CTI ATC-105.

2.7.1.6. Performance ratings: Required performance not less than prescribed by ASHRAE 90.1 when tested in accordance with CTI ATC-105.

2.7.1.7. Cooling tower shall be designed to provide adequate maintenance spacing between the top of the fill and the drift eliminators. The maintenance spacing shall allow for fill and drift eliminator maintenance as well as maintenance personnel access.

2.7.1.8. Cooling towers shall be designed with an internal access ladder from the internal walkway to an elevated fiberglass platform for access to mechanical equipment.

2.7.2. Cooling tower fans:

2.7.2.1. Cooling tower fans shall be adjustable pitch, multi-blade, axial flow, propeller type selected to deliver the design air flow at maximum efficiency and provide long life when handling saturated air at high velocities.

2.7.2.2. Fan shall consist of an odd number of blades with the minimum number of five (5) blades.

2.7.2.3. The fan blade material shall be FRP with vinyl or epoxy resin, in accordance with ASTM D1201, Type 5.

2.7.2.4. Fan hub shall be constructed of SAE 1020, hot-dipped galvanized steel per ASTM A123/A123M.

2.7.2.5. An air seal disc shall be provided to prevent recirculation of the air at the fan hub.

2.7.2.6. Cooling tower fan shall be statically, and moment balanced and have a maximum tip speed of 12,000 feet per minute.

2.7.2.7. Fan shall be capable of operating in reverse rotation for up to 50% of full speed, maximum duration of 1 hour.

2.7.2.8. Fan shall be statically and dynamically balanced and each blade shall be individually adjustable and replaceable.

2.7.2.9. Fan hardware shall be Series 300 stainless steel.

2.7.3. Gear speed reducers:

2.7.3.1. Fan drive shall be geared, right angle, speed-reduction drive in accordance with AGMA standards for Class II 24-hour continuous duty with shock load, for cooling tower service rated in accordance with CTI STD-111 or at 2.0 times motor rated horsepower, whichever is more stringent.

2.7.3.2. Gear speed reducers containing double reduction gearing consisting of herringbone and bevel gears shall be rated not less than 2.0 times motor horsepower and have a ratio of 12 to 1.

2.7.3.3. Gear speed reducers shall be rigidly mounted to maintain permanent alignment. Mounting to be capable of withstanding shock loading due to application of brakes and reversing of fans.

2.7.3.4. Gear speed reducers shall be capable of operating in reverse rotation.

2.7.3.5. Gears shall be spiral, helical bevel, or herringbone, machine cut from alloy steel, heat treated, and lapped.

2.7.3.6. Bearings shall be ball or tapered roller, for radial and thrust load in accordance with ABMA 9 or ABMA 11 for a minimum L-10 life expectancy of 80,000 hours.

2.7.3.7. Lubrication of oil bath type suitable for continuous operation in forward or reverse rotation.

2.7.3.8. Casing of cast iron per ASTM A48, Class 20, epoxy coated.

2.7.3.9. Pipe lubrication fill and vent lines to outside of fan stack adjacent to the electric motor for convenient access to check oil level and fill and drain gear case without shutting down cooling tower cell.

2.7.3.10. Lubrication and vent piping shall be stainless steel and adequately supported to prevent vibration.

2.7.3.11. Provide external oil filters and threaded Series 300 stainless steel oil fill, sight glass, drain, and vent piping with lubrication system.

2.7.4. Drive shaft:

2.7.4.1. Power shall be transmitted from the motor to the speed reducer by means of a full-floating, composite, tubular drive shaft center member supported by non-lubricated flexible stainless-steel hubs at both ends.

2.7.4.2. The shaft and couplings shall be selected for cooling tower service with a minimum service factor of 2.0.

2.7.4.3. Shaft seals shall be capable of preventing the entrance of water under all operating and non-operating conditions.

2.7.4.4. Provide with Type 316 stainless steel driveshaft guards at gear speed reducer end.

2.7.4.5. Provide 300 series stainless steel flexible, non-lubricated, coupling with 300 series stainless steel attaching hardware.

2.7.5. Motor:

2.7.5.1. Locate motor outside fan shroud.

2.7.5.2. Refer to "University of Iowa Utility Plant Electrical Systems" for additional requirements.

2.7.6. Heat Transfer Media:

2.7.6.1. Fill:

2.7.6.1.1. Cooling tower cells used in year-round operation and flow rates above 6,000 gpm shall utilize traditional, terra cotta clay cell blocks.

2.7.6.1.2. Cooling tower cells used during cooling season shall utilize rigid, UV-protected, cellular-film-type PVC in accordance with ASTM D3679 and ASTM D1784, Type 1, Grade 1. Fill shall be clog resistant with a minimum thickness of 15 mil and a flute height of $\frac{3}{4}$ ".

2.7.6.2. Fill shall be designed for a maximum temperature of 140°F.

2.7.6.3. Fill shall have a flame spread of 15 or less in accordance with ASTM E84.

2.7.6.4. Fill shall be designed for ease of removal, in sections, piece, or grids.

2.7.6.5. Fill shall be supported as required to accommodate construction loads and operational loads as well as potential ice loads.

2.7.6.6. Fill shall be designed to accommodate independently supported fiberglass walkable grating for personnel access to tower internal components.

2.7.7. Drift Eliminators:

2.7.7.1. Each cooling tower shell shall include drift eliminators designed and constructed to remove the maximum free water particles while have a minimum resistance to airflow.

2.7.7.2. Drift eliminators shall be cellular, 3 pass and constructed of impact-resistant, UV-protected PVC, in accordance with ASTM D1784 and a minimum thickness of 15 mils with 25 mil stiffeners.

2.7.7.3. Drift eliminators shall have a flame spread of 25 or less in accordance with ASTM E84.

2.7.7.4. Drift eliminators shall include a UV inhibitor in accordance with CTI STD-136.

2.7.7.5. Drift eliminator modules shall be capable of nesting with adjacent modules to provide seamless drift removal.

2.7.7.6. Drift eliminators shall be supported as required to accommodate snow loads, construction loads, operational loads, and with a maximum span between supports of 3'-0".

2.7.7.7. Drift eliminators shall be designed to accommodate independently supported fiberglass walkable grating for personnel access to tower internal components.

2.7.8. Hot water distribution system:

2.7.8.1. Hot water shall be distributed to the fill in each cooling tower via a headered piping system with laterals, branch lines, and nozzles installed over the fill and below the drift eliminators.

2.7.8.2. Hot water distribution system shall be self-draining and comprised of low-pressure, non-corrosive Schedule 80 PVC headers, laterals, and branches.

2.7.8.3. Cooling tower inlet connections shall be flanged for ASME Class 150 flat-faced flanges.

2.7.8.4. Provide air vent connection at end of piping header and blind flange cleanouts at the end of headers and branches.

2.7.8.5. Provide full size branch connection with blind flange on bottom side of distribution header (both ends) for flushing of header.

2.7.8.6. Nozzles:

2.7.8.6.1. Water shall be evenly sprayed over the fill media by evenly spaced and sized injection-molded polypropylene spray nozzles. The nozzles shall be non-clog type, removable, down-spray type, having no moving parts or restrictors that promote clogging.

2.7.8.6.2. Nozzles shall be capable of developing a “cyclone effect” or “cone” spray pattern over the fill and shall be located below the header and lateral piping elevation.

2.7.8.6.3. Nozzles shall have a maximum pressure drop of 2.0 psid.

2.7.8.6.4. Nozzles shall have a minimum orifice size of 1” and shall be removable and replaceable.

2.7.8.6.5. Manufacturer: Tower Engineering, Inc. (TEI) Series SFF.

2.7.8.7. Hot water distribution system shall be supported using Series 300 stainless steel supports and hangers.

2.7.8.8. Pipe supports in accordance with standard MSS SP-68 shall be provided.

2.7.9. Access and Safety:

2.7.9.1. Provide OSHA-compliant stainless-steel ladder with non-slip tread to access drift eliminator level from fan deck (at access hatch) for each cooling tower. Provide a landing platform at bottom of ladder a minimum of 6 feet by 3 feet.

2.7.9.2. Provide OSHA-compliant stainless-steel ladder with non-slip tread to access gear speed reducer island internal to the tower from drift eliminator level. Coordinate location with walkable grating.

2.7.9.3. Provide removable sections of drift eliminators to allow access to the hot water distribution system and nozzles from top of fill.

2.7.9.4. Cooling tower interior walkable grating:

2.7.9.4.1. Design in accordance with OSHA regulations.

2.7.9.4.2. Provide 24” wide fiberglass or polypropylene walkable grating on top of PVC drift eliminators and on top of PVC fill.

2.7.9.4.2.1. At fill level, provide two (2) separate walkways that traverse the entire width/length of the cooling tower and are perpendicular to each other. Walkway shall be moveable to allow Utility Operator to place walkway sections at any location on top of the fill.

2.7.9.4.2.2. At drift eliminator level, sufficient walkway shall be provided to access gear-speed-reducer island from ladder platform and to allow for routine maintenance without damage to drift eliminators or fill.

2.7.9.4.3. Drift eliminator platforms and walkways shall be independently supported from the drift eliminators themselves.

2.7.9.4.4. Designed for non-skid walking surface with 2" x 2" openings for maximum water flow.

2.7.9.5. All hardware, nuts, bolts, and washers shall be Series 300 stainless steel unless otherwise noted.

2.8. Condenser Water Piping and Pumps:

2.8.1. Design:

2.8.1.1. Condenser water piping systems shall be constant flow through chillers.

2.8.1.2. Piping system shall be arranged such that the condenser water pumps are located at a lower elevation than the cooling tower basins to exceed the net positive suction head required for the condenser water pumps.

2.8.1.3. Systems shall be configured with commonly headered condenser water pumps with chillers piped in parallel and cooling tower piped in parallel such that any pump can serve any chiller and any cooling tower.

2.8.1.4. Design to include a standby condenser water pump. (N+1 redundancy).

2.8.1.5. Include in-plant condenser water recirculation, bypassing the cooling towers, to allow the chemically treated, chilled water to be circulated through the plant when not in service.

2.8.1.6. Include provisions to utilize recirculation system to preheat condenser water internal to the plant prior to connecting to flowing over the cooling towers when starting chillers during low ambient conditions.

2.8.2. Piping:

2.8.2.1. Condenser water piping located inside the plant shall be carbon steel or stainless steel (where needed or warranted). Refer to "University of Iowa Chilled Water Plant Piping and Valve Standard Specifications" within the Appendix.

2.8.2.2. Condenser water piping located exterior to the plant shall either be ductile iron or stainless steel. Refer to "University of Iowa Chilled Water Plant Piping and Valve Standard Specifications" within the Appendix.

2.8.3. Condenser pumps:

2.8.3.1. Pumps shall be horizontal, split case, centrifugal pumps. Wet wells with vertical turbine pumps may be considered with prior permission from Utilities Operator.

2.8.3.2. Equip units with John Crane 5610 Single Cartridge seals.

2.8.3.3. Pumps shall employ an API Plan 32 for seal flushing.

2.8.3.4. Equip units with spacer drop-out type coupling to allow disassembly and removal of bearing housings and mechanical seals without removing motor.

2.8.3.5. Both pumps and motors shall utilize oil-lubricated bearings. Bearings shall be designed for a minimum life expectancy of 200,000 hours or life of the machine.

2.8.3.6. Motors: Refer to "University of Iowa Utility Plant Electrical Systems" for additional requirements.

2.8.3.7. Design pump base such that the pump, coupling, and motor do not overhang base.

2.9. Electrical System: Refer to "University of Iowa Utility Plant Electrical Systems" for requirements.

2.10. Process Control System

2.10.1. Design:

2.10.1.1. Develop conceptual network diagrams for discussion with Utilities Operator's Chilled Water I&C staff as well as Meters and Controls staff. Chilled Water I&C staff will review I/O partitioning, control functions, HMI graphics including alarming, archiving, and trending. Meters and Controls staff will focus on the communications networks between process controllers, Human-Machine Interfaces (HMI), and existing Utility network.

2.10.1.2. Partition I/O point to by equipment groups rather than equipment types to minimize a I/O module failure interrupting operation of like equipment. For example, an equipment group may be Chiller 1, Chilled Water Distribution Pump 1, Cooling Tower 1, and Condenser Water Pump 1.

2.10.1.3. Include minimum of 20 percent installed spare I/O point of each type as well as 20 percent space for future expansion in process control panels.

2.10.1.4. Process variables, control outputs, position feedback, control commands, feedback status, and critical alarms shall be hardwired to Process Control System Input/Output modules. Communication interfaces may be utilized to monitor points other than listed above.

2.10.1.5. Communications interfaces shall be Modbus TCP. Alternative protocols shall be discussed with and approved by the Utility Operator.

2.10.1.6. Communications interfaces shall include:

2.10.1.6.1. Chillers.

2.10.1.6.2. Chilled water distribution pumps variable frequency drives.

2.10.1.6.3. Cooling tower fans variable frequency drives.

2.10.1.6.4. Condenser water pump starters.

2.10.1.6.5. Chemical feed controllers and dosing pumps.

2.10.2. Hardware and unconfigured software:

2.10.2.1. Ethernet Switches: Hirschmann Mice.

2.10.2.2. Process Control System Hardware: Emerson (GE) Rx3i process automation controller series.

2.10.2.3. Process Control System HMI Software: GE Cimplicity.

2.11. Refrigerant

2.11.1. System design shall be in accordance with ASHRAE Standard 15 design for chillers using high-pressure refrigerant. The ASHRAE 15 design shall include both chiller equipment design considerations as well as equipment room ventilation requirements.

2.11.2. Owner is required to comply with Title VI of the Clean Air Act relating to ozone depleting substances.

2.11.3. Owner's preference is to use HFC refrigerants for comfort, commercial, and industrial process cooling. Class I refrigerants (CFCs) shall not be allowed.

2.11.4. Venting refrigerant into the atmosphere is prohibited. Provisions for proper handling and disposal of refrigerants shall be made. Design Professional shall coordinate with the Owner.

2.12. Plant HVAC

2.12.1. A minimum ventilation rate of 0.12 CFM per square foot will be maintained for each space within the mechanical room spaces. Where exhaust requirements for equipment, operations, etc. exceed these minimums, the amount of outdoor air will be increased to match the exhaust airflow and maintain space temperature in the building relative to.

2.12.2. Mechanical room design conditions:

2.12.2.1. Summer ventilation shall maintain a minimum of 10°F above ambient based on heat removal of installed equipment.

2.12.2.2. Winter ventilation and heating shall maintain space temperature of 65°F db ± 1°F.

2.12.3. The indoor design conditions of the electrical rooms:

2.12.3.1. Summer:

2.12.3.1.1. Dry Bulb Temperature: 90°F ± 1°F

2.12.3.1.2. Relative Humidity: 50% ± 10%

2.12.3.2. Winter:

2.12.3.2.1. Dry Bulb Temperature: 65°F ± 1°F

2.12.4. Air handling units or steam unit heater are preferred for central plant heating. Electric heating systems shall not be used.

2.12.5. Design plant HVAC systems in accordance with ASHRAE 62.1 General Ventilation standard for support spaces such as offices, conference rooms, restrooms, water quality laboratory, and control room.

3. ELECTRICAL:

3.1. The following information is provided as a general guideline in establishing Electrical Engineering design requirements for the University of Iowa Plant Utility Systems at the Main Power Plant, Main Campus chilled water plants, and Oakdale Campus plants.

3.2. Scope of Utility Plant Design Guidelines and Standards: The utility plant systems include all equipment, conduit, and cabling within the limits of each of the utility plants on the Main Campus and Oakdale Campus. For electrical systems distributed throughout the campus in utility tunnels or direct buried, refer to specific utility distribution requirements.

3.3. Equipment:

3.3.1. New plant main power supplies, distribution equipment, and cabling shall be oversized for future requirements. A minimum of 20 percent spare capacity shall be provided within each breaker panel board. Spare capacity is defined as 20 percent space feeder capacity and 20 percent spare poles within the panel. See specific design requirements under equipment type listed below.

3.3.2. Only UL or equivalent approved equipment shall be specified.

3.3.3. When installing or changing electrical equipment, the Design Professional will evaluate available fault currents and size the ampere interruption capacity accordingly. Equipment interrupting and bracing ratings shall include allowances for future loads. Design Professional will assume future loads are 80% motor loads.

3.3.4. Plant power distribution system standard nominal voltages:

3.3.4.1. 208Y/120V, 3-phase, 4-wire solidly grounded system.

3.3.4.2. 480Y/277V, 3-phase, 4-wire solidly grounded system.

3.3.4.3. 4.16kV, 3-phase, 3-wire solidly grounded system.

3.3.4.4. 13.8kV, 3-phase, 3-wire solidly grounded system.

3.3.4.5. 125VDC, 1-phase, 2-wire ungrounded system.

3.3.4.6. UPS 208Y/120V, 3-phase, 4-wire solidly grounded system.

3.3.5. Motors shall be generally 120V, single phase, 1/4HP and less, 480V, 3-phase, 1/2HP and above. Motors shall be generally supplied from motor control centers, independently mounted starters, panel board, or switchboard source only where approved.

- 3.3.6. Motors 150HP and above shall be provided with low voltage soft starters or variable frequency drives to reduce inrush and system voltage drop.
 - 3.3.7. Motors 250HP and above generally shall be supplied directly from low voltage switchgear feeder breakers.
 - 3.3.8. Provide separate demolition and construction Drawings.
 - 3.3.9. Identify the equipment locations on plan Drawings to coordinate with cable schedules.
 - 3.3.10. Electrical distribution equipment shall not be located in stairwells.
 - 3.3.11. The Design Professional will evaluate anticipated plant loads for potential harmonic design requirements.
 - 3.3.12. Power circuits shall not share neutrals.
 - 3.3.13. Provide lighting and receptacles in all accessible spaces.
 - 3.3.14. Fire alarm and miscellaneous signals shall be in conduit.
 - 3.3.15. Electrical distribution system shall provide electrical redundancy to redundant mechanical process equipment. Generally, identically sized pumps in the same process system shall be served from separate power supplies to prevent single point failure. Design electrical distribution system to avoid single point failure.
 - 3.3.16. Wall mounted electrical equipment shall be supported directly off structural steel, a supplemental steel specifically designed for equipment support or CMU walls. Use free-standing uni-strut style stands for electrical distribution equipment only with specific permission.
- 3.4. Identification:
- 3.4.1. The Design Professional will clearly indicate the required wording of all labels. Wording shall be coordinated with and approved by the Utility Operator.
- 3.5. Arc Flash:
- 3.5.1. Perform arc flash hazard analysis during the design development, schematic design, and construction document phases. Update the analysis as additional details are prepared.
 - 3.5.2. Design system to keep incident energy levels less than 40cal/cm² per particle.
 - 3.5.3. Prepare short circuit calculations and verify withstand and interrupting ratings.
 - 3.5.4. Prepare the system coordination study and coordinate with the supply transformer primary protection.

- 3.5.5. Install hazard labeling on equipment at the end of the Project prior to start-up.
- 3.6. Grounding:
 - 3.6.1. Buried loop is the preferred method for establishing grounding. In new construction, establish grounding through use of concrete reinforcing steel.
 - 3.6.2. Driven grounds shall not be specified where soil conditions consist of rock. In such conditions, use a counterpoise system or another approved alternative.
 - 3.6.3. Water lines, plant steel, and a grounding conductor from existing plant shall be bonded together.
 - 3.6.4. Grounding electrode shall have a resistance to ground between 2 to 5 ohms.
 - 3.6.5. Ground systems shall be connected to the primary power system ground mat serving the facility. Connect plant grounding electrode to grounding conductor(s) embedded in the 15kV duct bank system.
 - 3.6.6. All grounding system conductors shall be copper.
 - 3.6.7. Provide a separate grounding conductor with all circuits.
- 3.7. Lightning Protection:
 - 3.7.1. Lightning protection shall be included for new plants and extensions of existing plant systems when encountered.
 - 3.7.2. Plant lightning protection shall comply with NFPA 780, current edition, for protection of facilities and systems.
 - 3.7.3. Provide UL Lightning protection system in accordance with LPI-175.
- 3.8. Medium Voltage (601 VOLTS – 69k VOLTS)
 - 3.8.1. Design shall clearly route all 13.8kV and 4.16kV conduits.
 - 3.8.2. Provide 5" RGS for all 15kV, 500KCMIL loop cables and 4" RGS for all 15kV, #2AWG feeder cables.
 - 3.8.3. Size and coordinate raceway size for all 4.16kV circuits with Electrical Distribution.
 - 3.8.4. Scope break shall be constructed. Contractor shall provide all conduits, tray, supports, and pull string. Electrical Distribution (Utility Operator) will provide all 5kV and 15kV power cables including termination.
 - 3.8.5. Provide an oversized pull box every three (3) equivalent 90-degree bends in the raceway systems.

- 3.8.6. Provide a minimum of 24" radius on all medium voltage cable conduit systems.
- 3.8.7. Provide OZ/Gedney Type TNS end bells where requested.
- 3.8.8. Raceways:
 - 3.8.8.1. Plant raceway systems should be typically galvanized rigid steel conduit and 20C galvanized steel ladder type cable tray when indoors.
 - 3.8.8.2. Cable tray shall not be installed outdoors unless approved.
 - 3.8.8.3. Use of rigid aluminum conduits is allowed for trade sizes 2" and greater. Aluminum shall not be used underground or in contact with concrete.
 - 3.8.8.4. Full height tray dividers shall be provided to segregate 120VAC from 24VDC and millivolt thermocouple extension wiring.
 - 3.8.8.5. Do not install 480V power in the same tray as instrumentation cabling.
 - 3.8.8.6. Typically, fiber optic network cables will be furnished and terminated by the Meters and Control group. Design shall include the scope for the Contractor to provide the raceway systems, install the Meters and Controls supplied fiber optic cables, and for Meters and Controls to terminate and test the cable.
- 3.8.9. Cabling:
 - 3.8.9.1. Basis of cabling shall match Utility Operator's-ENGINE's Guide Specifications. Discuss with project manager.
 - 3.8.9.2. Design raceway systems to obtain the required cable signal segregation based on signal level.
 - 3.8.9.3. Use as basis of design multiconductor control cables in lieu of individual conductors.
 - 3.8.9.4. Copper network cables shall be installed in conduit or provided as shielded.
 - 3.8.9.5. Redundant UPS and communications cables shall be physically routed separately. Separate the routes to prevent physical single point failure.
 - 3.8.9.6. All redundant power systems shall be installed and tested to be in phase. Testing shall be performed for closed transition switching as required.

3.9. Low Voltage:

3.9.1. Equipment:

3.9.1.1. Design:

3.9.1.1.1. Load centers that are a self-contained enclosure housing primary main breaker, transformer, and integral distribution load center shall not be used. Components shall be kept separate.

3.9.1.1.2. Service entrance equipment shall have a main circuit breaker. Main-Tie-Main switchgear, MCCs, or switchboards shall be provided with main breakers (in addition to upstream feeder breakers) and double tie breakers for isolation and lockout purposes.

3.9.1.1.3. Phase, neutral, and ground buss shall be copper.

3.9.1.1.4. The phase arrangement on 3-phase buss shall be A-B-C from left to right, top to bottom, front to back as viewed from the front of the panels, switchboard, MCCs, and low voltage switchgear.

3.9.1.1.5. Provide a minimum 20 percent spare, usable space in new switchboards, panelboards, and motor control centers.

3.9.1.1.6. In existing plants, new switchboards, panelboards, motor control centers, enclosed switches, circuit breakers, and VFD shall match existing to the greatest extent possible.

3.9.1.1.7. Motors shall have the following requirements:

3.9.1.1.7.1. Voltage: 460V, 60Hz, 3-phase.

3.9.1.1.7.2. Totally enclosed fan cooled (TEFC).

3.9.1.1.7.3. Class F insulation, Class B temperature rise.

3.9.1.1.7.4. Efficiency: Premium efficiency meeting EPACT 1992 standards.

3.9.1.1.7.5. Temperature: 40°C ambient.

3.9.1.1.7.6. Service Factor: 1.15.

3.9.1.1.7.7. Elevation: Less than 3,000 feet above sea level.

3.9.1.1.7.8. Bearings: Lubricated bearings rated L10 with expected life of 200,000 hours.

3.9.1.1.7.9. Built to NEMA MG-1 standards.

3.9.1.1.7.10. Provide electrically insulated non-drive end bearing.

3.9.1.1.8. Motors 250HP and larger shall have copper or copper alloy rotor bars.

3.9.1.1.9. Motors 25HP and larger installed outdoors shall have space heaters to come on when the motor is not running.

3.9.1.1.10. Motors 250HP and larger shall have embedded 100-ohm platinum RTD embedded in the stator. Provide 100-ohm platinum RTDs on each bearing continuously monitored.

3.9.1.1.11. Variable frequency driven motors shall have electrically insulated drive and non-drive end bearings and be provided with Aegis shaft grounding rings.

3.9.1.1.12. Chiller plant motor larger than 200HP shall be provided with oil lubricated sleeve bearings.

3.9.1.1.13. Power plant motors shall be provided with grease lubricated bearings. Motors larger than 300HP shall be oil lubricated sleeve bearings.

3.9.1.1.14. Provide NEMA Type II motor terminal enclosures for motors 300HP and larger.

3.9.1.1.15. Acceptable Manufacturers:

3.9.1.1.15.1. Nidec – US Motors.

3.9.1.1.15.2. Siemens.

3.9.1.1.15.3. TECO-Westinghouse.

3.9.1.1.15.4. ABB.

3.9.1.1.15.5. General-Electric.

3.9.1.2. Switchboards:

3.9.1.2.1. Provide continuous ground bus the full length of the switchboard.

3.9.1.2.2. All switchboards shall have separate neutral and grounding busses.

3.9.1.3. Panelboards:

3.9.1.3.1. Provide continuous ground bus the full length of the panelboard.

3.9.1.3.2. All panelboards shall have separate neutral and grounding busses.

3.9.1.4. Motor Control Center:

3.9.1.4.1. Control circuit voltage shall be 120 volts or less.

3.9.1.4.2. Provide a minimum of two (2) additional auxiliary contacts (1 N.O. and 1 N.C.) in magnetic starters.

3.9.1.4.3. Design each motor control center section so starter units may be rearranged, removed, or added.

3.9.1.4.4. Provide spare starter compartments for future modification. Provide 20% spare capacity.

3.9.1.4.5. Starters shall be 12" buckets. 6" starter buckets not acceptable.

3.9.1.4.6. MCCs shall not be communication type. Provide hardwired control interface to process control system.

3.9.1.4.7. MCCs shall not house variable frequency drives nor low voltage transformer and distribution panels.

3.9.1.5. Breakers, Fuses, and Safety Switches:

3.9.1.5.1. Renewable fuses shall not be used.

3.9.1.5.2. Locate equipment disconnects adjacent to equipment served. If not feasible, locate per NEC.

3.9.1.5.3. Tandem branch circuit breakers shall not be used.

3.9.1.5.4. Provide early break contacts on safety switches to prevent operation of variable frequency drives when the switch is open.

3.9.1.6. Variable Frequency Drive (VFD):

3.9.1.6.1. Provide 18-pulse VFD with phase shifting autotransformer front end Toshiba VFDs ~~for all motors 25HP and larger~~. Alternate manufacturer: Eaton not acceptable.

3.9.1.6.2. Provide 5% input reactor on all 6-pulse drives as minimum means of harmonic mitigation.

3.9.1.6.3. Size drives such that the full speed at full load of the driven load shall not exceed 90% of the drive rated amperage.

3.9.1.6.4. A VFD shall not serve more than one (1) piece of equipment.

3.9.1.6.5. Provide all VFD motors with local disconnect switches with early break status contacts wired back to the drive to prevent the drive from operating when the disconnect switch starts to be opened and prevents drive operation until switch is completely closed.

3.9.1.7. Locate floor maintenance receptacles so that all areas are accessible with a 25-foot cord.

3.9.2. Raceways, Boxes, and Supports:

3.9.2.1. Raceway and Boxes:

3.9.2.1.1. All systems shall be installed in conduit. Flexible wiring systems shall not be used.

3.9.2.1.2. A red plastic tracer tape shall be buried 18 inches above all underground cable or conduit installations.

3.9.2.2. Supports:

3.9.2.2.1. Support systems shall be coordinated with the plant design for an efficient use of space and structural steel.

3.9.2.2.2. Raceway supports shall be completely independent of mechanical piping or system supports.

3.9.3. Wire and Cable:

3.9.3.1. Neutral conductors shall be a minimum of full size. Neutral conductor capacity shall be increased as necessary for harmonics.

3.9.3.2. Conductors and buss shall be copper. Aluminum conductors or buss shall not be used.

3.9.3.3. Conductors carrying more than 150v to ground shall not be installed in conduits with conductors carrying less than 150v to ground.

3.9.4. Metering and Switchgear:

3.9.4.1. Coordinate primary plant metering with the Metering and Controls group.

3.9.4.2. Provide raceways between new or relocated primary metering to plant network cabinets. Network cabling and network cabinets by Meters and Control group.

3.9.4.3. Primary 13.8kV distribution switchgear is supplied and installed by Electrical Distribution. Coordinate design documents for the Contractor to perform all heavy lifting for the Utility Operator supplied equipment.

3.9.4.4. Secondary unit substations are provided by Electrical Distribution. Coordinate

design requirements with Electrical Distribution. Coordinate design documents for the Contractor to perform all heavy lifting for the Utility Operator's supplied equipment.

3.10. Emergency and Back-up Power Systems

3.10.1. Life Safety Back-up Power:

3.10.1.1. Provide wall-mounted, distributed emergency lighting fixtures for egress lighting.

3.10.1.2. Uninterruptible Power Supplies (UPS):

3.10.1.2.1. Provide cooling, ventilation, and maintenance access space in battery rooms and battery cabinets.

3.10.1.2.2. Provide containment systems in battery rooms.

3.10.2. Non-Life Safety Back-up Power:

3.10.2.1. Non-life safety back-up power shall be served by natural gas engine generators. Diesel engine generators require an approved Deviation Request.

3.10.2.2. Packaged Generator Assemblies:

3.10.2.2.1. If a diesel engine generator is installed:

3.10.2.2.1.1. Fuel day tanks in generator rooms shall be 660 gallons maximum and provided with spill containment and leak detection. All fuel piping shall exit through the top of the tank.

3.10.2.2.1.2. Total on-site fuel storage shall provide for a minimum of eight (8) hours of run time.

3.10.3. Generator Environmental and Code Compliance:

3.10.3.1. Generators shall comply with New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and other applicable environmental regulations. Refer to ENVIRONMENTAL COMPLIANCE for general air emissions compliance requirements.

3.10.3.1.1. Engine shall be certified to emission standards and certificate shall be provided to the Utility Operator.

3.10.3.1.2. NSPS requires installation of a non-resettable hour meter.

3.10.3.1.2.1. Consult Utility Operator regarding type of monitor and communications requirements.

3.10.3.2. The generator fuel system shall be arranged to automatically shut down upon a fire or detected leak.

3.10.3.3. Consult with the Utility Operator for information on generator air construction permit requirements.

3.10.3.3.1. Utility Operator will prepare permit and registration application and complete air dispersion modeling, as per requirements of Concession Agreement.

3.10.3.3.1.1. Engines having maximum capacity greater than or equal to 400 brake horsepower (bhp) require that an air construction permit is received prior to commencing construction of the unit.

3.10.3.3.1.2. Engines having maximum capacity less than 400 bhp require a registration with the Iowa Department of Natural Resources.

3.10.3.3.2. Generator sets shall be located to disperse exhaust fumes (vertical exhausts with flapper-style rain caps), vibration, and noise without affecting the normal functions of the plant and surrounding site.

3.10.3.3.3. Stack height requirements shall be determined by the Utility Operator based on dispersion modeling to meet ambient air quality standards.

3.10.3.4. Refer to ENVIRONMENTAL COMPLIANCE for Spill Prevention Control and Countermeasures (SPCC) requirements.

3.10.3.4.1. SPCC requirements apply to gear boxes and fuel tanks.

3.10.4. Monitoring and Data Transmission:

3.10.4.1. UPS condition shall be monitored.

3.10.4.2. Generators shall be continuously monitored to provide, at a minimum:

3.10.4.2.1. Engine run-hours.

3.10.4.2.2. Engine power produced (kWh).

3.10.4.2.3. Engine fuel consumption.

3.10.4.3. Engines shall be connected to the Utility Network or plant automation system for the purposes of collecting and sharing the monitoring data. Consult with Utility Operator to determine connections for each Project.

3.10.5. Transfer Switches:

3.10.5.1. Closed transition transfer switches shall be installed for all generators where synchronizing switchgear and controls is not provided.

3.10.5.2. Provide a minimum of two (2) sets of auxiliary form-C contacts for normal and emergency transfer switch positions.

3.11. Lighting:

3.11.1. General:

3.11.1.1. Design plant lighting to have average lighting levels of 50-foot candles at floor level at a minimum that operate at average lumen output over the fixture life.

3.11.1.2. Design lighting for low light reflectance values of walls and floors. Calculate lighting levels assuming 0.25 light reflectance levels on all surfaces.

3.11.1.3. Lighting control shall use manual light switches. Do not provide motion detection control.

3.11.1.4. Light fixtures shall be LED type fixtures.

3.11.1.5. Alternate light fixtures on alternating circuits provided from separate power panels.

3.11.1.6. Lighting selection shall be approved by the Utility Operator. Use Utility Operator's standard fixture types unless specifically approved alternate is allowed.

3.11.1.7. Fixtures shall avoid plastic diffusers. Plastic will age with the plants and reduce lighting levels.

3.11.1.8. Provide fixtures specifically designed for the expected plant ambient temperatures.

3.11.1.9. Use self-contained battery back-up emergency lighting fixtures for egress lighting.

3.11.1.9.1. LED lighting is preferred.

3.11.1.10. Warranties:

3.11.1.10.1. All LED fixtures shall carry a five (5) year manufacturer's warranty.

3.11.1.10.2. Warranty shall include LED board/chip set, driver, and all other components involved with the performance of the LED product.

3.11.1.10.3. Warranty shall include color shift of less than three (3) Macadam Ellipses and lumen depreciation faster than the manufacturer's published L70 rating.

3.11.2. Interior Lighting:

3.11.2.1. Design:

3.11.2.1.1. Use a combination of wall-mounted fixtures, low bay, high bay, and stanchion-mounted fixtures. Provide flood lighting where required.

3.11.2.1.2. Provide photocell control fixtures on exterior doors.

3.11.2.1.3. Provide permanent means of accessing or lowering fixtures installed at elevations above 10'.

3.11.2.1.4. Interior lighting systems shall operate at either 277-volt or 120-volt.

3.11.2.1.5. Efficiency:

3.11.2.1.5.1. All LED products shall carry a Lighting Facts label listing the LPW for that product.

3.11.2.1.5.2. All LPW ratings shall be at the color temperature (CCT) used on the Project

3.11.2.1.5.3. All lamps shall be TCLP compliant (low mercury).

3.11.2.1.5.4. Energy-saving lamps shall not be used in cold temperature applications (below 50 degrees F).

3.11.2.1.5.5. Incandescent, compact fluorescent, halogen, or metal halide lamps are prohibited.

3.11.2.2. Lighting Fixtures (Luminaries):

3.11.2.2.1. Custom lighting fixtures are prohibited.

3.11.2.2.2. All recessed can lighting shall be LED.

3.11.2.3. Emergency Egress Lighting Fixtures and Exit Signs:

3.11.2.3.1. Systems shall provide a minimum of 90 minutes emergency use.

3.11.2.3.1.1. Acceptable systems in order of Utility Operator preference:

3.11.2.3.1.2. Self-contained fixture or sign battery units.

3.11.2.3.1.3. Central inverter-based systems require written approval from Utility Operator.

3.11.2.4. Fixture Installation:

3.11.2.4.1. All light fixtures shall be accessible without scaffolding.

3.11.2.4.2. Lighting fixtures shall not be installed above stair treads.

3.11.2.4.3. Lighting fixtures at landings shall meet ADA requirements for mounting heights.

3.11.3. Exterior Lighting:

~~3.11.4.3.11.3.1.~~ 3.11.3.1. Illuminance Targets: Exterior illuminance targets shall be selected in accordance with *The Illuminating Engineering Society Lighting Handbook, 10th Edition*. All areas should be considered Lighting Zone 2 (LZ2) with a high activity level. All illuminance targets are maintained values at grade unless noted otherwise.

3.12. Communications:

3.12.1. General:

- 3.12.1.1. Telephone, Wired Network, and Wireless Network hardware shall be included within the Project scope. Cost and quantity estimates shall be provided by University of Iowa ITS.
- 3.12.1.2. Telephone, Wired Network, and Wireless Network infrastructure shall be included within the Project scope.
- 3.12.1.3. Wireless connectivity shall not replace wired connections, but rather is a supplement.
- 3.12.1.4. There exists a Utility Network separate from the ITS network, BAS, Fire Alarm, and Access Controls systems. The Utility Network cabinet shall be shown on the floor plans.

3.13. Electronic Safety and Security

3.13.1. Electronic Access Control and Security (AMAG):

- 3.13.1.1. Reference the University of Iowa's Design Standards for AMAG requirements.

3.13.2. Fire Alarm and Detection Systems:

- 3.13.2.1. Reference the University of Iowa's Design Standards for Fire Alarm and Detection System requirements.

END OF SECTION