The University of Iowa *Design Standards & Procedures* is for use by architects, engineers, interior designers (hereafter referred to as Design Professional) and Commissioning Professionals to ensure the successful delivery of University of Iowa capital projects.

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INTRODUCTION

The University of Iowa Design Standards & Procedures is for use by architects, engineers and interior designers (hereafter referred to as Design Professional) to ensure the successful delivery of University of Iowa capital projects. The document represents the collaboration of many with a rich institutional understanding of building function, building systems, operations, landscaping, and construction. It is important that each project effectively balance the needs of the user, the institution, and the stakeholders at the University of Iowa.

Decisions made during the design period create consequences that have a profound impact on the conduct of University business, future operating budgets, and the quality of the campus environment. Because of this, the University of Iowa has developed a comprehensive facilities strategy for long-term stewardship. This approach looks at how the facility will function for the users and occupants, how the operations staff will effectively care for the facility, what resources the facility will consume over its life cycle, and how and when building systems and components will be renewed.

The focus on the total-cost-of-ownership takes on many forms at the University of Iowa and is reflected in our ambitious energy conservation plan, commissioning program, building renewal planning, and campus master planning. The Design Standards & Procedures reflect choices focused on managing cumulative operational costs, such as routine maintenance, minor repairs, preventive maintenance, custodial services, snow removal, grounds keeping, waste management, and utilities. The document is expected to be updated, and Design Professionals are encouraged to present recommendations related to new products, equipment and alternative designs that may assist in achieving the University’s stewardship and accountability objectives.

Designing for facilities stewardship starts with an understanding of the institution’s qualitative and quantitative priorities. The Design Standards & Procedures exists to assist the Design Professional by setting the minimum institutional requirements for the decision-making involved in projects at the University of Iowa. Additionally, the institution looks for a highly collaborative planning and design process that successfully manages the combination of standards and procedures with the engagement of users, service providers and stakeholders in the pursuit of a successful project for the University of Iowa.

The University values its partnerships with Design Professionals and looks forward to continued success in building The University of Iowa.

The University of Iowa Design Standards & Procedures manual has the following sections:

Section I: Orientation, describes the general business relations between the Design Professional and University.

Section II: Design Documentation and Deliverables, lists University codes, standards, and design review requirements to assist Design Professionals in planning and estimating work effort.
Section III: Presents General Design Principles to be used in the design of University facilities.

Section IV: Presents Design Standards and Details to be incorporated in specifications and construction documents.

Appendices follow Section IV with additional information supporting this document.

Design Professionals should visit the University of Iowa Facilities Management website for the most current information contained in this document: http://www.facilities.uiowa.edu
SECTION I – ORIENTATION

I. THE UNIVERSITY OF IOWA GOVERNANCE
Procurement of architectural and engineering services is governed by the Board of Regents’, State of Iowa, policy manual. Chapter 9 of the Board of Regents’ policy manual outlines specific requirements, procedures and thresholds regarding capital improvement projects. The University of Iowa (Owner) conforms strictly to these requirements and Design Professionals shall not work ahead of governing approvals.

1. OWNER’S REPRESENTATIVE:

1.1. For capital improvement projects, the Owner’s Design Project Manager (PM) is the designated Owner’s Representative (OR) through the bidding phase of the project. The PM is also the Owner’s Representative for studies and non-construction services. The Owner’s Construction Project Manager (CPM) replaces the PM as the Owner’s Representative during the construction phase of the project following award of the construction contract to the Contractor.

1.2. All instructions and approvals come to the Design Professional from the Owner’s Representative.

1.3. The Owner’s Representative shall manage internal Owner approvals and instruct the Design Professional accordingly.

II. AGREEMENTS BETWEEN THE OWNER AND THE DESIGN PROFESSIONAL

General

1. GENERAL

1.1. The Design Professional shall designate a project manager, who shall represent the Design Professional throughout all phases of the Project, and to whom all communications pertaining to the project shall be addressed. Any change in the Design Professional’s representative during the life of the Agreement between Owner and Design Professional shall be made only after written request by the Design Professional and written concurrence by the Owner’s Representative. The Design Professional shall provide an experienced project manager capable of effectively coordinating a multi-disciplined architectural and engineering team.

1.2. The Owner uses an “Agreement between Owner and Design Professional” AGREEMENT BETWEEN OWNER AND DESIGN PROFESSIONAL (Agreement) as the contract between the Design Professional and the Owner for all Architecture and/or Engineering design services where fees are $10,000 or more. The Design Professional should review this document carefully, no exceptions to this form shall be allowed. A sample agreement form may be found at Facilities Management’s website http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html.

1.3. The Design Professional shall provide all Basic Services as stated in the Agreement. The Design Professional may contract with Professional Consultants for these services. The employment of Professional Consultants does not relieve the Design Professional from responsibility for the entire project and for the full coordination of services required under the agreement, whether the work is performed by the Design Professional or their Professional Consultants. Any change of Professional Consultants during the term of the agreement shall be reviewed and approved by the Owner.

1.4. The Owner may request the Design Professional hire a specialty consultant to support and/or supplement the services of the Design Professional. The Design Professional shall be responsible for the performance of the specialty consultant per the terms of the Agreement between Owner and Design Professional.
1.5. The Owner may engage quality assurance professional services such as code review professionals, commissioning agents, testing and balancing agents and others to ensure compliance with specific project goals and objectives.

1.6. Design Professional shall cooperate mutually with the Owner and with any other such Design Professionals that might be employed by the Owner.

1.7. The Design Professional shall submit a Letter of Proposal – Exhibit A, found at http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html, to the Owner that includes the Design Professional’s perception of the Owner’s project scope of work and recommended scope of services. The Design Professional shall provide a proposed fee and estimate of reimbursable expenses, project schedule, and other requested information.

1.7.1. Reimbursable and non-reimbursable expense guidelines are described in Exhibit B of the Agreement. Reimbursable expenses shall be approved in advance, paid at actual cost and accompanied by itemized receipts. The Reimbursable Expense Worksheet found at http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html shall be used when preparing invoices for reimbursable expenses.

1.7.2. The Design Professional shall provide an hourly rate schedules for them and all of their Professional Consultants. See Schedule of Hourly Fees - Exhibit C found at http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html.

1.7.3. The Design Professional’s proposal shall identify project milestones, including design review document submittals. The Owner shall provide the Design Professional with any Owner schedule requirements.

1.7.4. All design review meetings shall be included in the Design Professional’s Basic Services fee. Basic Services shall include, as a minimum, design review meetings, a pre-bid meeting, a written bid evaluation a pre-construction meeting, construction progress meetings, punch list inspection(s), and final inspection unless waived by the Owner.

1.8. Proof of insurance, as required and specified in the Agreement, shall be submitted for approval with the signed agreement, unless previously provided to the Owner. The Agreement will not be executed nor will payments be approved without proof of insurance.

1.9. Payments will not be processed until an executed agreement is on file.

1.10. If the Design Professional believes additional services are requested by the Owner that are beyond the scope of services defined by the Agreement, the Design Professional shall notify the Owner immediately and seek approval prior to proceeding with the services at its own risk. The original agreement shall be amended for any additional services agreed to by both parties.

1.11. The Design Professional shall submit requests for amendments to the agreement using the Amendment Letter of Proposal found at http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html, or requests for additional fees, prior to proceeding with the services resulting in such requests. Additional fees shall not be allowed for services provided during the Design Phase after award of the construction contract.
1.12. The Design Professional shall submit payment requests (invoices) to Facilities Management Capital Accounting. Invoices shall be submitted in the Owner’s format http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html. Payment requests shall be accompanied by invoices detailing work completed and shall summarize the total bill for services to-date and the amount of the current request. The Owner is in the process of transitioning Design Professional payment requests to its electronic website, request shall be submitted through Build UI, and expects to start utilizing the new system by the summer of 2015.

1.12.1.13. Other Owner standard agreements may be substituted depending on project scope and desired services. Other agreement forms include the Special Services Agreement and the Professional Services Agreement (http://www.uiowa.edu/~purchase/psa/), http://www.facilities.uiowa.edu/pdc/consultants/agreement-form.html for design services where fees are less than $10,000 and the Special Services Agreement.

III. GENERAL

1. STANDARD OF CARE:

1.1. The Design Standards document in its entirety and other written instructions from the Owner (including review comments) to the Design Professional, establish an expectation of the standard of care to be employed by the Design Professional in pursuit of the performance of their work.

1.2. Conflicts between Owner-provided instructions, documents, codes, standards and other instruments and Owner program requirements related to the project shall be brought to the attention of the Owner by the Design Professional. The Design Professional may be held financially responsible for resolving conflicts that were not brought to the Owner’s attention.

1.3. Marked review documents and written instructions from the Owner that are not incorporated into the design by the Design Professional prior to bidding shall be documented by the Design Professional and approved by the Owner.

1.4. The Design Professional shall be financially liable for deviations from this document, marked review drawings, and written instructions, unless deviations are approved by Owner in writing. Requests to deviate from these Design Standards and Procedures, on a project-by-project basis, may be made to the Owner by submitting a Deviation Request Form, found at http://www.facilities.uiowa.edu/pdc/designstandards/index.html

2. DESIGN AND CONSTRUCTION DOCUMENT GUIDELINES:

2.1. Each project is given an official title which shall be used with consistency on all documents.

2.2. All documents submitted to the Owner shall include:

2.2.1. Date

2.2.2. Project title

2.2.3. Owner’s project number (Build UI)

2.3. The electronic text program to be used for the Project Manual shall be Microsoft Word (.docx), latest version.
2.4. The electronic drafting program to be used for the Drawings shall be Architectural Desktop or AutoCAD (.dwg), latest version, or a program 100% compatible with AutoCAD, latest version.

2.4.1. All drawings submitted to the Owner shall include:

2.4.1.1. Date

2.4.1.2. Project title

2.4.1.3. Owner’s project number (Build UI)

2.4.1.4. Design Professional firm name.

2.4.1.5. Graphic scale and orientation of drawing (if applicable)

2.4.1.6. Individual sheet title

2.4.1.7. Alphanumerical number indicating discipline and sheet number

2.4.2. Construction Drawings shall be size D sheets (24 inches x 36 inches) unless otherwise directed by the Owner.

2.4.3. Construction Drawings shall be segregated into disciplines (Architectural, Civil, Structural, Mechanical, Plumbing, Electrical, Interior, Fire Protection Systems, etc.).

2.4.4. All .dwgs files shall have x-refs bound and raster attachments included. Entities created with AutoCAD extensions shall be exploded or exported so they are correctly represented in AutoCAD, AutoCAD Map or AutoCAD Architectural Desktop. Entities (trees, manholes, etc.) shall be represented with blocks, not with “Civil 3D points”. The purge command shall be invoked to delete all unreferenced blocks, layers and line types.

2.4.5. Layering Guidelines: AutoCAD drawings shall comply with the current American Institute of Architects (AIA)/National Institute of Building Sciences (NIBS) National CAD Standard layer naming format. Fonts supplied with current version of AutoCAD shall be used.

2.4.6. The Design Professional shall create and submit both full- and half-sized .pdfs.

2.5. If BIM is utilized on a capital improvement project the deliverable format shall be Autodesk Revit (.RVT). When BIM is required by the Owner for Design Development and Construction Documents, the BIM authoring software shall be Autodesk Revit Architecture. MEP, Structure and the Coordination (clash detection) software shall be Autodesk Navisworks.

2.6. The Design Professional shall convert all electronic documents to Adobe Portable

2.6.1. Document Format (.pdf) and shall provide the electronic documents to Owner on CD or DVD and/or publish to the Owner’s web site, Build UI.

2.7. Format for all electronic documents on CD(s) and DVD(s) shall be as follows:

2.7.1. The Project Manual shall read “Construction Set” or “Record Documents” as appropriate on the front cover, shall be a multi-page .pdf and shall have blank pages inserted.
2.7.2. Drawings shall be dated, labeled “Construction Set” or “Record Documents”, as appropriate, in both the revision area of the title block and on the cover. Include both single page .pdfs and .dwgs files. Name electronic files as follows: “project number- - sheet number- - sheet title”.

2.7.3. The CD(s) or DVD(s) shall be labeled with the project number and “Construction Set” or “Record Documents”, as appropriate.

2.7.4. Note: The .pdfs created from AutoCAD file shall not be made using the “Convert to Adobe PDF” menu option or toolbar button. The plot command should be used to ensure the .pdf files will display all information correctly.

3. DESIGN PHASE:

3.1. The Design Professional shall conduct an appropriate review of existing conditions as a part of the Basic Services for all projects with work within existing facilities. The Owner shall make existing documentation available to the Design Professional upon request.

3.2. The Design Professional shall develop economically justified designs within the prescribed budget and space allocations. The Owner manages the total project budget. The Design Professional is required to design to the construction budget.

3.2.1. Design to obtain the lowest life-cycle cost consistent with a high quality facility.

3.2.2. The Design Professional shall work to develop a design whereby the Base Bid accounts for approximately 95% of the approved construction budget to allow for budget protection on bid day. The balance of the construction budget shall be accommodated with additive bid alternates so that an award may be made utilizing 100% of the approved construction budget.

3.2.3. If bid alternates are included in the design, they shall be additional to the base bid design and shall be listed in order of importance. Unless approved by the Owner, no more than four (4) additive alternates shall be allowed.

3.3. The Design Professional shall perform a project code analysis. The Design Professional shall reference applicable codes and editions and note the occupancy, construction type, egress conditions, and other information necessary. The code analysis shall note any potential nonconforming construction. Failure of design work to meet the established University basic 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.

3.4. The Design Professional shall notify the Owner’s Representative of Owner-related delays so as not to impact the design schedule. In order to meet institutional design criteria, the proposed design may be periodically reviewed by the Campus Planning Committee.

3.5. The Design Professional may be required to make presentations to the Board of Regents for the Schematic Design of major buildings.

3.6. The Design Professional shall assist the Owner in obtaining all necessary permits.

3.7. Building permits are not required for construction on the Owner’s property. Work on buildings off campus (usually leased property) or new construction located in flood plain areas may require building permits or special clearance from governmental agencies. Building permits are required through the State Building Code Division for all state building or significant renovation projects.
3.8. As required by the Iowa State Fire Marshal’s Office, the Design Professional shall assist the University Owner in securing occupancy certificates.

3.8.1. Buildings subject to state inspection shall not be occupied until a Certificate of Occupancy has been issued by the State Fire Marshal’s Office which includes partial or temporary certificates.

3.8.2. The Design Professional shall account for this activity in the project schedule.

3.9. The Design Professional shall advise the Owner if the project requires a construction activity that is outside of the University’s property line. The Owner shall contact appropriate agency to discuss project needs. The Design Professional shall assist the Owner in the preparation of any material needed for appropriate submittals that may include permits, easements and traffic control drawings.

3.9.1. Agencies include, but are not limited to:

   3.9.1.1. Iowa Department of Transportation (IDOT)
   3.9.1.2. City of Iowa City
   3.9.1.3. City of Coralville
   3.9.1.4. Cedar Rapids and Iowa City (CRANDIC) Railroad
   3.9.1.5. Iowa Interstate Railroad
   3.9.1.6. Federal Aviation Administration
   3.9.1.7. Corp of Engineers
   3.9.1.8. Iowa Department of Natural Resources

3.10. Meetings and Stakeholders:

   3.10.1. Owner projects may include academic, student, and service groups as stakeholders in a project. The Owner’s Representative arranges for and coordinates the Design Professional’s contact with these groups.

   3.10.2. Project meetings are scheduled by the Owner.

   3.10.3. The Design Professional shall conduct effective and productive design meetings. The Design Professional and their appropriate consultants are expected to be present at these meetings.

   3.10.4. The Design Professional shall review the meeting agenda with the Owner’s Representative in advance of meetings.

   3.10.5. Meeting minutes shall be kept by the Design Professional and reviewed by the Owner before issue. Unless otherwise directed, meeting minutes shall be issued to the Owner’s Representative for review within five (5) working days. Following review, the Design Professional shall distribute the meeting minutes to all participants.

3.11. Design Review Submittals
3.11.1. The Design Professional shall provide timely and complete submittals of design and construction documents. The Owner shall review the Design Professional’s work for program conformance and constructability. The Owner’s Representative is authorized to reject incomplete document submittals.

3.11.2. The Design Professional is responsible for the management and performance of its Professional Consultants. Delay on a Professional Consultant’s part of a document submittal is considered an incomplete submittal from the Design Professional.

3.11.3. Delay of a project due to incomplete document submittals is the responsibility of the Design Professional.

3.11.4. Document submittal requirements are described throughout this document. The Design Professional shall allow a minimum of two (2) weeks for the Owner’s review between submittal of review documents and the review meeting. The Owner considers the milestone achieved only when the review is complete. Incomplete review documents may delay the completion of a document review.

3.11.5. The Design Professional shall obtain the Owner’s required Bidding Documents (specifications), found at Facilities Management’s website [http://www.facilities.uiowa.edu/pdc/fmspecdocs.html](http://www.facilities.uiowa.edu/pdc/fmspecdocs.html), prior to the project being advertised, ensuring the most current version is utilized. The PM/CPM shall work with the Design Professional to tailor bidding documents for the project including but not limited to the Form of Bid and Project Requirements.

3.11.6. The Design Professional may be required to submit Drawings and Specifications, at schematic and subsequent phases, to the Iowa Department of Public Safety, State Building Code Division for approvals by that office as directed by the Owner. The Design Professional shall be responsible for payment of associated fees. Such fees are considered a reimbursable expense.

4. BID PHASE:

4.1. The Owner coordinates the advertisement after the final construction documents have been reviewed and approved. The PM sets the advertisement date and makes arrangements for the printing of the bid documents.

4.2. The Owner shall distribute plans utilizing an outside vendor.

4.2.1. The Design Professional shall coordinate the printing and distribution of the Construction Documents for bidding and Addenda with Facilities Management - Planning, Design & Construction project support, 319-335-5500, facilities-dcs@uiowa.edu, and Rapids Reproduction, 1-800-383-1223, [http://www.rapidsrepro.com](http://www.rapidsrepro.com). Rapids Reproduction, the Owner’s printing vendor, will distribute the Construction Documents for bidding and Addenda and maintain the Plan Holders List.

4.3. A pre-bid meeting shall be scheduled prior to the bid opening. Contractor questions asked during the bidding period shall be recorded and clarified by addenda when they result in a change to the Contract Documents (agreed to by the Owner).

4.4. The Design Professional shall prepare all addenda.
4.4.1. Addenda are issued prior to the bid opening and become part of the construction Contract Documents. Addenda items shall be approved by the Owner prior to issuance.

4.4.2. Addenda shall be issued a minimum of seven (7) calendar days prior to the bid date. If Addenda has been issued six (6) days or fewer before the bid date, either 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 before the bid opening.

4.5. To assure an adequate number of bids are received:

4.5.1. Design Professional shall review the local bidding climate prior to the issuance of the bidding documents. The size and composition of projects shall be considered to encourage competitive bidding. If it appears a conflict among projects may occur in the bidding market, the rescheduling of the bids shall be considered, if time allows and if rescheduling will result in additional bids.

4.5.2. Design Professional shall review the plan holders list after the project has been on the market for seven (7) to ten (10) days to determine if there is adequate interest in the project.

4.5.2.1. The Design Professional shall contact prospective bidders to encourage an adequate level of interest and suggest modifications that may be appropriate to achieve bidder interest.

4.5.2.2. If little interest is shown in the project, the Design Professional shall contact potential bidders, determine the cause and shall share this information with the Owner.

4.6. The Design Professional of record and all other appropriate Professional Consultants shall place their individual information blocks with certifications, seals, signatures and dates on the original title page of the Bidding Documents (drawings, specifications and addenda) and shall deliver to the Owner within 14five (5) days of after the project’s bid opening. The information block shall include the numbers of the pages or sheets which are covered by certification.

4.7. Bid Opening:

4.7.1. The Owner conducts a public bid opening for all projects with construction estimates exceeding $100,000.00. The Design Professional shall attend the bid opening if requested by the Design Project Manager.

4.7.2. Informal bid openings are conducted for projects with construction estimates less than $100,000.00. The Design Professional is not required to be present for the bid opening.

4.8. Evaluation of bids by the Design Professional:

4.8.1. After the bids have been received, the Design Professional shall provide a letter of recommendation for awarding the construction to the lowest, responsible bidder based on its review and analysis of the following, as requested by the Owner:

4.8.1.1. An analysis of the bidder’s qualifications to determine if the low bidder is responsible [qualified].

4.8.1.2. An analysis of the low bidder’s breakdown of cost against the scope of work to determine if the bid is responsive.

4.8.1.3. An analysis of the bid spread and its comparison to the Design Professional’s pre-bid construction estimate.
4.8.1.4. An analysis of variations in the bids.

B. Construction Phase

4.9. Initial LEED Design Submittal:

4.9.1. Shall be submitted within fourteen (14) days from bid opening.

4.9.2. Upon receipt, results shall be submitted to the Project Manager and Planning, Design, and Construction’s LEED Resource.

4.9.3. Develop strategies for compliance and responses with PD&C.

5. CONSTRUCTION PHASE:

4.9.5.1. Communications between the Design Professional and the Contractor during construction, including letters, memos, directives, etc., shall flow through the OR with the exception of Contractor shop drawings.

4.10. Meetings

4.10.1.5.2.1. A pre-construction meeting will be scheduled following award of the construction Contract to the Contractor. Project meetings are scheduled by the Owner.

4.10.2. The Design Professional shall contribute towards productive meetings during construction. The Design Professional and their appropriate consultants are expected to be present at these meetings.

4.10.3. The Design Professional shall review the meeting agenda with the Owner’s Representative in advance of meetings.

4.10.4. Meeting minutes shall be kept by the Design Professional and reviewed by the Owner before issue. Unless otherwise directed, meeting minutes shall be issued to the Owner’s Representative for review within three (3) working days. Following review, the Design Professional shall distribute the meeting minutes to all participants.

5.3. Shop drawings and submittals are submitted

5.3.1. Contractors shall submit shop drawings and submittals directly to the Design Professional by the Contractor and are returned directly to the Contractor by the Design Professional. The Design Professional shall review shop drawings and submittals in a timely manner, and return to the Contractor within two weeks, unless otherwise agreed upon by all parties, as to not delay the contractor.

4.10.5.3.2. Design Professional shall use the following action codes when reviewing Contractor shop drawings and the project schedule, submittals:

5.3.2.1. For R - Reviewed

5.3.2.2. RAN - Reviewed as Noted

5.3.2.3. R&R - Revise and Resubmit
5.3.2.4. NAR - No Action Required

5.3.3. Submittal Management by Submittal Exchange:

4.10.5.1.5.3.3.1. Projects with construction estimates greater than $100,000.00, the Design Professional may be required to use Submittal Exchange for electronic review, approval and tracking of required Shop Drawings/Submittals, unless directed by the Owner.

5.3.3.2. Design Professional shall establish and administer the Submittal Exchange process.

4.10.5.2.5.3.3.3. Subscription costs for Submittal Exchange shall be included by the Design Professional as a reimbursable expense.

5.3.3.4. The Design Professional shall contact Vicki Lyon (vicki.lyon@texturacorp.com or (515) 393-2440) with Submittal Exchange to set up project. State upfront that this is a UI PD&C project that requires the UI template and the standard UI team list.

5.3.3.5. Design Professional shall submit an archive flash drive created from Submittal Exchange at the end of the project. Submittal is required to receive final pay application.

5.3.3.6. Archive flash drive created by Submittal Exchange shall include:

5.3.3.6.1. Full final submittal log

5.3.3.6.2. Activity log

5.3.3.6.3. Html

5.3.3.6.4. Folders labeled with each CSI division number.

5.3.3.6.5. All submittals, including those actioned R, RAN, R&R, and NAR.

5.3.3.6.6. Multi page pdf of each submittal within the division folders labeled by CSI number, description and action code. (Example - 10 22 00 Partitions R.pdf)

5.3.4. Submittal Management by email:

4.10.5.3.5.3.4.1. Design Professional shall establish and administer the submittal Exchange for the project.

5.3.4.2. The Design Professional shall submit an archive flash drive, CD(s) or DVD(s) at the following statements when reviewing Contractor shop drawings and end of the project. Submittal is required to receive final pay application.

5.3.4.3. Archive shall include:

5.3.4.3.1. Full final Submittal Log

5.3.4.3.2. Folders labeled with each CSI division number.
4.10.5.3.1-5.3.4.3.3. All submittals, including those actioned R, RAN, R&R, and NAR.

(1) R – Reviewed
(2) RAN – Reviewed as Noted
(3) R&R – Revise and Resubmit
(4) NAR – No Action Required

5.3.4.3.4. Multi page pdf of each submittal within the division folders labeled by CSI number, description and action code. (Example -10 5116 Custom wood lockers RAN.pdf)

5.3.4.4. Design Professional shall send archive flash drive, CD(s) or DVD(s) to FM-Planning, Design & Construction Attn: Document Center. Label archive with UI project number and project name.

4.11.5.4. The Design Professional shall use the Owner’s project communications web site, Build UI, for Change Order management, to enhance communications and storage of contract change document information. Change Order management includes Requests for Information (RFI), Instructions to Contractor (ITC), and Change Authorization Request (CAR).

4.12.5.5. The Design Professional shall visit the construction work site in accordance with the construction progress meetings and shall coordinate with the contractor in-wall and above-ceiling inspections. Design Professional shall submit site observation reports for each site visit they conduct.

4.13.5.6. The Design Professional shall review all change order pricing and issue written responses within five (5) working days following receipt. Change orders exceeding $10,000.00 shall require a detailed, itemized estimate to include labor, equipment and material; plus applicable overhead and profit margins.

4.14.5.7. The Design Professional shall review and make recommendations regarding any HVAC testing and balancing reports and quality control/quality assurance test reports conducted as part of the project.

4.15.5.8. The Substantial Completion inspection will be scheduled by the CPM. The Design Professional shall inspect the work, system-by-system and room-by-room and make a record of deficiencies or corrections (punch list) required to fully comply with the construction Contract Documents. The Design Professional shall send the final punch list, organized by room, system, or area, to the CPM, who shall make it available to the Contractor.

4.16.5.9. Upon completion of the punch list items by the Contractor the Design Professional shall provide a letter to the CPM certifying the completion of the project and recommending Final Acceptance.

4.17.5.10. The Design Professional shall produce Record Documents within thirty (30) days following final acceptance of the project and shall send them to FM – Planning, Design & Construction, Attn: Document Center.

4.17.5.10.1. Record Documents shall be provided using CD(s) or DVD(s) and shall include:

5.10.1.1. Drawings and Project Manual modified to include addenda, post:

5.10.1.1.1. Addenda
5.10.1.2. Post-Bid changes, including changes made via the Submittal Process, supplemental documents and the

5.10.1.3. Supplemental Documents

4.17.1.1.1.5.10.1.1.4. Contractor’s field changes, As-Built Documents.

5.11. Initial LEED Construction Submittal:

5.11.1. Shall be submitted within sixty (60) days from Substantial Completion.

5.11.2. Upon receipt, results shall be submitted to the Project Manager and Planning, Design, and Construction’s LEED Resource.

5.11.3. Develop strategies for compliance and responses with PD&C.

5.12. Submit the following items upon receipt of Final LEED Certification:

5.12.1. LEED checklist of credits attempted.

5.12.2. LEED checklist of credits awarded.

5.12.3. Narrative of successful strategies and lessons learned.

4.18.5.13. The Owner shall not make final payment to the Design Professional until all outstanding items, including the Record Documents, have been received.

END OF SECTION I - ORIENTATION
SECTION II - DESIGN DOCUMENTATION AND DELIVERABLES

This section contains information to be used by Design Professionals in the planning, design and development of University facilities.

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 with consideration given to serviceability, maintainability, and sustainability of these facilities.

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 that will yield the lowest total cost.

I. DESIGN GUIDELINES

1. GENERAL

   1.1. University facilities 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 State Building Code Bureau, a division of the State Fire Marshal Office.

   1.5. The Design Professional shall incorporate the University of Iowa's 20/20 Vision when designing projects: [link]

   1.6. Designs shall comply with the Board of Regents, State of Iowa, Campus Sustainability – Part II requirements. A copy of, including LEED Certification. Requirements found at the requirements is available at:

   1.7. The Design Professional shall lead and manage the LEED design and certification process.

      1.7.1. Owner shall review Credit Interpretation Requests (CIR) prior to submittal.

      1.7.2. Upon receipt, CIR results shall be submitted to the Project Manager and Planning, Design, and Construction's LEED Resource.

      1.7.8. The Design Professional shall work with the Owner to incorporate any required Art in State Building work into the project as required. The procurement of the art work shall be by Owner.
Asbestos-containing materials shall not be used.

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 as gross area on each floor through which they pass.

2.1.3.11. Include 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 occupants or specific use. Areas defined as building service (i.e., public rest rooms, custodial supply closets, custodial office/break room), 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 supply closets, custodial office/break room)

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

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 design and construction include, but are not limited to:

1.1.1. ICC International Building Code and reference standards

1.1.2. ICC International Fire Code

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. ADA Standards for Accessible Design


1.1.9. American Society of Mechanical Engineers (ASME) Safety Code of Elevators and Escalators A17.1 (1996) and other codes as adopted by The Iowa Division of Fire Safety, Elevator Safety Unit.

2. IOWA ADMINISTRATIVE CODE

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


2.1.3. Public Safety [661], Chapter 18, “Parking for Persons with Disabilities”
2.1.4. Public Safety [661], Chapter 303, “Requirements For Energy Conservation In Construction”

2.1.5. Environmental Protection [567]

2.1.6. Labor Services [875], Chapter 72, “Conveyances Installed on or After January 1, 1975”

2.1.7. Chapter 89A, “Elevators” (Iowa Code)

3. FEDERAL REGULATION, CHAPTER 40, PART 112 “OIL POLLUTION PREVENTION”

3.1. The Design Professional shall comply with the Owner’s SPCC requirements. A copy of the Owner’s SPCC plan is available on request.

4. CODE CHANGE ADMINISTRATION AND VARIANCES

4.1. When any new editions of applicable codes are 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 in the Project Manual and on code check/fire life safety 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. Copies of:

4.3.1.4.1. Referenced codes

4.3.1.4.2. Informational sketches, drawings, calculations, and

4.3.1.4.3. Drawings

4.3.1.4.4. Calculations

4.3.1.4.5. Supporting material

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

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

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

5.1.1. National Fire Protection Association (NFPA) standards including current version of 70E
5.1.2. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
5.1.3. American Concrete Institute (ACI)
5.1.4. American National Standards Institute (ANSI)
5.1.5. American Refrigeration Institute (ARI)
5.1.6. American Society for Testing and Materials (ASTM)
5.1.7. Underwriter’s Laboratories, Inc. (UL), Federal Specifications
5.1.8. National Electrical Manufacturers Association (NEMA)
5.1.9. Williams Steiger’s Act 1970 - The Occupational Safety and Health Act of 1970 (OSHA) Law
5.1.10. FM Global Company
5.1.13. National Institute of Building Science
5.1.15. Building Industry Consulting Service International’s (BICSI)
5.1.16. Telecommunications Design Methods Manual (TDMM)
5.1.17. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA), Building Wiring Standards

5.2. Standards that apply to University design and construction, as applicable:

5.1.18. LEED

III. FEASIBILITY STUDY PHASE

1. GENERAL

1.1. The Design Professional shall be directed by the Owner as to the specific scope of work related to a Feasibility Study.

IV. SCHEMATIC DESIGN PHASE
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.

2. PROJECT DESCRIPTION

2.1. The Design Professional shall provide a project description including a brief summary of building systems and materials proposed in the Schematic Design. It shall include the following:

2.1.1. Construction, i.e., structural system, wall system, roof design, waterproofing, vertical conveying system, exterior and interior finishes, etc.

2.1.2. Building controls, plumbing, air conditioning, heating and ventilating systems, ducts, filtration, and piping. Include appropriate code references to be followed in design.

2.1.3. Electrical services, including voltage, number of feeders, and whether feeders are overhead or underground. Provide a specific description of items to be served by emergency power and describe consideration for special areas.

2.1.4. Fire detection and protection systems required for intended occupancy of the building.

2.1.5. Site work issues including exterior utility connections.

2.1.6. The scope of Finishes, Furnishings and Equipment.

2.1.7. The scope of Communication Systems and Audio/Visual equipment.

2.1.8. The scope of Access and Security.

3. ENERGY ANALYSIS

3.1. The Design Professional shall provide to the Owner an Energy Analysis that includes:

3.1.1. an Energy Impact Statement, per Section III, and provide calculations,

3.1.2. Calculations

3.1.3. Models (including any computer printouts)

3.1.4. a Written summary of the results (clearly indicating assumptions employed) to the Owner.

4. PROJECT COST ESTIMATE

4.1. The Design Professional shall provide a project cost estimate that includes:

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4.1.1. A written quantitative estimate of construction developed from complete Schematic drawings.

4.1.2. The construction cost estimate broken down into the major Architectural, Civil, Structural, Mechanical, and Electrical building components, by major divisions of work.

4.1.3. The construction cost estimate, excluding the construction related services and procedures which are to be performed directly by the Owner, and

4.1.4. The Design Professional’s design contingency, if applicable.

5. PROJECT SCHEDULE

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

5.1.1. Lead time estimates for special items.

6. PROJECT MANUAL

6.1. The Design Professional shall provide an outline of technical specifications.

7. DRAWINGS

7.1. The Design Professional shall provide drawings that include:

a. Site drawings,

7.2. Floor Plans

b. Floor plans,

7.1.1.7.2.1. Floor plans shall have rooms identified by the Program Room Numbers and Program Room Name.

7.1.2.7.2.2. Net and gross area of each floor and total gross area of the building shall be noted on the floor plan drawings.

7.2.7.3. Roof Plans

7.3.7.4. Primary elevations,

7.4.7.5. Minimum of one (1) primary building section, and

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

8. THE BOARD OF REGENTS SCHEMATIC DESIGN REPORT

8.1. The Design Professional may be directed to produce and present a Schematic Design Report to the Board of Regents.

8.1.1. The report shall be distributed to Board members, University administrators, and other officials.
8.1.2. The report may also be used in conjunction with development activities by the University.

8.1.3. It is imperative this document be succinct, accurate, and of professional quality.

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

8.1.4.1. Provide electronic and printed copies in quantities, per Owner direction.

8.1.4.2. Provide a one (1) to two (2) page Executive Summary summarizing:

   8.1.4.2.1. The size and scope of the project
   8.1.4.2.2. Estimated costs
   8.1.4.2.3. General programmatic information identifying programs and activities directly benefiting the University.

8.1.5. Provide background information on the history of the project; the programs

   8.1.5.1. Program(s) benefiting from the project
   8.1.5.2. Problems it will solve, e.g. space shortages, obsolete facilities, future growth.
   8.1.5.3. Describe other parameters affecting definition of the problem, such as master planning issues, existing structural limitations, and site conditions.
   8.1.5.4. Typical subheadings might include Project Background, Space Program, Planning Issues and Design Objectives.

8.1.6. Where the proposed project is part of a Master Plan or is part of a multi-phase development, include a summary of the planning associated with the total project.

   8.1.6.1. The summary should describe how the project fits into the overall objectives and parameters of the master plan, and may include conceptual drawings and other available drawings, and projected costs.

8.1.7. Include a table of assignable square footage that clearly illustrates the proposed assignments of space.

8.1.8. Prepare a presentation rendering(s) per Owner direction.

8.1.9. Provide a concise presentation of the proposed Schematic Design solution.

   8.1.9.1. Narrative should focus on important features of the design addressing the project statement outlined in the introduction.
   8.1.9.2. A general description of proposed materials and building systems should also be included as well as planning for future modifications (flexibility) and expansion (expandability).
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8.1.9.3.8.1.11.3. Typical subheadings might include: Site Plan, Interior Design/Building Organization, Architectural Solution, Exterior Design/Building Appearance and Future Expansion.

8.1.10.8.1.12. Schematic Design drawings should include site plan(s), floor plans, primary elevations, and other drawings necessary to adequately convey important features of the proposed building.

8.1.11.8.1.13. Include a Project Cost Estimate, formatted to University Owner’s guidelines, with approved costs from the Owner.

8.1.12.8.1.14. Use the following schedule outline of project schedule milestones (for projects with unknown construction awards and completes -usually due to funding), indicate the construction period in months):

8.1.12.1.8.1.14.1. Design Professional Selection (date)
8.1.12.2.8.1.14.2. Schematic Design Approval (date)
8.1.12.3.8.1.14.3. Contract Award (if known) (date)
8.1.12.4.8.1.14.4. Construction Complete (if known) (date)

V. DESIGN DEVELOPMENT PHASE

Information in the Design Development Phase and Construction Document Phase sections shall be used by the Design Professional in the preparation of the Contract Documents, consisting of the project manual, the drawings, and any addenda.

1. GENERAL

1.1. The term “Project Manual” refers to the written portion of the Contract Documents; Bid form, Uniform General Conditions, Institution Requirements, Project Requirements and Technical Specifications.

1.2. The term “Drawings” refers to the graphic portrayal of elements included within the scope of the Contract Documents.

1.3. There should be no duplication between portions of the Contract Documents; instead, they should be complementary.

1.4. 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.

1.5. The Design Professional shall design the entire project (architectural, civil, mechanical, electrical, and structural) unless otherwise agreed to by the Owner. Providing performance specifications is not considered equal to design.

1.6. The Design Professional shall verify with the Owner the level of involvement of FM - 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. FM – BLS shall provide design review and assist in inspecting landscape work regardless of their involvement with site design or site work.

1.7. The Design Professional shall perform a project code analysis. The Design Professional shall reference applicable codes and editions and note the occupancy, construction type, egress conditions, and other information necessary. The code analysis shall note any potential nonconforming construction. Failure of design work to meet the established University basic 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.

1.8. The Design Professional shall review all project permit requirements with the Owner.

1.9. The Design Professional shall not proceed into the Construction Document Phase until the requirements of the project are met and the Design Development Phase is approved by the Owner.

2. DESIGN SUMMARY (BASIS OF DESIGN)

2.1. Provide Owner design summary documentation in an indexed report format with all assumptions and references stated. Summary to include:

2.1.1. Architectural design calculations (including occupancy classifications, type of construction, fire resistive ratings, exiting calculations, allowable building height and area, toilet fixture calculations and any unusual provisions or exceptions applicable to the project).

2.1.2. Design Professional shall submit to the Owner calculations used to determine roof control and expansion joint width and spacing.

2.1.3. Space-by-space comparison of preliminary assignable area with program assignable areas. Tabulate by floor and include totals for the building.

2.1.4. Structural design calculations (include live load, roof load, snow load, wind load, lateral soils load and seismic load calculations, any unusual provisions, special loads or exceptions applicable to the project).

2.1.5. Mechanical design calculations (include building loadings, equipment sizing, steam pipe stress analysis, annual energy usage and any unusual provisions or exceptions applicable to the project).

2.1.6. Electrical design calculations (including fault current calculations, transformer loading, circuit sizing, building energy usage and any unusual provisions or exceptions applicable to the project).

2.1.7. Civil design calculations (include storm drainage, sanitary sewer, domestic water service, transportation and any unusual provisions or exceptions applicable to the project) demonstrating systems have capacity to support the project.

2.1.8. List major equipment and material information (e.g. catalog material, charts, tables, performance curves, etc.). Location of moveable items of furniture and equipment listed in space description sheets. Differentiate from built-in furniture and equipment.

2.1.9. Verification of compliance with University standards, guidelines, and codes.

3. ENERGY ANALYSIS
3.1. The Design Professional shall provide to the Owner an Energy Analysis that includes, to include:

3.1.1. An Energy Impact Statement, per Section III, and provide calculations, models (3.1.2. Calculations
3.1.3. Models, including any computer printouts
3.1.4. and a Written summary of the results (clearly indicating assumptions employed) to the Owner.

4. PROJECT COST ESTIMATE

4.1. The Design Professional shall provide a project cost estimate that includes, to include:

4.1.1. a Written quantitative estimate of construction developed from complete Design Development drawings and specifications.

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

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

4.1.4. the Construction cost estimate shall show the Contractor overhead and profit, and

4.1.5. the Design Professional’s Design contingency, if applicable.

5. PROJECT SCHEDULE

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

5.1.1. Updates regarding lead time estimates for special items.

5.2. Provide a construction-phasing schedule in bar chart and/or outline (narrative) form and/or a phasing floor and/or site plan-as, if applicable.

6. PROJECT MANUAL

The Design Professional shall use the Owner’s Division 00 documents. The Design Professional shall assist the Owner in preparing the following documents:

6.1. The Design Professional shall use the Owner’s Division 00 documents.

6.1.1. Cover Page

6.1.2. Seals & Signatures

6.1.3. Table of Contents
6.1.4. Advertisement for Bids
6.1.5. Form of Bid
6.1.6. Project Requirements

6.2. The Design Professional shall use the following Owner’s Division 01 documents:
6.2.1. Submittals
6.2.2. Contract Closeout
6.2.3. Operation and Material
6.2.4. Project Record Documents
6.2.5. Commissioning (as required)

6.3. The Design Professional shall use the Owner’s technical specification template for Fire Alarm and Detection Systems, as required by the project scope.

6.4. For consistency in format, the following rules shall be observed:
6.4.1. 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.
6.4.2. The term “Owner” shall always be capitalized, and no other term shall be used in reference to the University as the Owner.
6.4.3. 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.
6.4.4. “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.
6.4.5. “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; http://www.facilities.uiowa.edu/pdc/fmspecdocs.html.
6.4.6. The term “Contractor/Constructor” shall be capitalized when referring to the prime contractor, but not when referring to a subcontractor.
6.4.7. “Contract” shall be capitalized when referencing the agreement between a Contractor/Constructor and the Owner.
6.4.8. The term “Contract Documents” shall be used when reference is made to all documents so identified in the FORM OF AGREEMENT BETWEEN Contractor/CONSTRUCTOR AND OWNER.

6.5. The Design Professional shall carefully check that the Specifications include all items pertaining to the project and exclude items not incorporated in the project.
6.6. The Specifications shall include a complete list of extended guarantee items and list of items for which operations and maintenance data are required.

6.7. References to industry standards shall be checked to verify correct identification of numbers and date of issue.

6.8. The terms “to be,” “must be,” “will be” and “will” are not acceptable when referring to the Contractor/Constrctor. The mandatory “shall” or “shall be” are the only forms with full legal force.

6.9. Competitive bidding is required by State of Iowa Law. 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). Where this is not feasible because such standards have not been established, specify three (3) equally acceptable manufacturers or suppliers. This name of one (1) type followed by “or equal” or “or approved equivalent” is not considered to be an adequate specification. 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.

6.10. Specific vendor contact information shall not be included unless by reference through an Allowance.

7. DRAWINGS

7.1. Title sheets:

7.1.1. The title sheet or sheets in each set of drawings shall contain the following and shall be provided for each bound set:

7.1.1.1. Project title and project number
7.1.1.2. Owner’s name: (The University of Iowa)
7.1.1.3. Design Professional’s name
7.1.1.4. Drawing index
7.1.1.5. Site location map (including street address)
7.1.1.6. Advertisement/issue date

7.2. Site drawings:

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

7.2.2. 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.

7.2.3. Existing and proposed topographic contours.
7.2.4. Exterior elements; e.g., outdoor facilities, streets, service drives, parking areas, walks (including ADA), covered walks, landscape development, stairs, pools, retaining walls, terraces, etc. Include any elements to be demolished.

7.2.5. Section(s) through site, explaining changes in level within the proposed building as related to the adjacent site.

7.2.6. Existing and proposed underground utilities and structures. Show verified capacity at points of connection to existing utilities.

7.2.7. Show locations of any anticipated snowmelt systems.

7.2.8. Proposed landscape materials and location.

7.2.9. Show 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.

7.2.10. Show existing and final site grading and identify any surface water drainage issues that shall be corrected as part of the project.

7.2.11. Show method of general drainage of the site as affected by the proposed building and concepts for mitigating site runoff.

7.3. Architectural Drawings:

7.3.1. Floor Plans

7.3.1.1. Extent of demolition work, site access, and dust barriers.

7.3.1.2. Locations, sizes (dimensions), and space numbers of programmed spaces and other required gross areas, including:

7.3.1.2.1. Corridors (width)

7.3.1.2.2. Stairs

7.3.1.2.3. Restrooms

7.3.1.2.4. Locker Rooms

7.3.1.2.5. Custodial Closets

7.3.1.2.6. ITS rooms

7.3.1.2.7. Mechanical Spaces

7.3.1.2.8. Storage Rooms

7.3.1.2.9. Classrooms

7.3.1.2.10. Lecture Halls
7.3.1.2.11. Kitchens and related service areas

7.3.1.3. All floor plans and room finish schedules shall indicate room numbers.

7.3.1.4. Interior finish schedule indicating floor, wall, and ceiling finishes together with special items of finish.

7.3.1.5. Location of doors and windows. Indicate door swings.

7.3.1.6. Overall dimensions of each area of the building(s).

7.3.1.7. Location of plumbing fixtures such as lavatories, floor drains, water closets, urinals, service sinks, drinking fountains, fire hose cabinets, fire extinguishers, sprinkler systems, etc.

7.3.1.8. Principal built-in features, such as:

7.3.1.8.1. Fixed auditorium seats

7.3.1.8.2. Kitchen equipment

7.3.1.8.3. Display cases

7.3.1.8.4. Casework

7.3.1.8.5. Counters

7.3.1.8.6. Shelves

7.3.1.8.7. Lockers

7.3.2. Interior Signage drawings

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

7.3.3. Roof Plans

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

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

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

7.3.3.4. Identification of existing components and methods of attachment.

7.3.3.5. Simple sketches showing method of detailing new system.

7.3.4. Elevations and Sections
7.3.4.1. Exterior elevations for the building shall show the following:

7.3.4.1.1. Windows
7.3.4.1.2. Doors
7.3.4.1.3. Louvers
7.3.4.1.4. Solar Screening Systems
7.3.4.1.5. Stairs
7.3.4.1.6. Platforms
7.3.4.1.7. Retaining Walls
7.3.4.1.8. Grades, Paved Areas, etc.
7.3.4.1.9. Typical configuration and integration of the air and weather barrier into adjacent building envelope materials

7.3.4.2. Indicate floor heights and window sill heights.

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

7.3.4.3.1. Floor elevations
7.3.4.3.2. Finish exterior grades
7.3.4.3.3. Ceiling heights
7.3.4.3.4. Pipe tunnels
7.3.4.3.5. Unexcavated areas
7.3.4.3.6. Basement and areaways
7.3.4.3.7. Rooflines, Parapets, etc.

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

7.4. Structural Drawings:

7.4.1. Include the design loadings (dead, live, wind, snow, seismic), material specifications and design stresses (steel, concrete, masonry, soil bearing, etc.) assumed during the design, plus assembly stresses where applicable.

7.4.2. When structures employ a beam-column framework, a grid reference system using alphabetic and numeric symbols shall be utilized. When additions are made to existing structures, the original reference system shall be extended where practical.
7.5. Mechanical Drawings:

7.5.1. Plumbing

7.5.1.1. Demolition required drawings

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

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

7.5.1.4. Provide Equipment schedules for plumbing fixtures.

7.5.1.5. Provide Isometrics for water, sanitary, and gas piping.

7.5.2. Heating, Ventilating, Air Conditioning and Piping

7.5.2.1. Demolition required drawings and associated capping of piping and duct runs.

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

7.5.2.3. Air moving equipment and double line duct runs to all outlets including supply and exhaust fan systems, fume hoods, etc.

7.5.2.4. Pieces of equipment, showing locations and required piping connections including pumps, tanks, converters, etc.

7.5.2.5. Provide Equipment schedules indicating sizes, capacities and operating characteristics.

7.5.2.6. Provide air and water flow diagrams for supply and exhaust air, and water distribution systems. Diagrams are to indicate flow rates in mains and branches to assist in balancing.

7.5.2.7. Control schematics and sequence of operations.

7.5.3. Equipment Rooms (large scale drawings of)

7.5.3.1. Layout of equipment to assure adequate space allowance.

7.5.3.2. Elevations of built-up fan units to assure proper air flow and access to component parts of the units.

7.5.3.3. Pump layout and piping runs.

7.5.3.4. Provide Room section cuts assuring showing room accessibility for maintenance personnel.

7.5.4. Fire Protection and Detection

7.5.4.1. Pipe runs, sprinkler locations, standpipes, pumper connections, and test connections.
7.5.4.2. Coverage rate of sprinklers.

7.5.4.3. Special equipment.

7.5.4.4. Control schematic.

7.5.4.5. Fire alarm panel locations.

7.6. Electrical Drawings:

7.6.1. Demolition required drawings

7.6.2. Power and control layouts shall be on one (1) set of drawings and the lighting layouts on a different set of drawings using standard symbol conventions. Show all conduit sizes and the size and number of conductors. Show electrical and data on one (1) sheet and electrical, data, and furniture/casework on a separate sheet.

7.6.3. Provide single line electrical distribution diagrams showing primary service to substations and secondary service to distribution switchboards, motor control center, and panel boards for power and lighting. Show all conduit sizes and the size and number of conductors.

7.6.4. Point of connection to external utilities.

7.6.5. Indicate and provide utilization schedule for each load center unit substation, motor control center, distribution and switchboards, telephone equipment rooms, and closets.

7.6.6. Type and locations of lighting fixtures in typical offices, laboratories, corridors, examination rooms, etc., and use a schedule for details.

7.6.7. Type and locations of all exterior lighting fixtures. Provide a photometric drawing for exterior lighting for review and approval.

7.7. Electronic Safety and Security Drawings:

7.7.1. Fire Alarm and Detection drawings

7.7.1.1. Fire alarm and detection system drawings shall not be incorporated into the electrical or communications drawings.

7.7.1.2. Location of all control modules and test switches shall be shown on drawings (fan shutdown modules, damper control modules, etc.)

7.7.1.3. Location of damper indicator lights shall be shown on drawings.

7.7.1.4. Design Professional shall identify the estimated quantity of dry contacts required for the fire alarm system.

7.7.1.5. Design Professional shall provide Outline of sequence of operation for auxiliary controls from fire alarm system (smoke purge, damper control, HVAC control, etc.).
1. **GENERAL**

   1.1. All items listed under Design Development Phase, General apply to the Construction Document Phase, General requirements.

   1.2. Contract Documents shall be complete and ready for seals and signatures.

   1.3. All corrections to drawings and specifications identified during Design Development and subsequent intermediate reviews shall be completed and incorporated prior to issuing Contract Documents for bid.

   1.4. No allowances shall be included in the Contract Documents unless approved by the Owner.

   **1. The Design Professional shall submit an Arc Flash analysis to the Owner in an electronic file.**

   1.5. A finishes binder shall be produced, if required.

   1.6. **Warranties**

   1.6.1. Product and installation warranty requirements and manufacturer warranty requirements shall all be reviewed with the Owner prior to bidding. The General Conditions cover all one-year warranties and guarantees. Warranties and guarantees other than one year 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. All extended warranties shall be reviewed with the Owner.

   1.6.2. The Design Professional shall review any recommended extended warranty and/or guarantee periods with the Owner.

   1.7. **Training:**

   1.7.1. Product and system training requirements shall be reviewed with the Owner prior to bidding.

2. **DESIGN SUMMARY (BASIS OF DESIGN)**

   2.1. All items listed under Design Development Phase, Design Summary (Basis of Design) apply to the Construction Document Phase, Design Summary (Basis of Design) requirements.

3. **ENERGY ANALYSIS**

   3.1. All items listed under Design Development Phase, Energy Analysis apply to the Construction Document Phase, Energy Analysis requirements and shall be updated as required by the Owner.

4. **ARC FLASH ANALYSIS**

   4.1. **Arc Flash:**


   4.1.2. NFPA 70E, Current Edition, PPE Arc Flash Category 3 or higher require written approval from Owner.
4.1.3. Model shall evaluate available fault currents and size ampere interruption capacity for new or modified equipment. This shall include existing equipment downstream of new or modified equipment.

4.2. Design and Construction Deliverables

4.2.1. Design Deliverables

4.2.1.1. Preliminary design assessment(s) shall be conducted as soon as feasible, no later than 50% through the Construction Document Phase.

4.2.1.2. Submit electrical riser diagram showing preliminary breaker settings, ratings, available fault current, hazard levels in Construction Documents.

4.2.1.2. Construction Deliverables

4.2.1.2.1. Provide data to comply with NFPA 70E labeling requirements.

4.2.1.2.2. Provide coordinated breaker sizing and setting requirements for the service protector with all downstream circuits and protective devices in the building.

4.2.1.3. Record Deliverables

4.2.1.3.1. Record Arc Flash Assessment shall be conducted using as-installed equipment and conditions.

4.2.1.3.2. Submit as-installed electrical riser diagram showing final breaker settings, ratings, available fault current, hazard levels.

4.2.1.3.3. Submit as-installed riser diagram, assessment calculations and model file to Owner for record.

4.2.1.3.4. Submit as-installed panel schedules in electronic (.doc) format.

4.5. PROJECT COST ESTIMATE

4.1.5.1. All items listed under Design Development Phase, Project Cost Estimate apply to the Construction Document Phase, Project Cost Estimate requirements and shall be updated as required by the Owner.

4.2.5.2. 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.

5.6. PROJECT SCHEDULE

5.1.6.1. All items listed under Design Development Phase, Project Schedule apply to the Construction Document Phase, Project Schedule requirements.

5.2.6.2. 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.
7. OWNER REVIEW DELIVERABLES

7.1. Submit path of travel accessibility scoping. See SECTION III, GENERAL, ACCESSIBILITY.

6.8. PROJECT MANUAL


6.3.8.3. The date of issue for the Project Manual shall be the same date as on the Drawings.

6.4.8.4. 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.

6.5.8.5. The Design Professional shall list all required submittals, shop drawings, operation and maintenance manuals, warranties and certifications required.

6.6.8.6. Each technical specification section shall be marked “End of Section” at the end of the last page.

6.7.8.7. The geotechnical report, if applicable, shall be included for reference only.

7.9. DRAWINGS

7.1.9.1. All items listed under Design Development Phase, Drawings apply to the Construction Document Phase, Drawings requirements.

7.2.9.2. General

7.2.1.9.2.1. Drawings shall be carefully checked by the Design Professional to achieve coordination between architectural, structural, mechanical, electrical and fixed equipment drawings.

7.2.2.9.2.2. 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.

7.2.3.9.2.3. Notes and dimensions on the drawings shall be large enough to be easily read. This is especially true if drawings are to be reproduced at half size for bidding documents.

7.2.4.9.2.4. Schedules for mechanical equipment, electrical equipment, doors and windows, and room finishes shall be included.

7.2.5.9.2.5. Manufacturer and product names shall be referenced in equipment schedules.

7.2.6.9.2.6. Symbols and abbreviations shall be defined and shown on legends.

7.2.7.9.2.7. Design details, sketches and drawings shall be shown on the drawings, not in the Project Manual.
7.2.9.2.8. Sections and details shall be numbered and cross referenced.

7.2.9.2.9. 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.

7.3.9.3. Title sheets:

7.3.1.9.3.1. The title sheet or sheets in each set of drawings shall contain the following:

7.3.2.9.3.2. Design Professional’s Seal

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

7.4.9.4. Site drawings:

7.4.1.9.4.1. Project construction limits, construction fencing, and Contractor access shall be clearly shown on the site drawings.

7.4.2.9.4.2. Tree protection or special requirements shall be noted on drawings.

7.4.3.9.4.3. Sections and Elevations of utility profiles.

7.4.4.9.4.4. Landscape planting schedule

7.4.5.9.4.5. Site details

7.5.9.5. Architectural drawings:

7.5.1.9.5.1. Interior Signage drawings and details:

7.5.1.1.9.5.1.1. Shall be to-scale.

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

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

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

7.5.2.9.5.2. Roofing drawings:

7.5.2.1.9.5.2.1. 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.

7.5.2.1.2.9.5.2.1.2. Piping, conduit and related supports
7.5.2.1.3.9.5.2.1.3. Roof walkways, screens, hatches and ladders
7.5.2.1.4.9.5.2.1.4. Roof drains, overflow drains and scuppers
7.5.2.1.5.9.5.2.1.5. Miscellaneous penetrations
7.5.2.1.6.9.5.2.1.6. Expansion joints and area divided curbs
7.5.2.1.7.9.5.2.1.7. Gutters and downspouts
7.5.2.1.8.9.5.2.1.8. Valley, ridges, saddles and crickets.

7.5.2.2.9.5.2.2. Details of roof system and components including:
7.5.2.2.1.9.5.2.2.1. Roof perimeter condition
7.5.2.2.2.9.5.2.2.2. Penetration condition, including vent flashing
7.5.2.2.3.9.5.2.2.3. Roof-related sheet metal fabrication
7.5.2.2.4.9.5.2.2.4. Equipment curbs, skylight curbs, and roof hatches
7.5.2.2.5.9.5.2.2.5. Roof expansion joints and area dividers
7.5.2.2.6.9.5.2.2.6. Piping and equipment supports.
7.5.2.2.7.9.5.2.2.7. Typical roof drain and overflow drain, including sumps and flashings
7.5.2.2.8.9.5.2.2.8. Scuppers.

7.5.3.9.5.3. Roof flashing details shall indicate, as a minimum, the following components:
7.5.3.1.1.9.5.3.1.1. Roof deck and wall substrate and other adjacent materials.
7.5.3.1.2.9.5.3.1.2. Insulation including separate layers and vapor retarders.
7.5.3.1.3.9.5.3.1.3. Roof and flashing membrane
7.5.3.1.4.9.5.3.1.4. Cant strips
7.5.3.1.5.9.5.3.1.5. Flashing attachment
7.5.3.1.6.9.5.3.1.6. Counter flashing and reglets
7.5.3.1.7.9.5.3.1.7. Sealants
7.5.3.1.8.9.5.3.1.8. Wood nailers and blocking, including adequate attachment.

7.5.3.2.9.5.3.2. Roofing system interface(s) with rest of building envelope(s), including details indicating how penetrations are to be handled.
7.6.9.6. Structural Drawings:

7.6.1.9.6.1. Detail junctions between floors, roof, and exterior wall assuring continuity and load path.

7.6.2.9.6.2. Drawings shall clearly dimension and accurately describe non-standard details and construction requirements. Including but not limited to:

7.6.2.1.9.6.2.1. Construction and expansion joints
7.6.2.2.9.6.2.2. Special jacking and lifting procedures
7.6.2.3.9.6.2.3. Protective cover (concrete)
7.6.2.4.9.6.2.4. Anchor bolt material and projection
7.6.2.5.9.6.2.5. Special connection details
7.6.2.6.9.6.2.6. Shoring requirements (including soil nails)
7.6.2.7.9.6.2.7. Construction sequence
7.6.2.8.9.6.2.8. Bolt torque
7.6.2.9.9.6.2.9. Concrete reinforcing details
7.6.2.10.9.6.2.10. Connection capacity
7.6.2.11.9.6.2.11. Water stops, etc.

7.6.3.9.6.3. Show type, placement, and location of Rebar splices.

9.6.3.1. Type
9.6.3.2. Placement
9.6.3.3. Location

7.7.9.7. Mechanical Drawings:

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

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

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

7.7.2.9.7.2. Details, cross-sectional and elevation views.

7.7.3.9.7.3. Equipment schedules

7.7.4.9.7.4. Control schematic
7.7.5.9.7.5. Point listing

7.7.6.9.7.6. and Sequence of operation information shall be shown on mechanical drawings.

7.8.9.8. Electrical Drawings:

7.8.1.9.8.1. Completed equipment, lighting and power panel schedules.

7.8.2.9.8.2. Details, cross-sectional and elevation views.

7.8.3.9.8.3. Identify circuits

9.8.4. and show Equipment schedules.

10. FINISH AND FURNITURE DOCUMENTATION

7.9.10.1. Building finishes binders, project furniture binders, and color boards may be required based on electrical drawings, project scope. These working documents may be required during the design process. The final building finishes binder, project furniture binder and electronic versions of these shall be provided at completion of contract documents. Review requirements with Owner.

10.2. Building finishes binder: Review format, quantity of binders (one or two) and schedule expectation with Owner. The binder may include the following items.

10.2.1. Final building finish samples labeled with keyed identification of product information and location of use

10.2.2. 3D project renderings with selected building finishes

10.2.3. Finish schedule

10.2.4. 11 x 17 finish plan of each floor

10.3. Project furniture binder: Review format, quantity of binders (one or two) and schedule expectation with Owner. The binder may include the following items.

10.3.1. Table of Contents

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

10.3.2.1. Project name and number

10.3.2.2. Issue date

10.3.2.3. Furniture manufacturer’s representative contact information

10.3.2.4. Furniture product number and description

10.3.2.5. Furniture photos
10.3.2.6. Furniture finish photos

10.3.2.7. Furniture floor plan code

10.3.2.8. Room number with location name and quantities

10.3.3. Furniture finish samples labeled with keyed identification of product information and location of use

10.3.4. Furniture floor plans keyed to specifications

10.3.5. Workstation typical in plan view and 3D

10.3.6. Post-installation photos

10.4. Color boards: Review format and schedule expectation with PM. These may be requested for client presentations and fund-raising opportunities. The board may include the following items:

10.4.1. Building finish samples labeled with keyed identification of product information and location of use

10.4.2. 3D project renderings with proposed building finishes and/or furniture

10.4.3. Images of furniture

10.4.4. Samples of proposed furniture finishes with keyed identification of product information and location of use

END SECTION II - DESIGN DOCUMENTATION AND DELIVERABLES
SECTION III - GENERAL DESIGN STANDARDS

This section contains planning 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.

The individual guidelines are grouped under major headings of General, Civil, Architectural, Structural, Mechanical, and Electrical. Any conflicts between the requirements in listed reference documents shall be resolved by the Owner.

I. GENERAL

The following information is provided as a general guideline in establishing design requirements.

1. ACCESSIBILITY

1.1. The University of Iowa faces the challenge of providing an inviting, welcome, supportive, and universally accessible environment for all persons. The Americans with Disabilities Act, the 2010 ADA Standards for Accessible Design, Iowa State Building Code Chapter F302 - Accessibility of Buildings and Facilities Available to the Public, Iowa Administrative Code Chapter 18 - Parking for Persons with Disabilities, the International Building Code (IBC) Chapter 11, and the IBC referenced ICC A117.1 - Accessible and Usable Buildings and Facilities shall be used as minimum guides in establishing accessibility design requirements (using the most stringent if there are any differences) and shall not be construed to limit Design Professionals from going beyond these requirements and proposing a higher level of accessible design features. 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.

1.2. Building design, including renovations shall be based on “Universal Design” concepts and criteria. Universal Design is defined as “The design of products and environments to be usable by all people without the need for adaptation or specialized design”. The Owner has developed a project scoping and assessment model titled “MAPPS”, Measuring Accessibility Points Plan and Standards. The model includes an extensive checklist of accessibility considerations and provides an excellent framework for scoping a project design and rating, similar to LEED ratings, the relative extent of a universal design.

1.3. The following limited list identifies items that have been missed or excluded on various new construction or renovation projects and clarification of interpretation and/or clarity on design direction for specific items as required by the Owner:

1.3.1. In new construction, all public entrances to the building shall be designed for universal accessibility.

1.3.1.1. Entrances on an accessible route, including the main entrance, shall be provided with one (1) door, or set of power operated doors.

1.3.1.2. 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.
1.3.1.3. The main floor or centrally located Men’s and Women’s restroom shall include a power operated door or be designed without doors.

1.3.1.4. Power operated doors that are sequentially operated shall allow for a one-second-per-foot delay.

1.3.2. 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.

1.3.3. Avoid or eliminate grates or other openings in traveling surfaces.

1.3.4. Employee spaces used for purposes other than job-related tasks (break rooms, tea rooms, kitchen/kitchenettes, copy rooms, conference rooms, lounges, shower 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.

1.3.5. Every public and common use restroom shall have accessibility as required by ADA Standards for Accessible Design.

1.3.6. Provisions shall be made for restroom ambulatory compartments as required by ADA Standards for Accessible Design.

1.3.7. Alterations which could affect the usability of a facility shall be made in an accessible manner to the maximum extent possible.

1.3.8. Door and gate closer push/pull force and closing speed shall comply with the ADA Standards for Accessible Design.

1.3.9. Although areas used exclusively by employees for work are not required to be fully accessible, consider designing such areas to include non-required turning spaces, and provide accessible elements whenever possible.

1.3.10. Elements located in circulation paths (such as Automated External Defibrillator devices, fire extinguishers and Digital Media Monitors) shall be within the protrusion limits as required by the ADA Standards for Accessible Design.

1.3.11. 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.

1.3.12. Alterations that affect an area containing a primary function shall ensure that the path of travel to the altered area is made accessible for individuals with disabilities unless the cost and scope of such alterations is disproportionate to the cost of the overall alteration (as defined in the ADA Standards for Accessible Design). 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.

1.3.13. Travel Accessibility Scoping Schedule

1.3.13.1. Design Professionals shall submit path of travel accessibility scoping recommendations, including specific elements and associated costs, no later than 50 percent Construction Documents.
1.3.13.2. Kitchenettes serving the altered area are not required to be included within a path of travel scoping schedule, however break rooms shall.

a. Recycle and waste collection centers shall be designed to allow for accessible reach ranges and clear floor space area.

1.3.14. Induction hearing loop systems shall be considered the system of choice for spaces requiring assistive listening systems.

2. COMMISSIONING

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

2.2. Projects with a construction budget over $1 million shall default to include commissioning activities.

2.3. Systems and components to be Commissioned:

2.3.1. As design progresses, the Owner shall establish the systems to be commissioned. The final list of commissioned systems shall be included in the Bid Documents.

2.3.2. Systems and component selection is based on the following guidelines:

2.3.2.1. Can the facility afford a system or component malfunction without endangering safety, health or significant comfort of occupants or research?

2.3.2.2. Is the system unique when compared to other installations across campus?

2.3.2.3. Does the system operate interdependently with other building or campus systems?

2.3.2.4. Will there be significant impact on energy consumption to operate or maintain the system?

2.3.3. Building Envelope Commissioning shall concentrate on verifying continuous thermal, air and vapor barriers.

2.4. The Owner shall inform the Design Professional whether the University, the Design Professional, or an independent third party will act as the University’s Commissioning Authority.

2.5. The Commissioning Authority is responsible for preparing the following documents, and providing them to the Design Professional for distribution.

2.5.1. Design Review Comments


2.5.3. Review Comments from Contractor Submittals – The focus of this review shall be to develop the Construction Checklists and Functional Performance Tests.

2.5.4. Construction Checklists – Project specific pre-functional checklists completed by the Contractor.
2.5.5. Functional Performance Tests – Project specific functional performance criteria completed and documented by the Commissioning Agent with Contractor assistance.

2.5.6. LEED Documentation – Commissioning documentation as required by LEED.

3. ENERGY

3.1. 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.

3.2. Energy conservation criteria shall be followed by the Design Professional to achieve a high performance building that will:

3.2.1. Reduce the total ownership cost of facilities.

3.2.2. Improve energy efficiency and water conservation.

3.2.3. Provide safe, healthy, and productive built environments.

3.2.4. Promote sustainable environmental stewardship.

3.3. Design construction projects adding new gross square footage, and projects enrolled in Commercial New Construction rebate program to reduce the energy cost budget a minimum of 20 percent below ASHRAE 90.1, version adopted by the State of Iowa. Available energy reduction strategies identified by the project team shall be presented by the Design Professional for total cost of ownership evaluation by the Owner.

3.4. The Design Professional shall conduct an energy analysis as outlined below:

3.4.1. Energy impact statements shall be required for projects with estimated construction budget in excess of $1 million.

3.4.2. The Design Professional shall submit energy analysis information to the Owner in electronic format.

3.4.3. Energy Impact Statement

3.4.3.1. The Design Professional shall complete an Energy Impact Statement with the following information: (Refer to ENERGY IMPACT STATEMENT in Appendices for template).

3.4.3.1.1. Project/Building Narrative: Provide a brief narrative describing the operational needs of the building, including,

3.4.3.1.1.1. Gross square footage

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

3.4.3.1.1.3. Hours of operation

3.4.3.1.1.4. Utilities required

3.4.3.1.1.5. Mechanical systems description
3.4.3.1.2. Methods and Assumptions: Describe methods and assumptions used to calculate estimated quantities for each of the following categories and discuss significant energy-consuming equipment:

3.4.3.1.2.1. Electrical
3.4.3.1.2.2. Low Pressure Steam
3.4.3.1.2.3. High Pressure Steam
3.4.3.1.2.4. Chilled Water
3.4.3.1.2.5. Domestic Cold Water
3.4.3.1.2.6. Domestic Hot Water
3.4.3.1.2.7. Natural Gas
3.4.3.1.2.8. Storm Drainage System

3.4.3.2. The Design Professional shall provide all relevant calculations including electronic copies of spreadsheets, energy models, equipment data sheets, etc. upon request.

3.4.4. ASHRAE standard 90.1 energy analysis:

3.4.4.1. New Building or Addition Projects – The Design Professional shall assist the Owner in determining if the project will be enrolled in the MidAmerican Energy or Alliant Energy New Construction Program.

3.4.4.1.1. The Design Professional shall demonstrate compliance using the energy cost budget method as described in ASHRAE 90.1 for projects enrolled in the MidAmerican Energy or Alliant Energy New Construction Program.

3.4.4.1.2. The Design Professional shall demonstrate compliance 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 New Construction Program.

3.4.4.2. Renovation Projects (construction costs ≥ $1 million) - energy analysis shall be as follows:

3.4.4.2.1. Renovation Projects (construction costs ≥ $1 million) are defined as infrastructure renovations, capital equipment replacement projects and renovations that alter mechanical and electrical systems where the construction costs are estimated to be greater or equal than $1 million.

3.4.4.2.2. The Design Professional shall demonstrate compliance by using either the energy cost budget method or the prescriptive method as described in ASHRAE 90.1.

3.4.4.3. Renovation Projects (construction costs < $1 million) - energy analysis shall be as follows:
3.4.4.3.1. Renovation Projects (construction costs < $1 million) are defined as infrastructure renovations, capital equipment replacement projects and renovations that alter mechanical and electrical systems where the construction costs are estimated to be less than $1 million.

3.4.4.3.2. The Design Professional shall demonstrate compliance by using either the energy cost budget method or the prescriptive method as described in ASHRAE 90.1.

3.4.4.4. Energy analysis shall be reviewed and approved by the Owner at the conclusion of design development and contract document.

3.4.5. Investment Payback Calculations:

3.4.5.1. New Building or Addition Projects – The Design Professional shall conduct a life cycle cost analysis of energy options in accordance with 661 IAC 303.4.

3.4.5.2. Renovation Projects – The Design Professional shall conduct a life cycle cost analysis of energy options using the following 2-pronged analysis:

3.4.5.2.1. Simple Payback and Modified Life Cycle Cost.

3.4.5.2.1.1. The Simple Payback: Each investment alternative shall be calculated using: \( \text{Payback Period} = \frac{\text{Annual Energy Savings}}{\text{Capital Cost of the ECM}} \)

3.4.5.2.1.2. 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.

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

3.4.6. Lighting Energy Analysis:

3.4.6.1. Interior Lighting:

3.4.6.1.1. The Design Professional shall ensure Lighting Power Densities (LPD) are 30 percent less than allowed by ASHRAE 90.1 and meet the IESNA recommendations for foot candle lighting levels.

3.4.6.1.2. The Design Professional shall provide photometrics for review no later than 50 percent Construction Documents.

3.4.6.1.3. Submit the LPD compliance form for review no later than 50 percent Construction Documents. The Design Professional shall use the Owner’s LPD compliance form outlining the following:

i. LPD compliance form can be located at http://www.facilities.uiowa.edu/pdc/designstandards/index.html.
3.4.6.1.3.1. The Design Professional shall use the Owner’s LPD compliance form http://www.facilities.uiowa.edu/pdc/designstandards/index.html to outline the following:

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

3.4.6.1.3.1.2. “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.

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

3.4.6.1.3.2.1. Calculations shall identify the room geometry including ceiling height and fixtures and room reflectance values.

3.4.6.1.3.2.2. Light loss factors shall be clearly noted.

3.4.6.1.3.2.3. Initial lighting levels are not acceptable.

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

3.4.6.1.4. 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. Submit narrative no later than 50 percent Construction Documents.

4. ENVIRONMENTAL COMPLIANCE

3.5.4.1. Hazardous Materials

3.5.4.1.1. Projects involving hazardous waste, including but not limited to, PCBs, lead, mercury, and solvents, the Design Professional shall coordinate with the Owner to ensure proper storage, handling, and disposal.

3.5.2.4.1.2. Projects involving universal waste, including but not limited to, batteries, mercury-containing equipment, fluorescent tubes, and ballasts, the Design Professional shall coordinate with the Owner to ensure proper storage, handling, and disposal.

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

3.7.4.3. Contaminated Soils

3.7.1.4.3.1. Design Professional shall coordinate with the Owner for proper handling and disposal of known contaminated material and reporting.

4.4. Clean Air Act Compliance

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

4.4.2. 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.

4.4.3. 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. Exceptions to 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:

4.4.3.1. Boilers

4.4.3.2. Emergency generators

4.4.3.3. Incinerators

4.4.3.4. Fuel burning equipment

4.4.3.5. Pollution control equipment

4.5. Spill Prevention Control and Countermeasures (SPCC) 40CFR112:

4.5.1. 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):

4.5.1.1. Provide double-walled container or secondary containment.

4.5.1.2. Design Professional shall coordinate with the Owner to ensure exchange of required information prior to final review of drawings and specifications.

4.6. Underground Storage Tanks (UST):

4.6.1. If the project includes installation of an underground storage tank, Design Professional shall coordinate with the Owner for proper notice and registration with IDNR.

4.6.2. If the UST is 19,812 gallons or more, an air construction permit is required. Coordinate with Owner for proper permitting.

4.6.3. For removal of an underground storage tank, Design Professional shall coordinate with Owner for proper tank closure procedures and reporting.
4.7. National Pollutant Discharge Elimination System (NPDES):

4.7.1. Municipal Separate Storm Sewer System (MS4) NPDES Permit:

4.7.1.1. 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.

4.7.1.2. 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.

4.7.1.3. For projects disturbing the land or landscape, consult with Owner to determine applicable permit requirements.

4.7.1.4. Consultants shall use Shive-Hattery, Inc. to develop a Storm Water Pollution Prevention Plan (SWPPP) for projects of one (1) acre or more.

4.7.1.5. Design shall minimize the post-construction storm water runoff to prevent or minimize water quality impacts and minimize the quantity of storm water runoff.

4.7.1.6. The site shall be designed to manage the water quality volume of 1.25 inches according to the Iowa Storm Water Management Manual.

4.7.1.7. Best Management Practices (BMP) include, but are not limited to, storm water detention, retention, grass swales, bio retention swales, riparian buffers, and green roofs. BMPs shall be included in the project design.

4.7.1.8. 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.

4.7.1.9. 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.

4.7.2. NPDES General Permit No. 2 – Storm Water Discharge Associated with Industrial Activity for Construction Activities:

4.7.2.1. Comply with the requirements of NPDES General No. 2. Consult with Owner to ensure compliance with all applicable permit requirements.

4.7.2.2. Construction Site Runoff Control:

4.7.2.2.1. For construction sites of one (1) acre or more:

4.7.2.2.1.1. Owner is responsible for obtaining the Iowa NPDES General Permit No. 2 for the project.

4.7.2.2.1.2. Design Professional shall include Owner’s permitting requirements in the documents.

4.7.2.2.2. For construction sites less than one (1) acre:
4.7.2.2.2.1. Contractor shall provide sediment and erosion control measures to prevent sediment from leaving the site.

4.7.2.2.2. Design Professional shall include Owner’s MS4 Permit requirements in the documents.

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

4.7.3.1. Comply with the requirements of NPDES General No. 1. Consult with Owner to ensure compliance with all applicable permit requirements.

4.7.4. 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.

4.8. Flood Plain Permits: For projects with any activity within a 100-year flood plain, coordinate with Owner for proper permitting.

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

4.5. DEMOLITION

4.1-5.1. Permits, hazardous materials, and salvaging of equipment or fixtures shall all be reviewed with the Owner.

4.1.1-5.1.1. A permit shall be required for abandonment of a well. Design Professional shall coordinate with the Owner.

4.1.2-5.1.2. A permit shall be required to refer to ENVIRONMENTAL COMPLIANCE for removal of an underground storage tank. Design Professional shall coordinate with the Owner.

II. CIVIL

The following information is provided as a general guideline in establishing Civil Engineering design requirements.

1. GENERAL

1.1. Construction documents shall show all activities contained within construction boundaries indicated on site plan. Specified excavation requirements, precautions, and protective systems shall be taken into consideration when establishing construction boundary.

1.2. Ensure movement of trucks and equipment on Owner’s property is in accordance with Owner’s instructions and depicted on construction documents.

1.3. Topsoil shall be stripped from the construction site when possible and stockpiled in designated area for reuse.

1.4. Trenches shall not be backfilled until all required tests are completed and the utility systems, as installed, conform to requirements specified by the Construction Documents.

1.5. When rock is anticipated to be encountered during construction. Establish a base bid quantity and include a unit price for rock removal on the Bid Form.
1.6. Disposal off-site (per direction of Owner). Contractor shall remove excess suitable and unsuitable fill
materials from project site and dispose of legally off the Owner’s property.
1.7. Design Professional shall specify inspection and testing requirements and shall include procedures for
evaluation of test data.
1.7.1. 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 the Geotechnical Engineer.
1.7.2. Owner shall retain the services of an Engineering Inspection and Testing Firm. Contractor shall be
responsible for coordinating and scheduling inspections.
1.8. The Design Professional shall assist the Owner in obtaining all necessary permits for the project. National
Pollutant Discharge Elimination System (NPDES):

a. Owner’s National Pollutant Discharge Elimination System (NPDES), Phase II, Municipal
Separate Storm Sewer System (MS4) permit is available on request.
b. Design Professional shall include the following design elements:
4.1.2.1.1.1.1.1.

Construction Site Runoff Control:

(a) For construction sites of an acre or more:
4.1.2.1.1.1.1.1.1.1.1.1. Owner is responsible for obtaining the Iowa NPDES
General Permit No. 2 for the project.
4.1.2.1.1.2.1.1.1.1.1.1. Design Professional shall include Owner’s permitting
requirements in the documents.
4.1.2.1.2.1.1.1.1.1.

construction sites less than one (1) acre:

4.1.2.1.2.1.1.1.1.1.1.1. Contractor shall provide sediment and erosion
control measures to prevent sediment from leaving the site.
4.1.2.1.2.2.1.1.1.1.1.1. Design Professional shall include Owner’s MS4 Permit
requirements in the documents.
1.9. Post-Construction Storm Water Management: Refer to the Owner’s MS4 permitENVIRONMENTAL
COMPLIANCE for design requirements.
2.

SUBSURFACE INVESTIGATION
2.1. The Owner shall be responsible for providing record information of underground utility lines and
structures.
2.2. Contractor shall contact Iowa One-Call for location of utilities 48 hours before any excavation takes place.
All locates shall be Joint Locates.
2.3. If investigative soils analysis is required during project design, Owner shall retain a Geotechnical Engineer.

SECTION III – GENERAL DESIGN STANDARDS

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2.4. The Geotechnical Engineer, in consultation with the Owner and the Design Professional, shall determine number, sizes, depth, and proposed location of borings and/or pits. 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. To the extent possible, borings shall be located near the location of proposed footings/piers.

2.5. Boring information shall be shown, with dimensions, on a plot plan to be submitted in two (2) copies by the Design Professional to the Owner at least five (5) working days prior to proposed sampling.

2.6. The plan shall show:

2.6.1. A graphic scale, north arrow, and location of existing buildings and trees.

2.6.2. Above and below ground service/utility lines (both utility company and University-owned).

2.6.3. Pavement areas and established benchmark(s) with elevation(s) noted.

2.6.4. Existing site features, not specifically mentioned, impacting boring or pit locations.

2.6.5. The soils/geotechnical report shall be included as an informational item of the bidding documents in the general requirements, Section I.

3. SITE SURVEY

3.1. 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. This survey shall include, but not be limited to:

3.1.1. Any active or abandoned utility whether University of Iowa, City of Iowa City or private utility company services.

3.1.2. Adequate topographic information and spot elevations to allow for proper design for drainage.

3.1.3. Location, size and name of all plant material. This information shall be provided to Owner for evaluation of condition and determination of protective measures during construction.

3.1.4. Location and type of all site lighting fixtures.

3.1.5. Location of all structures, parking lots, sidewalks, roads, paths, etc.

4. LANDSCAPING

4.1. General

4.1.1. Selection of landscape plant materials shall be based on USDA Hardiness Zone 5a.


4.1.3. Selected plant materials shall not be on the Iowa Department of Natural Resources Invasive Plant Species list at: [www.iowadnr.gov/Environment/Forestry/ForestHealth/InvasivePlants.aspx](http://www.iowadnr.gov/Conservation/Forestry/Forest-Health/Invasive-Plants)
4.1.4. 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. Proposed removals shall be reviewed and approved in writing by the Owner.

4.1.5. All proposed plant material selections shall be approved by Owner. Plant selection shall be submitted no later than 50 percent Construction Documents.

4.1.6. Planting Schedules

4.1.6.1. A planting schedule shall be provided in the Contract Document.

4.2. Soils

4.2.1. Refer to Section IV for information.

4.3. Plantings

4.3.1. Group Plantings

4.3.1.1. Group plantings are encouraged due to the benefits of trees in close proximity.

4.3.1.2. Group planting shall be considered for the following locations

4.3.1.2.1. Green streets, such as a median or traffic triangle, with the opportunity for a large planting bed.

4.3.1.2.2. Continuous tree pit, where two or more trees are planted in a single trench in the sidewalk. Minimum continuous tree pit shall be 30 feet.

4.3.1.2.3. Raised planting bed within a plazas or alongside pedestrian passageways.

4.3.2. Trees and Shrubs

4.3.2.1. Critical Root Zone Protection

4.3.2.1.1. Refer to LANDSCAPING TREE PROTECTION DETAIL in Appendices.

4.3.2.1.2. The critical root zone (CRZ) shall be shown for each planting to remain.

4.3.2.1.3. Plantings to remain shall be protected by fencing installed to define the limits of the CRZ. Fence shall be installed prior to Contractor beginning site work, using the following formula and criteria:

4.3.2.1.3.1. Diameter of tree trunk is measured 4 ½ feet above ground level.

4.3.2.1.3.2. The diameter in inches is multiplied by 1 ½ feet to obtain the critical root zone radius.

4.3.2.1.3.3. When the above CRZ radius cannot be met, obtain written approval shall be obtained from the Owner for alternate method.

4.3.2.1.4. Fence shall remain intact throughout the construction period.
4.3.2.1.4.1. Fences shall be regularly inspected by the Owner. Identified deficiencies shall be immediately corrected.

4.3.2.1.4.2. If the health or welfare of the planting is determined to be at risk by the Owner, protection will be installed or augmented by the Owner at the Contractor’s cost.

(b) Projects with an anticipated duration of less than eight (8) months shall be [DETAIL FROM LS]

4.3.2.1.5. Projects with an anticipated duration of eight (8) months or longer shall have galvanized chain link fence posts and fabric, minimum height of 4 feet 0 inches. [DETAIL FROM LS]

4.3.2.1.6. No construction activities shall take place within the CRZ.

4.3.2.1.7. No equipment, materials, supplies and/or salvage shall be stored or placed within the CRZ.

4.3.2.2. The following species shall not be used along streets.

<table>
<thead>
<tr>
<th>Ash</th>
<th>Black Locust</th>
<th>Box Elder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalpa</td>
<td>Conifers</td>
<td>Mountain Ash</td>
</tr>
<tr>
<td>Mulberry</td>
<td>Poplars</td>
<td>Russian Olive</td>
</tr>
<tr>
<td>Silver Maple</td>
<td>Tree of Heaven</td>
<td>Willows</td>
</tr>
</tbody>
</table>

4.3.3. Turf

4.3.3.1. Finished turf areas shall have a final grade no steeper than 1 foot vertically to 3 feet horizontally. Steeper areas shall be covered with ground covers or modified with walls or other treatments.

4.3.3.2. 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.

4.3.3.3. Seed and Sod

4.3.3.3.1. Sod shall be provided at building entrances and high profile areas or when required for erosion control.

4.3.3.3.2. Seeding is preferred for long-term establishment. Selection of seed mix shall be based on site specific issues and reviewed with Owner.

4.3.3.3.3. Dormant seeding is allowable through a deviation request only with written approval from Owner.

4.4. Landscape Furniture and Fixtures
4.4.1. Site plans shall indicate the location of all site furniture (benches, signs, fences/barriers, bike racks, landfill and recycling receptacles, etc.).

4.4.2. Custom designed site furnishings shall not be allowed without a Deviation Request require written approval from Owner.

4.4.3. All metal shall be painted black.

4.4.4. All wood shall be Ipe.

4.4.5. 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. This shall include retaining walls, handrails, seat walls and site furniture benches, etc. Proposed solutions shall complement and be an integral part of the overall site design.

4.4.6. 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.

4.4.7. Bicycle Parking

4.4.7.1. Bicycle parking shall be provided per UI Parking and Transportation requirements.

4.4.7.2. Bicycle parking shall be evaluated based on the building programming, existing demand, and future growth.

4.4.7.2.1. 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.

4.4.7.2.2. Minimum of two (2) spaces, as based on the Association of Pedestrian and Bicycle Professionals’ Bicycle Parking Guidelines.

4.4.7.2.3. Final bicycle count shall be approved by Owner.

4.4.7.3. Bicycle racks shall be located along a major building approach line and clearly visible from the approach. The rack area shall be within 50 feet of an actively used building entrance but no further than 120 feet from an entrance. A rack area shall be as close as, or closer than, the nearest car parking space.

4.4.7.4. Bicycle racks shall be surface-mounted. Install 24 to 30 inches from surrounding wall or object.

4.4.7.5. Parallel racks shall be installed to allow pedestrian traffic between parked bikes.

4.5. Exterior Building Signage

4.5.1. All new buildings shall have at least one (1) major building identification sign located in close proximity to the building’s main entrance. Secondary entrances may be signed with a smaller building identification sign if the entrance is open to general public access and has public exposure. Final locations shall be reviewed and approved by the Owner.

4.5.2. Signs or lettering shall not be applied to an exterior building surface.
4.5.3. Design Professional shall identify signage locations on site drawings.

5. ROADWAYS, PARKING LOTS AND WALKWAYS

5.1. General

5.1.1. Curbs shall be Portland cement concrete.

5.1.2. Pavements shall be designed to accommodate the design vehicle for the pavement’s use.

5.1.3. 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.

5.1.4. Mowing strips shall be incorporated into the parking lot design where the lot abuts lawn areas. Mowing strip shall be 24 inches wide strip of pavement, on the lawn side of the curb or parking bumpers, to allow the lawn to be mowed while parking spaces are occupied.

5.1.5. All sidewalks, ramps, and other paved, exterior walking surfaces shall be concrete. Concrete pavers may be used in limited areas as accents.

5.1.6. All materials shall be slip resistant.

5.1.7. 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.

5.1.8. Design shall be in accordance with AASHTO “GREEN BOOK”— A Policy on Geometric Design of Highways and Streets.

5.1.9. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.

5.2. Roadways

5.2.1. Asphalt and Portland Cement Concrete Paving

5.2.2. The ratio of slab width to length shall not exceed 1.67 for street pavements.

5.2.3. Variance in joint spacing may be permitted to achieve desired architectural effect as approved by Owner.

5.3. Parking Lots

5.3.1. All accessible parking spaces shall be designed per “universal accessible” criteria defined in Iowa Administrative Code Section 661-18.3 Exception.

5.3.2. Parking spaces, other than accessible shall be 8 feet 6 inches in width. No compact car spaces shall be permitted.

5.3.3. All accessible parking spaces shall be designed per “universal accessible” criteria as defined in Iowa Administrative Code Section 661-18.3.

5.3.4. Metered accessible parking spaces shall include curb-cuts and sidewalk access to the meters.
5.4. Walkways

5.4.1. All sidewalks shall have a minimum width of 8 feet. Where a sidewalk abuts a road or driveway, minimum width shall be 10 feet.

5.4.2. 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.

5.4.3. A medium broom finish shall be applied perpendicular to traffic flow. All brooming directions shall be shown on the drawings and described in the specifications.

5.4.4. All sidewalks leading up to a vehicular roadway or route shall have a detectable warning plate installed.

5.4.5. Site steps are not allowed on public sidewalks when ADA requirements can be accomplished with a ramp. Design accessible exterior routes without ramps when possible and use alternatives such as sidewalks and proper grading to achieve gentler slopes.

5.4.6. The ratio of slab width to length shall not exceed 1.25.

5.4.7. Variance in joint spacing may be permitted to achieve desired architectural effect as approved by Owner.

5.4.8. Concrete color shall be specified to match surrounding walkways.

6. TEMPORARY TRAFFIC CONTROL

6.1. General

6.1.1. Barricades

6.1.1.1. Construction sites in or adjacent to the pedestrian access route shall be protected with a barricade.

6.1.1.2. Barricades shall be installed in the following locations:

6.1.1.2.1. Between the pedestrian access route and any adjacent construction site.

6.1.1.2.2. Between the alternate circulation path and any adjacent construction site.

6.1.1.2.3. Between the alternate circulation path and the vehicular way, if the alternate circulation path is diverted into the street.

6.1.1.2.4. Between the alternate circulation path and any protruding objects, drop-offs, or other hazards to pedestrians.

6.1.1.2.5. 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.

6.1.1.3. Wooden railing, fencing, and similar systems placed immediately adjacent to motor vehicle traffic shall not be used as substitutes for crashworthy temporary traffic barriers.
6.1.1.4. Tape, rope or chain shall not be used as a control for pedestrian movements or as a safeguard to protect individuals from hazards.

6.1.1.5. Barricades are not required where the construction site or alternate-circulation path is enclosed with a solid, cane-detectable fence or wall.

6.1.1.6. Where protection is provided using a solid fence or wall, a painted or applied horizontal 6 inch minimum stripe in 70 percent contrast shall be provided at between 42 and 60 inches above the adjacent grade.

6.1.1.7. Barricade specifications:

6.1.1.7.1. Shall meet or exceed ADA guidelines and MUTCD standards. Use Plastic Safety Systems Safety Wall ADA compliant pedestrian barricades or approved equal.

6.1.1.7.2. Construction barricades at the alternate circulation path shall be continuous, stable and non-flexible.

6.1.1.7.3. Shall have a solid toe rail with its top edge at 6 inches minimum in height and its bottom edge no higher than 1 ½ inches above the adjacent surface.

6.1.1.7.4. Shall have a continuous railing mounted at a top height of 36 to 42 inches with diagonal stripes having at least 70 percent contrast.

6.1.1.7.5. 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.

6.1.1.7.6. Barricade support members shall not protrude more than 4 inches beyond the toe rail into the alternate circulation path.

6.1.2. Warnings and Signage

6.1.2.1. Warning signs shall be posted when an alternate circulation path or a barricade is created in the public right-of-way.

6.1.2.2. Warnings shall be located at both the near side and the far side of the intersection preceding a temporarily completely blocked pedestrian way.

6.1.2.3. 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).

6.1.2.4. 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.

6.1.2.5. Wall and/or post-mounted signs with a leading edge between 27 and 80 inches above ground shall protrude no more than 4 inches. 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.

6.1.2.6. Adequate lighting shall be required to provide visibility of signage during non-daylight hours.
SECTION III – GENERAL DESIGN STANDARDS

6.1.2.7. Visual characters shall comply with the 2010 ADA Standards for Accessible Design, Section 703.5, excluding 703.5.1. Finish and contrast shall be eggshell finish with a minimum 70 percent visual contrast.

6.1.2.8. Pedestrian control signage shall be white with black lettering, except the S1-1 and R1-6A signs.

6.2. Vehicular Traffic

6.2.1. Temporary traffic control shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).

6.2.2. Construction activity impacting any street shall have a temporary traffic control plan approved by the appropriate agency

6.2.2.1. Iowa City Engineer’s Office
6.2.2.2. Coralville City Engineer’s Office
6.2.2.3. Iowa Department of Transportation
6.2.2.4. The University of Iowa - Building & Landscape Services

6.2.3. Contract Documents shall include language for Contractor to provide and install temporary construction project signage, with Contractor responsible for maintaining as installed through project completion.

6.2.4. Signs may be installed on the project fencing or supported independently, depending on site conditions.

6.3. Pedestrian Traffic

6.3.1. 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:

6.3.1.1. Limits of construction (staging areas, entrance to construction site / staging areas, vehicular circulation to and through site).
6.3.1.2. Pedestrian routes around construction site (accessible routes, accessible parking locations, crosswalks, curb-cuts).
6.3.1.3. Building entrances (key building entrances and service areas to be maintained, accessible building entrances).
6.3.1.4. Signage plan (proposed pedestrian signage, designated pedestrian routes, signage location).
6.3.1.5. Details of proposed pedestrian safety improvements (temporary sidewalks, ramps, etc.).
6.3.1.6. Phasing (separate plans indicating construction phasing and schedule).

6.3.2. Pedestrian control plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) Part 6: Temporary Traffic Control
6.3.3. Alternate / Temporary Pedestrian Circulation Paths

6.3.3.1. 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.

6.3.3.2. Where the alternate circulation path is adjacent to potentially hazardous conditions, the path shall be protected with a barricade.

6.3.3.3. The alternate circulation path shall have no protrusions up to a height of 80 inches, including scaffolding and scaffolding braces.

6.3.3.4. A pedestrian route shall not be severed and/or moved for non-construction activities, such as parking for vehicles and equipment.

6.3.3.5. Access to transit stops shall be maintained.

6.3.3.6. Where possible, the alternate circulation path shall parallel the disrupted pedestrian access route, on the same side of the street.

6.3.3.7. 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.

6.3.4. Movement by work vehicles and equipment across pedestrian walkways shall be minimized and, when necessary, shall be controlled by flaggers.

6.3.5. Staging or stopping of work vehicles or equipment along the side of pedestrian paths shall be avoided.

6.3.6. Access to the work space by workers and equipment across pedestrian walkways shall be minimized.

7. SANITARY SEWER

7.1. General

7.1.1. Sanitary sewers shall be designed in accordance with the standards and requirements of The Iowa Department of Natural Resources.

7.1.2. Sewer systems shall be designed to carry traffic loads in all locations.

7.2. Piping

7.2.1. Refer to Section IV for information.

7.3. Accessories

7.3.1. Review manhole numbering with Owner.

7.3.2. Pre-cast concrete manholes shall comply with ASTM C478 or ASTM C76, Class 3.

7.3.3. Cast-in-place manholes shall be fully detailed in the construction documents.
8. STORM SEWER

8.1. General

8.1.1. Rational Formula shall be used. Runoff Coefficients shall be selected from the tables in the current version of SUDAS, Chapter 2, Storm Water.

8.1.2. This section applies to storm water conveyance systems outside the footprint of buildings. Refer to Mechanical Systems section for building systems.

8.1.3. Design Professional shall submit estimated storm water loads to Owner for evaluation with the West Campus Storm Water Study no later than Design Development Documents. Refer to Section II for information.

8.1.4. 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.

8.1.5. Storm water systems shall be designed using the actual time of concentration. The worst case of complete development, per the current Campus Master Plan, or current conditions shall be used for calculation of offsite flow.

8.1.6. No ponding is allowed on paved areas. Detention basins shall be labeled on the drawings.

8.1.7. Return Periods

8.1.7.1. 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.

8.1.7.2. Return periods shall be ten (10) years with actual time of concentration (duration) for parking lots, park space, and open areas.

8.1.7.3. Owner shall establish “return periods” for all other areas. Return period shall satisfy governing municipality’s regulations.

8.1.7.4. Design Professional shall compare above return periods with those required by the local municipality. Coordination with municipality may be required and shall be reviewed with the Owner. Any discrepancies shall be discussed with the Owner.

8.1.8. Buildings and structures shall be developed so water does not enter through doors, window wells, area ways, basements, drains, etc., during a minimum hundred-year storm. Design shall maintain positive drainage away from building entrances.

8.1.8.1. Connections to building drains shall be designed to prevent surcharge from the storm sewer for the hundred-year storm.

8.1.8.2. Sidewalk grade shall be set to prevent surface from collecting and channeling surface drainage.

c. National Pollutant Discharge Elimination Systems (NPDES)

(1) Comply with the requirements of the NPDES General Permit No. 2.
(2) The University’s Municipal Separate Storm Sewer System (MS4), NPDES Permit requires the control of storm water runoff from long term post-construction sites (MS4, NPDES Permit No. 52-25-0-06, condition II-E).

(3) In compliance with the MS4 requirements, Consultants shall use Shive-Hattery, Inc. for the development of SWPPP for projects over 1 acre or more.

(4) Design shall minimize the post-construction storm water runoff in order to prevent or minimize water quality impacts and minimize the quantity of storm water runoff.

(5) The site shall be designed to manage the water quality volume of 1.25 inches by infiltration processes according to the Iowa Storm Water Management Manual.

(6) Best Management Practices (BMP) incorporating features including, but not limited to, storm water detention, retention, grass swales, bio retention swales, riparian buffers, or green roofs shall be included in the project design. Submit narrative describing BMP features, including operation and maintenance requirements, no later than 50 percent Construction Documents. A deviation request form is required for projects without a documented BMP.

8.2. Piping

8.2.1. Storm pipes shall run on a straight line and grade between structures.

8.2.2. Horizontal and vertical bends are permitted in roof drain connections provided a cleanout is included. The deflection shall utilize a wye with the cleanout as an upstream extension of the downstream line’s alignment.

8.3. Accessories

8.3.1. Intake Grates

8.3.1.1. Grates shall be placed outside of pedestrian pathways when possible.

8.3.1.2. If grates must be placed within pedestrian pathways; they shall comply with the following: require written approval from Owner.

8.3.1.2.1. Refer to the current edition of “ADA Standards for Accessible Design, Floor or Ground Surfaces” for maximum spacing and configuration.

8.3.1.2.2. Grating sizing shall be reviewed with Owner. Consideration shall be made regarding the types of traffic, material transported in the area, and types of footwear expected.

9. DOMESTIC WATER

9.1. General

9.1.1. 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.
9.1.2. Flushing instructions shall be explicit in drawings, including source of water, outlet point, air relief vents, and final destination of water.

9.2. Piping

9.2.1. Piping shall conform to AWWA standards and the requirements of the Iowa DNR.

9.2.2. Piping shall have an Iowa DNR permit. Permit shall be filled out by the Design Professional and signed by the Owner.

9.3. Accessories

9.3.1. Water meters shall be located inside buildings. Provide a ¾ inch conduit from the meter back to a central PLC location for remote meter monitoring. Refer to \textit{UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL} in Appendices.

9.3.2. Fire hydrants shall be provided in accordance with the requirements of the local fire district or department. 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 \textit{UTILITY DISTRIBUTION HYDRANT DETAILS} in Appendices.

9.4. Testing: \textit{Refer to Section IV for information.}

10. NATURAL GAS

10.1. Natural gas piping upstream of the meter shall be coordinated with the Natural Gas Provider.

10.2. Natural gas piping downstream of meter shall be coordinated with the Owner and shall not be buried.

11. CHILLED WATER

11.1. General

11.1.1. Coordinate the building central chilled water interface design and anticipated usage with Owner.

11.1.2. Provide for the installation of control equipment and a communications pathway to support central chilled water interface monitoring and control, including a PLC with ¾ inch conduit to all metering and control devices.

11.1.3. Condensing water systems shall be equipped with automatically controlled water treatment and blow down systems designed to control scale buildup, corrosion, and concentration of dissolved solids. Coordinate equipment requirements with Owner.

11.1.4. Provide controls for every device.

11.1.5. Three-way or on/off valves shall not be used.

11.1.6. Size control valves for the entire range of flow, considering the maximum pressure drop possible. System pressure shall not be allowed to overpower any control valve. Use the flow coefficient provided by the manufacturer to determine the maximum allowable pressure drop for each valve.
11.1.7. Verify final valve sizing with The University of Iowa Chilled Water Plant.

11.2. Piping: Refer to Section IV for information.

11.3. Accessories: Refer to Section IV for information.

2. Accessories

11.4. Testing: Refer to Section IV for information.

3. Testing

   a. Refer to Section IV for information.

12. STEAM AND CONDENSATE

12.1. General

12.1.1. Steam lines designated as a main Campus steam service shall be installed in a utility tunnel.

12.1.2. Design steam and condensate systems to 175 psig, and 500 degrees F.

12.1.3. Condensate systems shall be equipped with automatically controlled water treatment and blow down systems designed to control scale buildup, corrosion, and concentration of dissolved solids.

12.1.4. Coordinate steam distribution system load design requirements, available steam distribution facilities and operational needs of the steam plant with Owner.

12.1.5. Provide provisions for pipe expansion.

12.1.6. Design condensate systems to account for condensate load during steam startup.

12.2. Piping

12.2.1. The Design Professional shall furnish design pipe size and flow information to the Owner.

12.3. Accessories

12.3.1. Meter Stations

   12.3.1.1. Meter stations are required for steam system usage points at each building.

   12.3.1.2. Each meter station shall consist of a V-cone steam flow meter and multi variable transmitter with Tri-Loop. Project shall provide raceway from each steam flow meter to the utilities PLC cabinet.

   12.3.1.3. Review product specifications, sizing, manufacturer numbers and cabling with the Owner.

12.3.2. Steam Trapping Stations

   12.3.2.1. Trapping stations shall be located every 250 feet and at elevation changes on steam lines.

   12.3.2.2. Direct-bury steam systems shall require steam vaults to access trapping stations.
12.3.2.3. Refer to **UTILITY DISTRIBUTION STEAM TRAPPING STATION DETAIL** in Appendices.

b. Pressure Reducing Valves (PRV)

12.3.3. Every building shall have a PRV.

12.3.4. Piping Penetrations: Through walls shall be detailed on drawings.

12.3.5. Supports and Anchors

12.3.5.1. All piping hangers and anchors shall be properly designed to avoid excessive stress in any pipe section.

12.3.5.2. Support and anchoring details shall be provided for all steam and condensate piping.

12.3.5.3. Supports and Anchors shall be detailed on the drawings. All anchor points shall be reviewed by a Structural Engineer.

12.3.6. Expansion joints: **Expansion joints shall be piston type and shall be detailed on the drawings.**

(1) Expansion joints shall be piston type and shall be detailed on the drawings.

12.4. Testing: Provisions for Steam-Blow shall be shown on design drawings and procedures shall be reviewed by the Owner and Engineer of Record.

13. **UTILITY TUNNELS**

13.1. Refer to Section IV for information.

14. **ELECTRIC DISTRIBUTION**

14.1. General: Refer to Section IV for information.

14.2. High Voltage Equipment: Refer to Section IV for information.

14.3. Ductbank: Refer to Section IV for information.

15. **COMMUNICATIONS DISTRIBUTION**

15.1. General: Refer to Section IV for information.

15.2. Underground Pathways: Refer to Section IV for information.

15.3. Building Entrance Pathway: Refer to Section IV for information.

15.4. Communication Manholes: Refer to Section IV for information.

15.5. Termination, Splicing and Testing: Refer to Section IV for information.

### III. ARCHITECTURAL

The following information is provided as a guide in establishing architectural requirements and shall not be construed to limit the Design Professional from proposing more cost effective alternates.
1. GENERAL

1.1. Building Elevations:

1.1.1. Finished floor height shall be expressed on contract documents as actual elevation based on The University of Iowa’s datum.

1.1.2. Floor elevations shall be continuous without height transitions between floor types.

1.2. Standard Floor and Room Numbering:

1.2.1. SpaceCampus Planning & Utilization (SPU) and Space Management (CPSM) shall assign all building and room numbers.

1.2.2. The Design Professional shall provide the Owner with an electronic copy of the plan drawings. The renumbering of any room, group of rooms or all rooms within a building, or the initial numbering of rooms within a new building, building addition, or acquired building is subject to the approval of SPU/CPSM.

1.2.3. Process to Assign Room Numbering Assignment and Update Room Numbers Process:

1.2.3.1. By the end of the Schematic Design phase, the Design Professional shall provide floor plan(s) to Space Planning and Utilization (CPSM) for review. Rooms and other spaces, including exterior entries, shall be numbered in accordance with University conventions and returned.

1.2.3.2. The project shall use the room numbers provided for in the Design Development documents.

1.2.3.3. If the building/room layout changes at Design Development, or any subsequent phase, the Design Professional shall request an update to the room numbering plan from SPU/CPSM.

1.2.3.4. Construction Documents shall not be issued for bid without completing steps 2 and 3.

1.2.3.5. Room names and numbers shall be identified on all floor plan drawings.

1.2.3.6. Per the Standard Form of Agreement, the Design Professional shall submit CAD drawings of the Construction Documents to SPU/CPSM within ten (10) working days of the award of construction contract.

1.2.3.7. Design Professional shall notify Owner of any changes during the course of construction that impact room numbering or entry doorways. Owner shall provide new room numbering designations. The Design Professional shall update the Construction Documents, including finish and door schedules, with the new room numbering designations.

1.2.3.8. The Design Professional shall include the final room number designations and updated schedules in the Record Documents.

2. BUILDING ENVELOPE

2.1. General
2.1.1. The building envelope shall comply with ASHRAE/IES Standard 90.1.

2.1.2. The wall assembly shall have a minimum R-value of 24

2.1.3. The roof assembly shall have a minimum R-value of 30

2.2. Exterior Building Materials:
   2.2.1. 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.
   2.2.2. Materials shall be practical, maintenance free, durable, and cost effective.
   2.2.3. Exterior walls systems of brick or stone are preferred over metal.
   2.2.4. Block backup is preferred over the use of steel stud backup.
   2.2.5. Exterior insulation and finish systems (EIFS) stucco and plaster shall not be used as the primary finish of a building or renovation.

2.3. Exterior Enclosure Performance Requirements:
   2.3.1. 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 inch water (1.57 psf) (0.02 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2178.
   2.3.2. 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.

3. ROOFING

3.1. General

3.1.1. Roofing systems shall comply with the following:
   3.1.1.1. Underwriters Laboratory (UL):
   
   3.1.1.1.1. UL labels are required for each membrane, with top side fire rating meeting ASTM E108 Class A.


   3.1.1.5. FM Global RoofNav:

   3.1.1.5.1. Minimum 1-60 SH (severe hail) approved rating.
3.1.1.5.2. All components shall be approved for both individual and use in a listed assembly.

3.1.2. Roof Access: Stairs shall be provided for roof access. Ladders and ships ladders are not acceptable.

3.1.2.3.1.3. Verify wind velocity requirements with the Owner.

3.1.2.3.1.4. All roofing materials shall be asbestos-free.

3.1.4.3.1.5. The Design Professional shall consider the following design parameters when selecting a roof system:

3.1.4.1.3.1.5.1. Life expectancy of building

3.1.4.2.3.1.5.2. Life of the roof system

3.1.4.3.3.1.5.3. Present and future use of building, including specific uses in the building that could affect the roof system

3.1.4.4.3.1.5.4. Aesthetics

3.1.4.5.3.1.5.5. Initial cost of the roof system and additional building costs required for recommended roof system

3.1.4.6.3.1.5.6. Maintenance costs and requirements

3.1.4.7.3.1.5.7. Energy costs associated with recommended roof system

3.1.4.8.3.1.5.8. Building height, roof slope, wind resistance requirements

3.1.4.9.3.1.5.9. Local environmental issues, contaminants and pollutants

3.1.4.10.3.1.5.10. Structural properties of roof superstructure

3.1.4.11.3.1.5.11. Type of roof deck

3.1.4.12.3.1.5.12. Vapor retarder requirements

3.1.4.13.3.1.5.13. Roof traffic, access and penetrations

3.1.4.14.3.1.5.14. Code and insurance requirements and restrictions

3.1.4.15.3.1.5.15. HVAC internal pressures

3.1.4.16.3.1.5.16. Application issues, such as staging

3.1.5.3.1.6. The Design Professional shall follow these roofing guidelines when designing the roofing system:

3.1.5.1.3.1.6.1. Single-ply ballasted roofs and spray foam roofing system shall not be used.

3.1.5.2.3.1.6.2. 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.
3.1.5.3 Locate roof drains at projected low points.

3.1.5.4 Provide roof walkways to and around rooftop equipment, and other areas, as directed by the Owner. Roof mats shall be a non-slip material.

3.1.5.5 Supports for rooftop-mounted equipment shall be a minimum 14 inch height above finished roof. Use prefabricated equipment supports where possible. Equipment support frames or stands shall provide following working clearances:

<table>
<thead>
<tr>
<th>EQUIPMENT WIDTH</th>
<th>HEIGHT ABOVE FINISHED ROOF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25 inches</td>
<td>14 inches</td>
</tr>
<tr>
<td>25-37 inches</td>
<td>18 inches</td>
</tr>
<tr>
<td>37-49 inches</td>
<td>24 inches</td>
</tr>
<tr>
<td>49-61 inches</td>
<td>30 inches</td>
</tr>
<tr>
<td>Over 61 inches</td>
<td>48 inches</td>
</tr>
</tbody>
</table>

3.1.5.6 Existing roof decks shall be checked by a Registered Structural Engineer, as directed by Owner.

3.1.5.7 Existing roof access shall be evaluated, and roof access hatches, ladders, and other components shall be installed.

3.1.5.8 Minimize use of pitch pans or sealant pockets. Maintain minimum 12 inch flashing height above finished roof.

3.1.5.9 Minimize roof penetrations. If structural penetrations are unavoidable, use round structural steel shapes to facilitate flashing.

3.1.5.10 Account for thermal break(s).

3.1.5.11 In new construction, roof shall have a minimum design slope of ¼ inch per foot.

3.1.5.12 In reroofing, the roof shall have a minimum slope of 1/8 inch per foot. Tapered insulation may be necessary to achieve required slope.

3.1.5.13 Use crickets, saddles and edge strips, tapered at 2 times slope, to direct water from penetrations and parapet walls.

3.1.5.14 Green roof systems and 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.
3.2. Roofing Systems:

3.2.1. Green Roof Systems:

3.2.1.1. Systems shall be modular and non-compartmentalizing.

3.2.1.2. Shall have direct access to green roof installations. Access through office space, classrooms, labs or other non-public areas is not acceptable.

3.2.2. Metal Roofing-Structural Standing Seam (SSR)

3.2.2.1. Structural metal roofing shall meet UL 90 uplift rating.

3.2.2.2. Minimum design slope 1 inch per foot.

3.2.3. Slate:

3.2.3.1. Slate material shall be ASTM C406, Type-S1, with ninety (90) to one hundred (110) year performance-life.

3.2.3.2. Use of artificial slate requires Owner approval.

3.2.3.3. Minimum design slope 5 inches per foot. Slopes down to 3 inches per foot are acceptable with adhered polyethylene reinforced bitumen sheet underlayment.

3.2.4. Asphalt Shingles:

3.2.4.1. Asphalt shingles shall be fiberglass seal-tab type with minimum twenty-five (25) year manufacturer’s warranty.

3.2.4.2. 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.

3.3. Roofing Components

3.3.1. Membrane and Insulation Assemblies: Refer to Section IV for information.

3.3.2. Roof Deck

3.3.2.1. Systems shall be designed by a registered Structural Engineer.

3.3.2.2. Design Professional shall determine expected wind uplift conditions and determine suitability of the recommended system.

3.3.2.3. Roof deck securement shall be per FM Global Property Loss Prevention Data Sheet 1-29.

3.3.2.4. 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.

3.3.2.5. Gypsum, wood or wood fiber cement decks shall not be used.
3.3.3. Vapor Retarders: Design Professional shall determine the need for a vapor retarder. Provide calculations to Owner for record.

3.4. Accessories: Refer to Section IV for information.

4. DOORS AND WINDOWS

4.1. Doors:

4.1.1. Design Professional shall review condition of existing doors and hardware and shall advise the Owner of necessary or recommended replacements or upgrades.

4.1.2. Minimum door size shall be 3 feet 0 inches in width and 7 feet 0 inches in height. Door heights shall not exceed 8 feet 0 inches.

4.1.3. Doors shall have an intermediate rail at the centerline of exit device.

4.1.4. Glass doors shall have stiles and rails

4.1.5. Doorframes installed in existing structures shall match the color of existing door frames.

4.2. Hardware:

4.2.1. Refer to LOCKSET TYPES BY BUILDING DETAILS in Appendices

4.2.2. All door hardware shall be heavy-duty, institutional grade.

4.2.3. General Assignment Classrooms shall have electronic access control.

4.2.4. Non-General Assignment Classrooms shall have double cylinder classroom security (intruder function) locksets.

4.2.5. ITS telecommunication rooms shall have electronic locks, door closers, and access control.

4.2.6. Hardware specifications shall be provided by a Door & Hardware Institute Certified Architectural Hardware Consultant.

4.2.7. Electrified hardware that is to integrate with the University’s AMAG access control system shall be 24 volt. Electrified hardware that is to integrate with the University’s Millennium access control system shall be 12 volt. Refer to the Electronic Access Control and Security (AMAG) section for more information.

4.2.8. Hinges:

4.2.8.1. Hinges shall be of full mortise-type with concealed bearings. Exterior hinges shall be stainless steel.

4.2.8.2. Use non-removable pins on all out-swing doors which are to be secure.

4.2.9. Door Closers:
4.2.9.1. Floor and concealed top jamb-mounted closers are not acceptable.

4.2.9.2. Cushion stops shall not be used.

4.2.9.3. Delayed action may be used in animal care facilities only.

4.2.9.4. Door closers shall be installed on all custodial, maintenance, and telecommunication rooms.

4.2.10. Power Operators:

4.2.10.1. Power operators shall be hard-wired, push plate operated only. Radio frequency types shall not be used.

4.2.10.2. Push-and-go function shall not be activated.

4.2.11. Protection Plates: Protection plates shall be used on all doors with door closers.

(1) Protection plates shall be used on all doors with door closers.

4.3. Windows:

4.3.1. Replacement windows shall be aluminum. In restoration projects, wood windows may be allowed as approved by the Owner.

4.3.2. Aluminum windows shall have thermal break construction and shall comply with American Architectural Metal Association (AAMA) standards. Framing shall be thermally broken from any interior construction.

4.3.3. Windows installed in climate-controlled buildings shall be non-operable to maintain a specific air balance and provide security.

4.3.4. 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.

4.3.5. Window frames installed in existing structures shall match the color of existing window frames.

4.3.6. Window systems requiring desiccants shall not be used.

4.4. Glass and Glazing

4.4.1. All new construction and major renovations shall use low-E glazing.

4.4.2. 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.

4.4.3. Exterior glass systems shall be a minimum of insulated, double-pane glass with aluminum thermal break frame construction. Polyamide thermal break is preferred over polyurethane poured and debrided type thermal breaks. Steel framing shall not be exposed to the exterior except where required by code.

4.4.4. Maintenance and replacement of broken glazing shall be considered during design. Replacement from the interior of the building is preferred. Other replacement methods require Owner approval.
4.4.5. Exterior windows and exterior glazed doors shall have ¼ inch double glazing, certified by the Insulating Glass Certification Council (IGCC).

4.5. Joint Sealants:

4.5.1. Refer to Section IV for information.

5. FINISHES

5.1. Wall Systems:

5.1.1. Follow the USG gypsum board construction manual guidelines.

5.1.2. Wall Finishes:

5.1.2.1. Finish selection shall be based on ease of cleaning and serviceability.

5.1.2.2. 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.

5.1.2.3. Public stairways and corridors shall have durable wall finishes.

5.1.2.4. Mechanical rooms shall have masonry or concrete walls.

5.1.2.5. Restrooms shall have ceramic tile wainscot.

5.1.2.6. Lactation Rooms shall have painted walls.

5.1.2.7. Commercial-grade wall covering may be used with Owner approval. If vinyl, vinyl shall be Type II.

5.1.2.8. Chair rails shall be provided in conference rooms, classrooms or similar multi-use spaces.

5.2. Ceiling Systems:

5.2.1. List appearance as criteria requirement when including “approved equal” to allow for coordination with maintenance stock.

5.2.2. Specialty ceiling tiles/systems require Owner approval. Ceiling tiles/systems shall be removable without requiring the use of specialty tools.

5.2.3. Sound attenuation shall be used at partitions and above ceilings. Review criteria for acoustical separation with Owner.

5.2.4. Drywall 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). Drywall ceilings shall not be used in public restrooms.

5.2.5. Ceiling systems shall use noncombustible materials.

5.3. Paint Finishes:
5.3.1. Paint shall be manufacturer’s premium product. Specify the most sustainable paints and coatings available for the particular application.

5.4. Floor Finishes:

5.4.1. Entry mats are required at all main entrances.

5.4.1.1. Entries shall have removable, roll-up “Entrap” matting installed into a mat well. Mat wells shall not have drains.

5.4.1.2. 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.

5.4.2. Hard, durable, slip resistant surfaces requiring minimum maintenance shall be used in the following rooms:

(2) Lobbies and public areas
(3) Stairwells and shall have applied nosing one (1) piece full width of riser.

5.4.2.1. Entry level corridors

5.4.2.2. Food preparation and service spaces

5.4.2.3. Laboratories

5.4.2.4. Lactation rooms

5.4.2.5. Lobbies and public spaces

5.4.2.6. Restrooms

(4) Classrooms, Auditoriums and Lecture Halls

5.4.2.7. Stairwells

5.4.2.8. Storage rooms

5.4.3. Carpet tiles may be used in the following rooms:

5.4.3.1. Auxiliary corridors

(5) Computer labs

5.4.3.2. Classrooms, Auditoriums, and Lecture Halls

5.4.3.3. Computer labs

5.4.3.3.1.1.1.1. Offices

5.4.3.4. Conference rooms

5.4.3.5. Offices
5.4.4. Sealed concrete shall be used in the following rooms:

5.4.4.1. Restrooms
5.4.4.2. Mechanical rooms
5.4.4.3. Custodial closets
5.4.4.4. Storage rooms
5.4.4.5. Laboratories

5.4.5. Ceramic tile shall be used in the following rooms:

5.4.5.1. Lactation rooms
5.4.5.2. Restrooms
5.4.5.3. Lactation rooms

5.4.6. Vinyl tile (premium quality products only) shall be used in the following rooms:

5.4.6.1. Classrooms
5.4.6.2. Lactation rooms
5.4.6.3. Laboratories

5.4.7. Non-slip quarry tile shall be used in the following rooms:

5.4.7.1. Food preparation and service spaces
5.4.7.2. Restrooms

5.4.8. Epoxy coating shall be used in the following rooms:

5.4.8.1. Food preparation and service areas
5.4.8.2. Laboratories

5.4.9. Mechanical rooms located above another space shall have epoxy coating with all corners, edges, cracks, etc. caulked to prevent leakage to spaces.

5.4.10. Stairwells shall have applied nosing one (1) piece full width of riser.

5.4.11. Flooring materials other than listed above require written approval from Owner.

6. Furnishings
6.1. Window Treatments:

6.1.1. Window treatment shall match building standard.

6.1.2. Roller shades are preferred.

6.1.3. Shade opacity shall be reviewed with Owner.

7. INTERIOR SIGNAGE

7.1. General

7.1.1. Signage shall adhere to current ADA Standards for Accessible Design.

7.1.1.1. Copy shall provide appropriate contrast with background as identified by the ADA guidelines.

7.1.1.2. Mounting locations shall be as identified by the ADA guidelines.

7.1.1.3. Digital displays outside rooms shall include an ADA compliant component.

7.1.1.4. Provide direction to accessible seating within auditoriums and tiered classrooms.

7.1.1.5. 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.

7.1.1.6. Based on agreements with the Fire Protection Authorities, red copy shall only be used as identified below.

7.1.2. Signage shall follow the International Fire Code (IFC).

7.1.2.1. Rooms with one (1) or more breaker panels shall be identified as "Electrical Room".

7.1.2.2. Access door to building generator shall be identified as "Generator".

7.1.2.3. Door openings onto a roof shall have a sign reading "Roof Access", including within penthouses.

7.1.2.4. Rooms that have a fire pump, main sprinkler valve, or fire command center shall identified as “Fire Equipment”. Copy shall be red.

7.1.2.5. Elevator machine rooms shall be identified as "Elevator Equipment".

7.1.2.6. Mechanical rooms shall be identified as "Mechanical".

7.1.2.7. Custodial rooms shall be identified as "Custodial".

7.1.2.8. 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.
7.1.2.9. 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.

7.1.2.10. "In Case of Fire Use Stairs, Do Not Use Elevator" signs shall be located at elevators without message applied to call button panel.

7.1.3. Signage design, material, finish, size, and font are building specific and are subject to require Owner approval.

7.1.4. Signage detail drawings shall be submitted for review no later than 50 percent Construction Documents.

7.1.5. Signs shall be designed to be updateable while maintaining vandal and tamper resistance.

7.1.6. Every room shall be identified. The minimum signage required shall be a sign type room number.

7.1.7. Interior decorative or super graphic displays shall not be visible from the exterior of the building.

7.1.8. Departmental policies may require additional signage.

7.1.9. Design Professional shall provide a sign schedule and location plan.

7.1.10. Specifications for printed insert sign types shall include the printed inserts, the electronic template for updating the inserts, and the insert material.

7.1.11. Signs referencing public venues include the following rooms:

7.1.11.1. Restrooms

7.1.11.2. Accessible Restrooms, including accessible, single use, family, and other restrooms

7.1.11.3. Lactation rooms

7.1.11.4. Classrooms

7.1.11.5. Vending rooms

7.1.11.6. Cafeterias

7.2. Sign Types:

7.2.1. Refer to INTERIOR SIGNAGE DETAILS in Appendices for examples of sign types.

7.2.2. Building Directory
7.2.2.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

7.2.2.2. Directory to be immediately viewable upon entering the building from the primary entrance and in major circulation areas.

7.2.2.3. Directory shall permanently identify level number and may include building name. Copy shall be permanently printed.

7.2.2.4. Directory shall be used to display destination addresses. Content shall include public venue, department names and locations within the building. Directory may include administrative offices.

7.2.2.5. Destinations shall be listed alphabetically. Provide minimum capacity of 10 percent greater than the current list of destinations.

7.2.2.6. Locations shall be keyed to floor levels, room numbers or map artwork.

7.2.2.7. Map artwork shall be plan view or stacked perspective.

7.2.2.7.1. Artwork shall schematically replicate the footprint of each level.

7.2.2.7.2. Features to be shown shall be stairs, elevators, restrooms, accessible restrooms, single use restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances, and department identification.

7.2.2.7.3. Room number ranges shall be identified.

7.2.2.7.4. A uniquely shaped and/or colored "YOU ARE HERE" symbol shall be placed in the plan location of the viewer.

7.2.2.7.5. Map artwork shall be oriented so that top of map is the direction the viewer is facing.

7.2.2.7.6. Map shall be sized to convey information clearly.

7.2.3. Elevator Directory:

7.2.3.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

7.2.3.2. Directory shall permanently identify level number. Building name may be included as directed by the Owner.

7.2.3.3. Directory shall be used as display of destination addresses accessible by the elevator. Content shall include building name, public venue, department names, administrative offices, and floor level locations.

7.2.3.4. Destinations shall be listed alphabetically. Provide capacity of 10 percent greater than the current list of destinations.

7.2.3.5. Sign shall be located adjacent to the entrance into an elevator cab. One (1) directory can serve two (2) adjacent elevator cabs.
7.2.4. Elevator Cab Directory:

7.2.4.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

7.2.4.2. Elevator Cab Directory shall be used in addition to Elevator Directory.

7.2.4.3. Directory shall be used as display of destination addresses accessible by the elevator. Provide capacity of 10 percent greater than the current list of destinations.

7.2.5. Overhead Directional:

7.2.5.1. Use of overhead directional signs shall be limited.

7.2.5.2. Overhead directional signs shall be used to direct to primary destinations or range of room numbers.

7.2.5.3. Copy on overhead directional signs shall be at a minimum of 32 inch height and comply with ADA requirements for visual character height. Copy shall be self-adhesive vinyl, silkscreened or applied cut-out lettering.

7.2.6. Wall-mount Directional:

7.2.6.1. Wall-mount directional shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.

7.2.6.2. Wall-mount directional shall permanently identify level number. Building name may be included as directed by the Owner.

7.2.6.3. Copy shall be listed according to direction with left destinations listed first, upper destinations second and right destinations third. Destinations in like direction shall be alphabetized.

7.2.6.4. Signs shall be located at decision points.

7.2.6.5. Wall-mount directional may include map artwork.

7.2.6.6. Map artwork:

7.2.6.6.1. Artwork shall be plan view or stacked perspective.

7.2.6.6.2. Artwork shall schematically replicate the footprint of each level.

7.2.6.6.3. Features shall include stairs, elevators, restrooms, accessible restrooms, single use restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances.

7.2.6.6.4. Room number ranges shall be identified.

7.2.6.6.5. A uniquely shaped and/or colored symbol labeled “You Are Here” shall be placed in the plan location of the viewer.

7.2.6.6.6. Map art shall be oriented with top of map the direction the viewer is facing.
7.2.7. Overhead Identification:

7.2.7.1. Use of overhead identification signs shall be limited.
7.2.7.2. Overhead identification signs shall be used to identify primary destinations.
7.2.7.3. Copy shall comply with ADA requirements for visual character height.
7.2.7.4. Copy shall be self-adhesive vinyl, silkscreened, or applied cut-out lettering.
7.2.7.5. Sign shall be used in conjunction with wall-mounted department identification.

7.2.8. Projecting Flag Identification:

7.2.8.1. Projecting flag identification shall be used for public areas visually hidden from direct view.
7.2.8.2. Flag shall be an acrylic blade fastened to an aluminum armature.
7.2.8.3. Copy shall comply with ADA requirements for visual character height.
7.2.8.4. Graphics shall be limited to symbol glyphs for public venues.
7.2.8.5. Glyphs shall be silkscreened or self-adhesive vinyl.

7.2.9. Department Directory:

7.2.9.1. Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts. Changeable inserts shall be 8 ½ by 11, 8 ½ by 14, 11 by 17 or as approved by Owner.
7.2.9.2. Directory shall be used as display of destination addresses within the department. Content may include program names, faculty / staff identification and room numbers.
7.2.9.3. Destinations shall be listed alphabetically. Provide capacity of 10 percent greater than the current list of destinations.

7.2.10. Department Identification Plaque:

7.2.10.1. Department identification plaque shall be wall-mounted.
7.2.10.2. Plaque shall be scaled larger than room identification signage to provide more significance.
7.2.10.3. Plaque shall use uppercase sans-serif ADA spec tactile copy and Grade II Braille for the permanent identification component of the message. Permanent message shall be department name and/or room number.
7.2.10.4. Supporting copy shall be silk-screened.
7.2.10.5. Sign face shall be matte.
7.2.10.6. Sign location shall not be viewable from the exterior of the building.

7.2.11. Department Identification Vinyl Lettering:
7.2.11. Vinyl lettering shall be scaled larger than room identification signage to provide more significance.

7.2.11.2. Vinyl lettering identifying a permanent space shall include ADA compliant identification.

7.2.11.3. Vinyl lettering shall not be viewable from the exterior of the building.

7.2.12. Room Number:

7.2.12.1. Room number shall be wall-mounted.

7.2.12.2. Rooms identified by number only include general storage rooms and rooms whose purposes are to be discreet.

7.2.12.3. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille.

7.2.12.4. Sign face shall be matte.

7.2.13. Room Identification:

7.2.13.1. Room Identification shall be wall-mounted.

7.2.13.2. Rooms whose purpose or room information is not likely to change frequently shall be identified by room text and room number.

7.2.13.3. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the permanent component of the message. Permanent message shall be room text and room number.

7.2.13.4. Sign face shall be matte.

7.2.14. Conference Room Identification:

7.2.14.1. Conference Room identification shall be wall-mounted.

7.2.14.2. Sign shall include “Conference” and room number.

7.2.14.3. Signs shall incorporate gripper bar paper holder. Gripper bars shall be constructed of extruded aluminum.

7.2.14.4. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the permanent component of the message. Permanent message shall be room text and room number.

7.2.14.5. Sign face shall be matte.

7.2.15. Office and Multi-purpose Room Identification:

7.2.15.1. Office and multi-purpose room Identification shall be wall-mounted.

7.2.15.2. Sign shall identify rooms by room number and in-house, updatable insert.
7.2.15.3. Typical rooms include offices and rooms whose purpose or room information may change frequently.

7.2.15.4. Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the room number.

7.2.15.5. In-house, updateable insert shall be inserted into a slot between a clear window on the face and a backer panel. Face shall have thumb notch or similar means to enable updating.

7.2.15.6. Signs shall incorporate gripper bar paper holder. Gripper bars shall be constructed of extruded aluminum.

7.2.15.7. Sign face shall be matte.

7.2.16. Open Office Work Station Identification:

7.2.16.1. Each open office work station shall receive an identification sign.

7.2.16.2. Open office work station signage shall not include room number.

7.2.16.3. Sign shall identify occupant or use by in-house, updateable insert.

7.2.16.4. Confirm mounting detail with Owner.

7.2.16.5. In-house, updateable insert shall be placed into a slot between a clear window on the face and a backer panel. Face shall have thumb notch or similar means for enabling updating.

7.2.16.6. Sign face shall be matte.

7.2.17. Symbol Identification:

7.2.17.1. Symbol identification shall be wall-mounted.

7.2.17.2. Information shall be organized with room number on top, symbol glyph on 6 inch area in the middle and supporting text on bottom.

7.2.17.3. Typical rooms include unisex single use, men's, and women's restrooms, and stairwells.

7.2.17.4. Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.

7.2.17.5. Sign face shall be matte.

7.2.18. Large Symbol Identification:

7.2.18.1. Large symbol identification shall be wall-mounted.

7.2.18.2. 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.

7.2.18.3. Typical rooms include family restrooms and locker rooms.
7.2.18.4. Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.

7.2.18.5. Sign face shall be matte.

7.2.19. Entrance Number Plaque:

7.2.19.1. An entrance number plaque shall be placed at each exterior door, including entrances from rooftop and balconies.

7.2.19.2. Plaque shall be an exterior grade 1/8 inch 2-ply material with contrasting color layers, Rowmark Ultra-Matte material or approved equal.

7.2.19.3. Numbers shall be assigned by Owner. "ENT" shall precede all numbers. Sign shall use uppercase sans-serif.

7.2.19.4. Plaques shall be sized to fit on doorframe, centered over door on outside of facility. Typical size plaque is 1-1/2 inch by 6 inch with 1 inch copy.

7.2.20. Loading Dock Entrance Number Plaque:

7.2.20.1. Loading Dock entrance number plaque shall be placed at each exterior dock. Plaque shall be a 1/8 inch painted aluminum panel with highly contrasting, self-adhesive, vinyl copy.

7.2.20.2. Numbers shall be assigned by Owner. "ENT" shall precede all numbers. Sign shall use uppercase sans-serif.

7.2.20.3. Typical plaque size is 12 inch by 12 inch with 4 inch copy or sized in accordance with specific building criteria.

7.2.20.4. Sign shall be placed adjacent to door and viewable from street.

7.2.21. Code Specified Information:


7.2.21.2. Refer to applicable code for text, symbols, size and sign layout.

7.2.21.3. SmokeTobacco-free signage shall coordinate with building design and placed at all building entrances.

7.2.21.4. Sign face shall be matte.

7.2.22. Architectural Lettering:

7.2.22.1. Architectural lettering may be used to identify the following:

7.2.22.1.1. Building

7.2.22.1.2. Department

7.2.22.1.3. Special venues
7.2.22.1.4. Points of sale

7.2.22.2. Letters shall be individually cut out characters from acrylic sheet, solid surface material, metal or cast from metal.

7.2.22.3. Architectural Lettering identifying a permanent space shall also include ADA compliant identification.

7.2.23. Custom Signage:

7.2.23.1. Custom signage may be used to identify the following:

7.2.23.1.1. Donor Signage
7.2.23.1.2. Building
7.2.23.1.3. Department
7.2.23.1.4. Special venues
7.2.23.1.5. Points of sale

7.2.24. Donor Signage:

7.2.24.1. Donor recognition signage shall be designed as part of the interior signage.

7.2.24.1.1. Finished product shall complement and coordinate with building design.
7.2.24.1.2. Coordinate with The University of Iowa Foundation to design the signage types for the various donation levels.
7.2.24.1.3. Donor Signage types;

7.2.24.1.3.1. Donor Wall
7.2.24.1.3.2. Room
7.2.24.1.3.3. Departments
7.2.24.1.3.4. Building

7.2.24.1.4. Signs shall be designed to allow for the addition of future donors.
7.2.24.1.5. Signs shall be designed to be updated with little or no modification to the existing signage.

7.2.24.2. Custom Signage identifying a permanent space shall also include ADA compliant identification.

7.2.24.3. Custom Signage may be illuminated.

7.2.24.3.1. Illuminated signs shall be UL listed.
7.2.24.3.2. Lamp types shall be reviewed by Owner.
7.2.24.3.3. Signs shall be designed to prevent excessive heat build-up.
7.2.24.3.4. Electrical service shall be concealed.

8. SPECIALTIES

8.1. Visual Display and Bulletin Boards:
8.1.1. Bulletin boards in public areas shall be enclosed.

8.2. Projection Screens:
8.2.1. Screen size, surface and placement shall be specified or approved by ITS E1 -Physical Infrastructure.
8.2.2. Provide motorized tension projection screen when screen size is larger than 50 inches by 80 inches.

8.3. Restrooms and Restroom Accessories:
8.3.1. Restrooms:

(9) Water closets shall be wall-mounted.
8.3.1.1. Provide floor drains and centrally located hose bibbs. Locate hose bibb adjacent to lavatory such that it is reachable without reaching under lavatory counter, 18 inches above finish floor.

(10) Unisex Restroom Standards
8.3.1.2. Single Use Restrooms:

8.3.1.2.1. New facilities and additions shall include an accessible single use restroom.
8.3.1.2.2. Remodel projects impacting, or adjacent to, existing restroom facilities shall include an accessible single use restroom.
8.3.1.2.3. Accessible single use restrooms shall not be used as a substitute for accessible multi-user restrooms.
8.3.1.2.4. Restroom shall be located on the main floor of the facility within the main circulation path.
8.3.1.2.5. Restroom shall contain no more than one (1) lavatory and two (2) water closets without urinals or one (1) water closet and one (1) urinal.

(a) Location of room Restroom shall be on the main floor of the facility within the main circulation path.
8.3.1.2.6. Shall contain one (1) baby changing station.
8.3.1.2.7. Signage shall include word “UNISEX SINGLE USE RESTROOM”.

8.3.2. Toilet Partitions:
8.3.2.1. Partitions shall be High Density Polyethylene (HDPE) material.

8.3.2.2. **Partitions shall be wall or ceiling mounted to allow for Owner cleaning methods.** Overhead braces shall have anti-grip design.

8.3.2.3. **Ceiling-supported partitions shall have a flip-over latch for closure.**

8.3.3. Restroom Accessories:

8.3.3.1. Locate electric hand dryers or paper towel dispensers to minimize water in walking path.

8.3.3.2. Paper towel dispensers **shall require Owner approval.**

8.3.3.3. Lavatories shall be installed in countertops and not as separate wall-hung fixtures.

8.3.3.4. Mirrors shall be the full width of the counter, without a shelf.

8.3.3.5. A narrow shelf shall be located near the entrance of restroom. Coat hooks shall be included either below or near the shelf.

8.3.3.6. **Provide coat hook in each restroom stall. Locate hooks on wall or partition to prevent injuries to Owner staff when cleaning or maintaining the space.**

8.3.3.7. Ceramic toilet accessories shall not be used.

8.3.3.8. **Provide alcove to accommodate freestanding waste can.** Built-in waste receptacles shall not be used.

8.3.3.9. All accessible toilet stalls shall have the toilet paper dispensers installed above the side wall grab bar. The outlet of the toilet paper dispenser shall be 4 feet 0 inches AFF and the top of the gripping surface of the grab bar shall be minimum 2 feet 9 inches and maximum 3 feet 0 inches AFF.

8.3.3.10. **Dual-unit Sanitary napkin and tampon machines shall not be coin-free and ADA compliant.**

8.3.3.11. Each stall **installed in women’s restrooms shall have a sanitary napkin and tampon disposal container.**

8.4. Lactation Rooms:

8.4.1. Minimum room size shall be 6 feet by 9 feet.

8.4.2. Room shall be accessed directly from the women’s restroom where possible.

8.4.3. Door shall be keyed with storage room lock with deadbolt and occupancy indicator.

8.4.4. 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.
8.3.8.8.4.5. 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.

8.3.9.8.4.6. Provide mirror, 4 foot high by 3 foot wide minimum, mounted above the non-sink side of the counter.

8.3.10.8.4.7. Provide 4 foot by 4 foot bulletin board.

8.3.11.8.4.8. Provide one (1) upholstered, non-caster chair with arms.

8.3.12.8.4.9. Provide wall-mounted clock.

8.4.8.5. Recycling and Landfill (Trash) Receptacles:

b. Recycling and trash receptacles shall be located in all buildings for use by visitors, students, faculty and staff.

c. Types of Receptacles
   (1) Freestanding
   (2) Casework enclosed roll-in receptacles

d. A paired recycling and trash receptacle shall be at each location.

8.5.1. Receptacle type, locations. Design Professional shall identify and account for the collection, transport, and disposal of the expected waste streams from each space. Waste streams include recycling, landfill, composting, biohazardous materials (red bins), batteries, electronics, and other specialized materials. Collection points shall be identified on the floor plans.

8.5.2. Recycle and Landfill containers shall exist in pairs.

8.5.2.1. Restrooms shall contain landfill container(s) only. Use Small or Slim Jim container based on anticipated volume of waste.

8.5.2.2. Printing and copy equipment stations shall have recycling container(s) and a Tiny Trash container for waste such as staples.

8.5.2.3. Containers:

8.4.1.1.4.8.5.2.3.1. Containers, other than listed below, require written approval from Owner.

8.5.2.3.2. Products

8.5.2.3.2.1. Tiny Trash Container: Busch Systems BC1500 (container), BC1500L (lid)

8.5.2.3.2.2. Small Containers: 7 gallon Rubbermaid 2956-73

8.5.2.3.2.3. Slim Jim Container: 23 gallon Rubbermaid 3540-75

8.5.2.3.2.4. 32 gallon: Rubbermaid 2632-73 (container), 2640 (casters)

8.5.2.3.2.5. 40 gallon: Rubbermaid 3536-73 (container), 3530 (casters)
8.5.2.3.6. 64 gallon: Toter ACC64

8.5.2.4. Color:

8.5.2.4.1. Recycle containers and/or signage shall be blue.

8.5.2.4.2. Compost containers and/or signage shall be green.

8.5.2.4.3. Landfill containers shall not be blue, green, or red.

8.5.2.5. Signage:

8.5.2.5.1. Containers shall have signage indicating “Recycle”, “Landfill”, or “Compost” on the container or enclosure.

8.5.2.5.2. Signage shall indicate the waste stream details as indicated below and be located on or above the container or enclosure.

8.5.2.5.2.1. “Recycle: Plastic containers, paper, cans, cardboard”

8.5.2.5.2.2. “Landfill: Plastic bags, wrappers, glass, Styrofoam”

8.5.2.5.2.3. “Compost: Food scraps, coffee grounds/filters, paper towels/napkins”

8.5.2.5.3. Tiny Trash containers and blue Small containers with the recycle logo do not require signage

8.5.2.6. Openings:

8.5.2.6.1. Recycle container openings shall be Saturn-top or lidded.

8.5.2.6.1.1. Diameter of opening: 5 to 6 inches

8.5.2.6.1.2. Width of ring: 2 1/2 to 3 inches

8.5.2.6.1.3. Length of opening: 10 to 14 inches

8.5.2.6.2. Compost container openings shall be rectangular or lidded.

8.5.2.6.2.1. Width of opening: 5 to 8 inches

8.5.2.6.2.2. Length of opening: 10 to 14 inches

8.5.2.6.3. Openings shall be ADA accessible.

8.5.3. The following shall apply where containers are installed in enclosure, including cabinetry or casework:

8.5.3.1. Containers shall be capable of being rolled into cabinetry. Containers shall not be lifted.

8.5.3.2. Enclosures shall accommodate standard, 40 gallon containers as listed above.

8.5.3.3. Enclosure opening shall be ADA accessible.
8.5.3.4. Signage shall be visible to public.

8.5.4. Locations:

8.5.4.1. 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.

8.5.4.2. Public gathering spaces, such as corridors, concourses and atria, shall be primary collection points. Corridors serving classrooms shall have containers.

8.5.4.3. Staff breakrooms and lounges shall be primary collection points.

8.5.4.4. Classrooms shall not have containers.

8.5.4.5. Conference and meeting rooms shall have containers.

8.5.4.6. Wet lab spaces shall have containers.

8.5.4.7. Mailrooms shall have containers.

8.5.8.6. Vending Space:

8.5.8.6.1. Vending Machines available for use on Campus by Coca-Cola (The University of Iowa approved beverage supplier). Design Professional shall account for vending space needs and utility requirements. Review with the Owner.

8.5.1.1.8.6.1.1. Royal 660

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

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

8.5.1.1.3.8.6.1.3. Power shall be 115 volts, 12 amps.

8.5.1.2.8.6.1.2. Royal 804

8.5.1.2.1.8.6.1.2.1. Taller version of Royal 660.

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

8.5.1.2.3.8.6.1.2.3. Power shall be 115 volts, 12 amps.

8.5.1.3.8.6.1.3. RVV500

8.5.1.3.1.8.6.1.3.1. Smaller glass front, may hold cans or bottles.

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

8.5.1.3.3.8.6.1.3.3. Power shall be 115 volts, 12 amps.
8.5.1.4.8.6.1.4. D5000

8.5.1.4.1.8.6.1.4.1. Large glass front.

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

8.5.1.4.3.8.6.1.4.3. Power shall be 115 volts, 12 amps.

8.5.1.5.8.6.1.5. Vendo Vue

8.5.1.5.1.8.6.1.5.1. Mid-size glass front.

8.5.1.5.2.8.6.1.5.2. Dimensions shall be 72 inches high by 41 1/2 inches wide by 35 inches deep.

8.5.1.5.3.8.6.1.5.3. Power shall be 115 volts, 10 amps.

8.6.8.7. Custodial Work Spaces:

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

8.6.1.1.8.7.1.1. Locate on the ground floor near the Supplies Storage and Delivery Room.

8.6.1.2.8.7.1.2. 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.

8.6.1.3.8.7.1.3. Provide the following:

8.6.1.3.1.8.7.1.3.1. Fire rated ceilings.

8.6.1.3.2.8.7.1.3.2. Lighting levels at 20 foot candles.

8.6.1.3.3.8.7.1.3.3. 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. All receptacles to be GFCI.

8.6.1.3.4.8.7.1.3.4. Two (2) telecom-data telephones.

8.6.1.3.5.8.7.1.3.5. 3 foot 0 inch door. Door shall open outwards.

8.6.1.3.6.8.7.1.3.6. 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.

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

8.6.2.1.8.7.2.1. 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).

8.6.2.2.8.7.2.2. Provide the following:
8.6.2.2.1 Three (3) 1 foot 6 inch wall shelves on adjustable brackets and standards. One-half (1/2) of the shelving in this room shall be enclosed with doors and locks.

8.6.2.2.2 HVAC – to maintain 60 degree F minimum.

8.6.2.2.3 Lighting levels at 20 foot candles.

8.6.2.2.4 Two (2) duplex electrical outlets (GFCI) on shelving wall.

8.6.2.2.5 3 foot 6 inch door. Door shall open outwards.

8.6.3.1 Equipment Storage Room: Room is used to store large equipment including vacuums, carpet extractors, carpet drying fans, ladders, etc.

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

8.6.3.2 Provide the following:

8.6.3.2.1 2 feet 6 inch by 36 inch by 10 inch utility slop sink with 6 inch sides, installed in the rear corner of the room with hot and cold water blended into a single hose bibb. Maintain a clear path from door to sink even when equipment is parked.

8.6.3.2.2 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.

8.6.3.2.3 Floor sink with strainer basket to empty scrubbers, slope floor to the drain.

8.6.3.2.4 Two (2) 1 foot 0 inch wide adjustable shelves, 9 feet 0 inches in length, on brackets, at the rear of the room. Bottom shelf shall be 3 feet 4 inches AFF.

8.6.3.2.5 Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.

8.6.3.2.6 Emergency eye wash station. Refer to Section IV, PLUMBING SYSTEMS for additional information.

8.6.3.2.7 Minimum of three (3) wall-mounted shelves 4 feet 0 inch AFF to support charging units for battery-powered machinery.

8.6.3.2.8 Heating and ventilation for recharging battery-powered machinery.

8.6.3.2.9 One (1) duplex electrical outlet (GFCI) for each charger unit, located 4 feet 0 inches AFF on wall next to the battery charger shelves.

8.6.3.2.10 Lighting levels at 20 foot candles.
8.6.3.2.11.8.7.3.2.11. One (1) duplex electrical outlet (GFCI) near the floor by the door.

8.6.3.2.12.8.7.3.2.12. Door shall be 3 foot 6 inch and shall open outwards.

8.6.3.2.13.8.7.3.2.13. Enamel painted concrete walls. Gypsum board walls with 18 inch high metal plating may be used with Owner approval.

8.6.3.2.14.8.7.3.2.14. Washer/dryer hook-up.

8.6.4.8.7.4. Custodial Service Room:

8.6.4.1.8.7.4.1. Minimum of one (1) Custodial Service Room per floor or one (1) closet per 20,000 square feet. Locate within 50 feet of main traffic restrooms. Access to Custodial Service Room shall be from public hallways.

8.6.4.2.8.7.4.2. Room shall be a minimum 7 feet by 9 feet.

8.6.4.3.8.7.4.3. Utility panels, gauges, meters or pipes shall not be placed in the custodial service room.

8.6.4.4.8.7.4.4. Provide the following:

8.6.4.4.1.8.7.4.4.1. Three (3) white painted or laminated 3/4 inch by 12 inch deep plywood shelves mounted on adjustable brackets and standards, bottom shelf 30 inches AFF, top shelf 60 inches AFF.

8.6.4.4.2.8.7.4.4.2. Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.

8.6.4.4.3.8.7.4.4.3. Emergency eye wash station. Refer to Section IV, PLUMBING SYSTEMS for additional information.

8.6.4.4.4.8.7.4.4.4. Wall bracket to support a 6 foot 0 inch step ladder.

8.6.4.4.5.8.7.4.4.5. Lighting levels at 20 foot candles.

8.6.4.4.6.8.7.4.4.6. One (1) duplex electrical outlet (GFCI) located on shelving wall.

8.6.4.4.7.8.7.4.4.7. 3 foot 6 inch door. Door shall open outwards.

8.6.4.4.8.8.7.4.4.8. 2 feet 6 2/4 inch floor by 36 inch by 10 inch utility slop sink with 6 inch sides, installed in the rear corner of the room with hot and cold water blended into a single hose bibb. Maintain a clear path from door to sink even when equipment is parked.

8.6.4.4.9.8.7.4.4.9. 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.

8.6.5.8.7.5. Heavy Equipment Room: Room [houses rider scrubbers and sweepers]:

8.6.5.1.8.7.5.1. 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.

8.6.5.2.8.7.5.2. Room shall be a minimum 15 feet by 15 feet.

8.6.5.3.8.7.5.3. Utility panels, gauges, meters or pipes shall not be placed in the custodial service room.

8.6.5.4.8.7.5.4. Provide the following:

8.6.5.4.1.8.7.5.4.1. Heating and ventilation for recharging battery-powered machinery.

8.6.5.4.2.8.7.5.4.2. One (1) 1 foot 0 inch wide adjustable shelf, mounted on the wall 3 feet 4 inches AFF.

8.6.5.4.3.8.7.5.4.3. Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.

8.6.5.4.4.8.7.5.4.4. Emergency eye wash station. Refer to Section IV, PLUMBING SYSTEMS for additional information.

8.6.5.4.5.8.7.5.4.5. 2 feet 6 1/4 inch floor by 36 inch by 10 inch utility slop sink with 6 inch sides, installed in the rear corner of the room with hot and cold water blended into a single hose bibb. Maintain a clear path from door to sink even when equipment is parked.

8.6.5.4.6.8.7.5.4.6. 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.

8.6.5.4.7.8.7.5.4.7. Wall-mounted shelf 4 feet 6 inch AFF to support charging units for battery-powered machinery.

8.6.5.4.8.8.7.5.4.8. Lighting levels at 20 foot candles.

8.6.5.4.9.8.7.5.4.9. One (1) duplex electrical outlet (GFCI) near the floor by the door.

8.6.5.4.10.8.7.5.4.10. Enamel painted concrete walls. Gypsum board walls with 18 inch high metal plating may be used with Owner approval.

8.6.5.4.11.8.7.5.4.11. 7 foot double door. Door shall open outwards.

8.6.6.8.7.6. Light Bulb Storage Room: The main storage room for light tubes and lamps:

8.6.6.1.8.7.6.1. Room size shall be reviewed with the Owner.

8.6.6.2.8.7.6.2. Provide the following:

8.6.6.2.1.8.7.6.2.1. 3 foot 6 inch door. Door shall open outwards.

8.6.6.2.2.8.7.6.2.2. Three (3) 1 foot 6 inch wall shelves on adjustable brackets and standards at the back of the room. The bottom shelf shall be 2 feet 6 inches
AFF. Shelves shall be spaced about 1 foot 8 inches apart, running the full length of the longest wall.

8.6.6.2.3.8.7.6.2.3. One (1) duplex GFCI receptacle located near the floor by the door.

8.6.6.2.4.8.7.6.2.4. HVAC is required with 60 degree F winter heat minimum.

8.6.6.2.5.8.7.6.2.5. Lighting levels at 20 foot candles.

8.7.8.8. Maintenance Rooms:

8.7.1.8.8.1. Building Maintenance Work Control Center—(houses building control work station, maintenance staffing, and general computer access):

8.7.1.1.8.8.1.1. Located separately from Building Maintenance Shop and Building Maintenance Material / Equipment Storage Room.

8.7.1.2.8.8.1.2. 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). Minimum room width of 20 feet for any size group.

8.7.1.3.8.8.1.3. Provide the following:

8.7.1.3.1.8.8.1.3.1. 3 foot 0 inch door. Door shall open outwards.

8.7.1.3.2.8.8.1.3.2. Fire rated ceilings

8.7.1.3.3.8.8.1.3.3. Lighting levels at 20 foot candles.

8.7.1.3.4.8.8.1.3.4. 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.

8.7.1.3.5.8.8.1.3.5. Two (2) telecom-data telephones.

8.7.2.8.8.2. Building Maintenance Shop—(houses work benches, tools, equipment, carts, barrels and supplies):

8.7.2.1.8.8.2.1. Room shall be minimum 200 square feet.

8.7.2.2.8.8.2.2. Located adjacent to the Building Maintenance Material / Equipment Storage Room.

8.7.2.3.8.8.2.3. Provide the following:

8.7.2.3.1.8.8.2.3.1. 3 foot 0 inch door. Door shall open outwards.

8.7.2.3.2.8.8.2.3.2. Fire rated ceilings

8.7.2.3.3.8.8.2.3.3. Lighting levels at 20 foot candles.
8.7.2.3.4 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.

8.7.2.3.5 Two (2) telecom-data telephones.

8.7.3 Building Maintenance Material / Equipment Storage Room (main storage room for building maintenance supplies and attic stock):

8.7.3.1 Room shall be minimum 200 square feet.

8.7.3.2 Provide the following:

8.7.3.2.1 3 foot 6 inch door. Door shall open outwards.

8.7.3.2.2 Fire rated ceilings

8.7.3.2.3 Lighting levels at 20 foot candles.

8.7.3.2.4 One-half (1/2) of the shelving in this room shall be enclosed with doors and locks. Three (3) 1 foot 6 inch wall shelves on adjustable brackets and standards at the back of the room. The bottom shelf shall be 2 feet 6 inches AFF. Shelves shall be spaced 1 foot 8 inches apart, running the full length of the longest wall.

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

8.7.3.2.6 HVAC is required with 60 degree F winter heat minimum.

8.8.9 Telecommunication Rooms (TR):

8.8.1 Room shall be a minimum of 10 feet by 12 feet. Size to be determined by quantity and type of horizontal cables served from the telecommunication room as well as future cable plant expansion expectations. ITS EI - Physical Infrastructure shall be involved in determining room sizes and locations.

8.8.2 TRs shall be aligned vertically and centrally located to meet current ANSI/EIA/TIA allowable cable lengths.

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

8.8.4 Access to telecommunication rooms shall be coordinated with ITS EI - Physical Infrastructure.

8.8.5 Room shall not have a ceiling.

8.8.6 Provide the following:

8.8.6.1 Year-round cooling with continuous air flow to maintain.

8.8.6.1.1 72 to 80 degrees F
8.8.6.1.2. 8.9.6.12. 45 to 55 percent maximum relative humidity

8.8.6.1.3. 8.9.6.13. Positive air pressure with a minimum of one (1) complete exchange per hour.

8.8.6.2. 8.9.6.2. Minimum 100 amp dedicated, TVSS protected power panel tied to building generator if possible. Panel size dependent on size of area and user density being served.

8.8.6.3. 8.9.6.3. Minimum of two (2) 20 AMP outlets per data switch.

8.8.6.4. 8.9.6.4. Minimum if one (1) convenience receptacle per wall.

8.8.6.5. 8.9.6.5. Grounding and bonding for communication systems.

8.8.6.6. 8.9.6.6. Equipment racks, ladder racking, and cable management.

8.8.6.7. 8.9.6.7. ¾ inch A/C (A side out) rated plywood on all walls, mounted from 6 inches to 8 feet 6 inches AFF.

8.8.6.8. 8.9.6.8. Lighting:

8.8.6.8.1. 8.9.6.8.1. Minimum lighting levels equivalent of 50 lumens measured at 3 feet AFF.

8.8.6.8.2. 8.9.6.8.2. Provide manual wall switches only. Automatic lighting controls shall not be installed.

8.8.6.8.3. 8.9.6.8.3. Connect a minimum of one (1) light Fixture to emergency power.

8.8.6.8.4. 8.9.6.8.4. Bottom of fixtures shall be 8 feet 6 inches AFF.

8.8.6.8.5. 8.9.6.8.5. Coordinate with ITS EI - Physical Infrastructure for TR/Light Fixture Layout

8.8.6.8.6. 8.9.6.8.6. Door closer and door sweep.

8.9.8.10. Classrooms - General Assignment:

8.9.1. 8.10.1. General Approach to Classroom Design:

8.9.1.1. 8.10.1.1. Develop rooms with good sight lines and efficient seating layout. Design shall proceed from the “inside out”

8.9.1.1.1. 8.10.1.1.1. Determine projection screen quantity, size and location.

8.9.1.1.2. 8.10.1.1.2. Determine seat size, orientation and size of the instructor area.

8.9.1.1.3. 8.10.1.1.3. Draw viewing angles from each screen and insure that all seats fit within.

8.9.1.1.4. 8.10.1.1.4. Determine location and width of access aisles.
8.9.1.5. After these steps, determine location of walls.

8.9.1.2. Classrooms shall be shaped and sized to maximize seating and occupant comfort and interaction.

8.9.1.3. Design corridors and alcoves to provide informal student spaces with flexible, comfortable furniture to encourage collaboration.

8.9.2. Classroom design details may vary to accommodate the latest best practices for teaching.

8.9.3. Classroom Design Specifics:

8.9.3.1. Classroom Location:

8.9.3.1.1. Locate general assignment 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.

8.9.3.1.2. Group classrooms together on the common floor.

8.9.3.1.3. Locate classrooms away from noise-generating equipment and activities, including mechanical systems, elevators, vending, food service, and restrooms. Where classrooms adjoin such spaces, provide acoustic separation.

8.9.3.1.4. Locate restrooms near lecture halls. Avoid common walls between restrooms and classrooms.

8.9.3.1.5. Provide corridor seating outside lecture halls and along hallways outside classrooms.

8.9.3.2. Accessibility:

8.9.3.2.1. Specialized equipment shall be included as follows:

8.9.3.2.2. Remote Real Time Captioning - Place an Ethernet connection and an electrical outlet in the front of the room for all auditoria seating 100+.

8.9.3.2.3. Lighting for Interpreter - A separate light for a sign language interpreter in all auditoria seating 100+ shall be placed in the front of the room. This light shall not spill onto the projection screen and shall illuminate the Interpreter from the front. The light control may be located with other controls at the lectern.

8.9.3.2.4. Accessible seating in lecture halls shall be fixed table and moveable chairs and/or open space for wheelchairs.

8.9.3.2.5. 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.

8.9.3.3. Acoustics;
All classrooms shall be designed with three (3) acoustic goals:

1. Prevent external and background noise from affecting the room.
2. Prevent sounds generated within the room from affecting adjacent spaces.
3. Foster effective sound transmission from the speaker and media to the audience, and allow audience comments to be easily heard.


Extend walls to structure.

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

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

Acoustical Wall Panels, as needed

Shall be placed beyond arm’s reach where possible.

Placed on the rear wall when one (1) wall in conventional classroom is to be treated. Place rear wall panels on the upper half of the wall, with bottom of panels no lower than 4 feet 0 inches AFF.

Side wall treatment may be added if rear wall does not provide surface at the minimum listed below for the type of room. Place side wall panels no lower than 6 feet 0 inches AFF.

Panel configuration does not have to be continuous, panels may be spaced rather than butted against each other.

Specific recommended quantities are shown in the following tables:

<table>
<thead>
<tr>
<th>ROOM SIZE</th>
<th>RECOMMENDED ACOUSTICAL TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMINAR ROOM</td>
<td></td>
</tr>
<tr>
<td>Up to 500</td>
<td>100 sf</td>
</tr>
</tbody>
</table>
### ROOM SIZE IN SQUARE FEET | CEILING HEIGHT | RECOMMENDED ACOUSTICAL TREATMENT (PANELS WITH MIN NRC OF 0.8)
--- | --- | ---
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

<table>
<thead>
<tr>
<th>Room Size</th>
<th>Ceiling Height</th>
<th>Recommended Acoustical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2,500</td>
<td>8-12 foot</td>
<td>100 sf</td>
</tr>
<tr>
<td>Up to 3,500+</td>
<td>12-18 foot</td>
<td>500 sf</td>
</tr>
<tr>
<td>3,501 - 4,000</td>
<td>15-20 foot</td>
<td>800 sf</td>
</tr>
<tr>
<td>Up to 5,000+</td>
<td>20-40 foot</td>
<td>1750 sf</td>
</tr>
</tbody>
</table>

8.9.3.4.8.10.3.4. Ceiling:

8.9.3.4.1.8.10.3.4.1. Ceilings shall accommodate projection screen with bottom of screen at a minimum 3 feet 4 inches AFF, and screen height 1/5 the distance from front wall to last row of seats.

8.9.3.4.2.8.10.3.4.2. Ceiling height requirements may differ for seminar rooms, classrooms, and auditoria within the same building.
Provide maintenance access to equipment mounted at or above ceilings.

Wall Finishes:
- Refer to Finishes section, above.
- Locate chair rail on back and side walls.
- Apply a durable, easy-to-clean surface such as epoxy paint across the entire front wall below the writing surface.

Windows:
- Windows shall not be located at the front or back of classroom.
- Provide light control at each window for media projection. Roller shades at 3 percent room darkening are preferred. Some locations may require dual-head with blackout roller shades. Mount tightly against frame or wall to reduce light spill.

Doors:
- Preferred door location is at the rear of the classroom.
- In rooms with tiered or sloped floors, place doors to allow wheeled access to the teaching area and multiple seating areas.
- Equip new doors with sidelights maximum width of 1 foot 0 inches. 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 AFF and top minimum 5 feet 2 inches AFF.
- Doors shall operate quietly and provide acoustic separation.
- Doors open outward and shall not block corridor traffic.

Flooring:
- Flat floors shall be hard, durable and slip-resistant requiring minimal maintenance.
- Seating areas in sloped and tiered floors may be sealed concrete.
- Carpet may be used when a more luxurious floor finish than resilient flooring is required and operating budgets allow for proper maintenance.
- Carpet shall be variegated in color, not solid, in order to hide dirt and wear.
8.9.3.8.2.10.3.8.2.3. Edge of stair risers shall be visible on carpeted stair aisles to prevent tripping.

8.9.3.9.8.10.3.9. Furnishings:

8.9.3.9.1.8.10.3.9.1. Furniture shall be selected for durability, ease of maintenance, and comfort.

8.9.3.9.2.8.10.3.9.2. General assignment classroom furniture shall have an appearance distinct from other furnishings in the building.

8.9.3.9.3.8.10.3.9.3. Writing surfaces shall be dark finish and resist marks.

8.9.3.9.4.8.10.3.9.4. Tablet arms shall be large enough to hold both an 8 ½ by 11 inch pad and electronic device.

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

8.9.3.9.6.8.10.3.9.6. 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).

8.9.3.9.7.8.10.3.9.7. Fixed Auditoria and Lecture Room seating width shall be 23 to 24 inches on center. Riser mounted seating may be preferred for new riser construction – confirm with Owner.

8.9.3.9.8.8.10.3.9.8. Student tables shall be minimum depth of 18 inches.

8.9.3.9.9.8.10.3.9.9. Moveable tables shall be equipped with casters.

8.9.3.9.10.8.10.3.9.10. Moveable seating shall not have arm rests.

8.9.3.9.11.8.10.3.9.11. Caster or chair-glide shall match room flooring type.

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

8.9.3.9.13.8.10.3.9.13. Lecture and Seminar Room seating shall be heavy-duty, stain repellant, upholstered fabrics.

(a) Lecture room seating shall be attached to risers.

8.9.3.9.14.8.10.3.9.14. Instructor table shall be 48 to 60 inches wide by 24 inches deep and include a modesty panel.

8.9.3.9.15.8.10.3.9.15. Instructor chair shall be provided.

8.9.3.9.16.8.10.3.9.16. Provide battery-operated GPS clock, part of Match existing campus clock system, in each classroom managed by the Office of the Provost.

8.9.3.9.17.8.10.3.9.17. Rooms shall have a multimedia lectern.
SECTION III – GENERAL DESIGN STANDARDS

8.9.3.9.18-8.10.3.9.18. Rooms shall have a moveable tabletop or free-standing lectern in addition to the multimedia lectern.

(b) Coordinate need for waste and recycling receptacles with Owner’s recycling program requirements.

8.9.3.9.19.8.10.3.9.19. Coat racks shall not be provided.

8.9.3.9.20.8.10.3.9.20. Pencil sharpeners shall not be provided.

8.9.3.9.21.8.10.3.9.21. Tack surfaces in the general assignment classrooms shall not be provided.

8.9.3.10.8.10.3.10. Typical Classroom Front:

8.9.3.10.1.8.10.3.10.1. 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.

8.9.3.10.2.8.10.3.10.2. Typical screen height in a flat floor classroom is 8 feet.

8.9.3.10.3.8.10.3.10.3. The multimedia lectern shall not obstruct students’ view of the writing surface and projection screen.

8.9.3.10.4.8.10.3.10.4. Classroom seating layout

8.9.3.10.4.1.8.10.3.10.4.1. Locate seats within the viewing angle. The viewing angle is considered 45- degrees each side of the center of the projection screen.

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

8.9.3.10.5.8.10.3.10.5. 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.

8.9.3.10.6.8.10.3.10.6. Provide space for a moveable instructor’s table, 48 to 60 inches wide by 24 inches deep, and instructor chair. Instructor’s chair is not required in seminar classrooms.

8.9.3.11.8.10.3.11. Writing Surfaces:

8.9.3.11.1.8.10.3.11.1. In each classroom, provide maximum possible writing surface at the front instruction wall. Additional writing surface on side walls may be provided.

8.9.3.11.2.8.10.3.11.2. Writing surface shall be porcelain-covered steel, dry-erase marker board with continuous full-length tray.

8.9.3.11.3.8.10.3.11.3. Minimum width shall be 12 foot. Writing surface shall be a minimum 4 feet in height, mounted 86 inches AFF to top. Bottom of the board shall not be less than 36 inches AFF.
Provide continuous cork tack strip at top. Strip shall be equipped with map hooks at 24 inch intervals.

Projection Booth:

An enclosed booth is preferred in Lecture Halls and Auditoria.

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

Include additional mechanical cooling for large-venue projection equipment.

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

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

Acoustically isolate the booth.

Mechanical Systems:

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

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

The HVAC system shall provide for year-round service.

Electrical Systems:

The front teaching wall shall have minimum of one (1) duplex outlet.

The number and location of the outlets shall be coordinated with Owner.

Electrical outlets shall be provided in all fixed student tables, with outlets for each pair of seats.

Lighting:

Provide back-lit toggle switches at each room entrance.

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

Consult ITS EI - Physical Infrastructure for any programmable/scene lighting configuration.
8.9.3.16.4. Lighting controls shall be integrated into the multimedia control panel.

8.9.3.16.5. 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.

8.9.3.16.6. General classroom lighting shall provide 45 - 65 foot candles on writing surfaces.

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

8.9.3.16.8. Lighting shall be evenly distributed for reading and writing and allow occupants to see each other's faces.

8.9.3.16.9. Seating area shall maintain lighting levels adequate for note-taking while viewing projection screens. Note-taking lighting levels may be achieved with dimming or selected switching of lamps.

8.9.3.16.10. Provide independent, adjustable lighting at projection screens.

8.9.3.16.11. Provide independent, adjustable lighting at writing surface. Writing surface shall be evenly illuminated.

8.9.3.16.12. Maintain lighting levels at the lectern adequate for reading.

8.9.3.16.13. Avoid suspending fixtures from the ceiling to prevent conflict with ceiling-mounted projectors.

8.9.3.16.14. Provide task lighting on the equipment rack or technology controls.

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

8.9.3.16.16. Mount luminaires so lamps are parallel to front wall.

8.9.3.17. Technology:

8.9.3.17.1. Provide portable media equipment storage closet, with storeroom lock, in each classroom building. Closet shall include one (1) data and one (1) electrical outlet.

8.9.3.17.2. Classrooms shall include projector, screen and multimedia equipment.

8.9.3.17.3. Consult ITS EL - Physical Infrastructure for multimedia equipment, rack, lectern, and controls requirements.

8.9.3.17.4. Multimedia lecterns shall be adjustable to allow for a variety of positions and ADA access.
8.9.3.17.5.8.10.3.17.5. Multimedia Lecterns:

8.9.3.17.5.1.8.10.3.17.5.1. Shall have minimum 15 RU's for A/V equipment.

8.9.3.17.5.2.8.10.3.17.5.2. Surface space for a 24 inch monitor, 7 inch control touch panel, document camera, and 24 inches of writing space.

8.9.3.17.5.3.8.10.3.17.5.3. Minimum of one (1) dedicated 20 amp circuit at the lectern.

8.9.3.17.5.4.8.10.3.17.5.4. Minimum of five (5) data outlets and one (1) phone line.

8.9.3.17.5.5.8.10.3.17.5.5. Phone for hotline calls, located at the lectern or wall nearest lectern.

8.9.3.17.5.6.8.10.3.17.5.6. Provide mock-up of the lectern for instructors review. Allow sufficient time for any modifications before production.

8.9.3.17.6.8.10.3.17.6. Audio/visual signal pathways, conduit size, and termination points in the general assignment classrooms shall be approved or specified by ITS EI - Physical Infrastructure.

8.9.3.17.7.8.10.3.17.7. Voice amplification is required for rooms seating seventy (70) or more. Rooms with voice amplification shall provide external line level outputs for assistive listening devices and/or multi-boxes.

8.9.3.17.8.8.10.3.17.8. Provide full wireless coverage for all classroom spaces.

8.9.3.17.9.8.10.3.17.9. Provide a minimum of four (4) active network drops grouped together at the instructor’s lectern or nearby location as approved by ITS EI - Physical Infrastructure.

8.9.3.17.10.8.10.3.17.10. TILE classrooms require five (5) active network drops at the instructor’s station and four (4) network drops for each student table. Additional capacity to expand data service to every seat in a TILE classroom is preferred.

8.9.4.8.10.4. Classroom Types:

8.9.4.1.8.10.4.1. Seminar Room:

8.9.4.1.1.8.10.4.1.1. Furnish with a large central table or multiple small tables that can be grouped into one (1) central table.

8.9.4.1.2.8.10.4.1.2. Furnish with moveable chairs.

8.9.4.1.3.8.10.4.1.3. Design for up to twenty-two (22) students.

8.9.4.1.4.8.10.4.1.4. Basis of design is 25 square foot per seat.
8.9.4.2.8.10.4.2. Small Classroom:

8.9.4.2.1.8.10.4.2.1. Flat floor.

8.9.4.2.2.8.10.4.2.2. Furnish with moveable tables and chairs.

8.9.4.2.3.8.10.4.2.3. Design for up to fifty (50) students.

8.9.4.2.4.8.10.4.2.4. Basis of design is 25 square foot per seat.

8.9.4.2.5.8.10.4.2.5. When tablet arm chairs are authorized, allow 18 square foot per seat.

8.9.4.3.8.10.4.3. Large Classroom:

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

8.9.4.3.2.8.10.4.3.2. Tiered floor.

8.9.4.3.3.8.10.4.3.3. Furnish with fixed tables and moveable chairs.

8.9.4.3.4.8.10.4.3.4. Design for fifty-one (51) to ninety-nine (99) students.

8.9.4.3.5.8.10.4.3.5. Basis of design is 20 square foot per seat.

8.9.4.4.8.10.4.4. Lecture Hall/Auditoria:

8.9.4.4.1.8.10.4.4.1. Sloped or tiered floor.

8.9.4.4.2.8.10.4.4.2. Furnish with low maintenance, fixed tablet arm chairs. Seats shall be labeled with row and number.

8.9.4.4.3.8.10.4.4.3. Design for one-hundred (100) or more students.

8.9.4.4.4.8.10.4.4.4. Basis of design is 12 square feet per seat.

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

8.9.4.5.8.10.4.5. TILE (Transform, Interact, Learn, Engage) Inquiry-Based Learning Space:

8.9.4.5.1.8.10.4.5.1. Flat floor.

8.9.4.5.2.8.10.4.5.2. Furnish with tables and moveable chairs.

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

8.9.4.6.8.10.4.6. Shared Informal Study Space:

8.9.4.6.1.8.10.4.6.1. These spaces are defined as individual and collaborative study space available on an unscheduled basis.
Furnish with equipment and infrastructure to support individual and group work.

**8.10.8.11.** Offices:

**8.10.1.8.11.1.** Guidelines for office size:

- **8.10.1.1-8.11.1.1.** Dean or Vice President: 200 to 300 square feet
- **8.10.1.2-8.11.1.2.** Departmental Executive: 180 square feet
- **8.10.1.3-8.11.1.3.** Faculty private office: 140 square feet
- **8.10.1.4-8.11.1.4.** Staff private office: 120 square feet

**8.10.2-8.11.2.** Loading Dock Facilities

**8.10.3-8.11.3.** Review loading dock facility requirements with Owner.

**8.10.4-8.11.4.** Potential requirements:

- **8.10.4.1-8.11.4.1.** TrashLandfill dumpster or compactor equipment with appropriate decking, railings and access.
  - **8.10.4.1.1-8.11.4.1.1.** Costs associated to procure and account for dumpsters or compactors shall be part of the project.

**8.10.4.1.2-8.11.4.1.2.** Dumpsters shall be accessible by a front-loading truck with the following minimum dimensions:
  - **8.10.4.1.2.1-8.11.4.1.2.1.** Travel access height: 13 feet 2 inches
  - **8.10.4.1.2.2-8.11.4.1.2.2.** Arm operation height: 23 feet
  - **8.10.4.1.2.3-8.11.4.1.2.3.** Overall width: 9 feet 6 inches
  - **8.10.4.1.2.4-8.11.4.1.2.4.** Overall approach length: 30 feet 8 inches
  - **8.10.4.1.2.5-8.11.4.1.2.5.** Vehicle wheelbase: 16 feet 8 inches
  - **8.10.4.1.2.6-8.11.4.1.2.6.** Turning radii, inside: 43 feet
  - **8.10.4.1.2.7-8.11.4.1.2.7.** Turning radii, outside: 60 feet 8 inches

**8.10.4.1.3-8.11.4.1.3.** Compactors and recycle roll-off containers shall be accessible by a rear hook and lift system truck.
  - **8.10.4.1.3.1-8.11.4.1.3.1.** Arm operation height: 15 feet 6 inches feet
  - **8.10.4.1.3.2-8.11.4.1.3.2.** Overall approach length: 54 feet
  - **8.10.4.1.3.3-8.11.4.1.3.3.** Compactor length: 22 feet 6 inches
Compactor height: 8 feet 7 inches

Overall width: 9 feet 6 inches

Travel access height: 13 feet 2 inches

Provide with IDOT required bumper assembly.

Provide either hydraulic or manual lift and/or catwalks for servicing trash / recycle containers.

Refuse trucks shall not be expected to back up more than fifty (50) feet to access or exit dock.

Dock levelers shall be sealed to prevent air infiltration.

Truck dock bays at grade and/or at loading height. Bays may include a recessed lift.

Minimum of two (2) spaces for service vehicle parking.

Dedicated receiving area.

Dedicated holding area (hazardous materials, chemicals, spent lamp storage).

Keyed hose bibbs with easy access and an isolated shut-off valve.

Two (2) area drains, one (1) in open areas and one (1) near dumpster locations in enclosed areas.

All animal rooms shall comply with the current edition of AAALAC standards.

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).

9. CONVEYING SYSTEMS

9.1. General

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.

9.2. Elevators

Elevators shall be designed to the current ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

Passenger elevators shall be high-efficiency electric traction.
9.2.3. Hydraulic elevators may be considered for fewer than four (4) stops or when higher load capacities are required.

9.2.4. Elevator machine rooms, hoist ways and lobby spaces shall be environmentally conditioned to allow for proper operation of the elevator.

9.2.5. 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. Minimum of one (1) elevator shall provide service to mechanical penthouses.

9.2.6. Access to basement and penthouse mechanical spaces shall be provided.

9.2.7. Elevator pit shall have a sump pit, a sump pump with an alarm connected to the building control system, and no floor drain.

9.2.8. Provide one (1) GFCI receptacle in the elevator car.

9.2.9. Elevator car lighting shall be LED.

9.2.10. Elevator finishes

   9.2.10.1. Freight elevators shall have textured aluminum or textured steel floors. Wall finishes shall be steel.

   9.2.10.2. Passenger elevator shall have entry-mat quality carpet tile floors or hard surfaces.

      9.2.10.2.1. Carpet tiles shall not contain animal hair.

      9.2.10.2.2. Hard surface options include terrazzo and VCT.

      9.2.10.2.3. Rolled goods shall not be used.

9.3. Lifts

   9.3.1. Vertical platform lifts and incline stair lifts are not allowed.

   9.3.2. Loading dock lifts for material transportation are allowed.

9.4. Escalators: Escalators are not allowed.

IV. STRUCTURAL

The following information is provided as a guide for designing structural support systems. All load criteria shall be in accordance with the current edition of the applicable codes.

1. GENERAL

   1.1. Load Criteria:

      1.1.1. Load criteria for all structural systems shall be noted on the drawings.
1.1.2. Roof Loadings:

1.1.2.1. Minimum ground snow load design is 30 psf. The snow load design shall also account for drift-loading on lower roof surfaces.

1.1.3. Floor Loadings:

1.1.3.1. Shall account for program requirements.

1.1.4. Wind Design:

1.1.4.1. 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.

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

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

1.4. Facilities shall be constructed of fire resistant materials.

2. FOUNDATIONS

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

3. CONCRETE

3.1. Mix Design and Material

3.1.1. Concrete strengths shall be specified in accordance with actual requirements.

3.1.2. Concrete mix shall be specified with minimum cement content, as well as maximum water/cement ratio.

3.1.3. 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.

3.1.4. Calcium chloride in concrete mixes shall not be permitted.

3.1.5. Substitution of up to 20% (by weight) of cement material with class C or F fly-ash complying with AASHTO M 295 is acceptable.

3.2. Exposed Concrete:

3.2.1. Exposed concrete intended as a finish material shall be clearly identified in the drawings and specifications.

3.3. Precast Concrete:

3.3.1. Panels shall be designed with adequate structural integrity to permit handling, transportation, storage, and erection.

3.3.2. Fabricator shall comply with the following codes and standards:
3.3.1.1.3.3.2.1. ACI-318 “Building Code Requirements for Reinforced Concrete”
3.3.1.2.3.3.2.2. CRSI “Manual of Standard Practice”
3.3.1.3.3.3.2.3. Prestressed Concrete Institute MNL117, “Manual for Quality Control for Plant and Production for Architectural Precast Concrete Products.”

3.3.2.1.1. Panels shall be designed with adequate structural integrity to permit handling, transportation, storage, and erection.

3.4. Placement:

3.4.1. Base course and under slab drainage system for slabs shall conform to geotechnical engineer recommendations. Slabs shall be constructed on a minimum 4 inch base of ¾ to 1 inch clean rock with a plastic vapor barrier.

3.4.2. Areas having floor drains shall have positive slope to the floor drain. Indicate direction of pitch on drawings.

3.4.3. Slab flatness and levelness shall be within 1/8 inch in 10 feet.

3.4.4. ASTM E1155 shall be used to specify flatness and levelness when a high level of accuracy is required.

3.4.5. Joint spacing and detail shall be shown on the drawings.

3.5. Testing: Design Professional shall specify allowable limits for each test required.

4. MASONRY

4.1. General

4.1.1. Stone coping shall be used for modification to existing facilities with stone coping.

4.1.2. Use of stone coping for design effect shall require approval from Owner.

4.1.3. Masonry units shall not be used for foundation walls below grade.

4.1.4. Waterproofing materials shall not be used on new masonry or stone surfaces.

4.1.5. Design Professional shall indicate wall expansion joints on drawings.

4.1.6. 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.

4.2. Brick and Block Masonry:

4.2.1. Follow Brick Institute of America (BIA) and Masonry Advisory Council (MAC) for design requirements.

4.2.2. Allowances may be specified for brick only if specific selections cannot be made.

4.2.3. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.
4.2.4. Testing:

4.2.4.1. Brick, including that incorporated into the face of architectural precast panels, shall comply with ASTM C216 and shall have a rating of “no efflorescence” when tested according to ASTM C67.

4.2.4.2. Lab certification of brick shall be based on samples taken the project specific production run and shall be approved prior to delivery.

4.3. Stone Masonry:

4.3.1. Limestone shall follow the current edition of the Indiana Limestone Handbook.

1. Accessories
   a. Mortar and Manufacture of Masonry Units shall conform to current ASTM Standards on Masonry. (1) In particular, C91-89 (Standard Specification for Masonry Cement) and C270-89 (Standard Specification for Mortar for Unit Masonry) shall apply.

5. METALS

5.1. Structural Steel:

5.1.1. Construction Documents shall clearly assign the responsibility for the design of steel connections. The responsible party shall seal the connection designs.

5.1.2. Design Professional shall use twist-off bolts and load indicator washers for field structural connections where possible.

5.1.3. Pre-engineered metal building roof purlins shall be adequately braced on the compression flange to resist all design loads.

5.1.4. Purlin slide clips commonly used with standing seam systems shall not be considered an effective brace for the purlin.

5.1.5. Separate purlin bracing such as threaded rods or sag angles shall be provided in addition to the slide clips.

5.2. Testing: Design Professional shall specify allowable limits for each test required.

5.3. Miscellaneous Metals: Refer to Section IV for information.

6. WOODS AND PLASTICS

6.1. Rough Carpentry: Fire-retardant lumber shall be in accordance with American Wood Preservers Association standards.


V. BUILDING MECHANICAL
The following information is provided as a general guideline in establishing Mechanical Engineering design requirements.

1. **GENERAL**

   1.1. The Design Professional shall plan access for servicing and maintenance of equipment.

      1.1.1. **Wall and Ceiling Access Doors:**

         1.1.1.1. Access doors shall be placed in a reasonable and safe location. Location points shall be noted if under carpet.

   1.2. Mechanical rooms shall include ventilation and temperature management where the space may exceed 85 degrees F.

   1.3. Minimize rooftop equipment and roof penetrations by consolidating equipment in mechanical rooms.

   1.4. Piping riser shall not be routed through Custodial Rooms.

   1.5. Shut-off valves shall be provided at pipe branches and where required to facilitate partial system isolation.

   1.6. Equipment, fixtures, or other appliances attached to any piping system shall have a shut off valve located at the connection to the piping system.

   1.7. All valves shall be located with sufficient room for maintenance or replacement.

   1.8. For existing buildings, equipment names shall be consistent with the equipment naming convention used in that building. Avoid duplicating equipment names for new equipment (E.g. a new fan in an existing building with fans shall not be named “EF-1”). Request building equipment list from Owner.

   1.9. For all equipment serving a space or a zone, preference is for that equipment name to correspond to the space or zone it serves. (E.g. a VAV serving space 1001 shall be named VAV-1001).

   1.10. The use of once-through cooling of any equipment is prohibited. Water-cooled systems shall use chilled water.

1. **Clean Air Compliance**

   1.11. Refer to ENVIRONMENTAL COMPLIANCE, above.

   a. 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. Exceptions to the pre-construction permit requirements are provided under Iowa Department of Natural Resources (DNR) rules.

   b. Emissions sources requiring a permit include, but are not limited to:

      4.1.2.1.1.1.1.1. Boilers

      4.1.2.3.1.1.1.1. Emergency generators

         (1) incinerators

         (2) fuel burning equipment

      4.1.2.4.1.1.1.1. Pollution control equipment
c. Refer to the DNR Air Quality Bureau home page: http://www.iowadnr.gov/InsideDNR/RegulatoryAir for more information.

4.1.3.1.1.1. Permitting, monitoring, pollution control, and dispersion modeling shall be coordinated and completed with the assistance of the Owner.

d. If project includes a significant or insignificant air emission source, as defined below, Design Professional shall coordinate with the Owner to ensure exchange of required information.
   1. Significant air emissions sources that require information for the Title V operating permit and a construction permit/registration
   2. Insignificant air emissions sources that require information for only the Title V permit
   3. Exempt sources (bathroom vents, sewer vents, comfort air conditioning, etc.)

2. FIRE PROTECTION AND SUPPRESSION

2.1. General

2.1.1. All new buildings shall be designed with automatic fire protection systems throughout the building. Automatic fire suppression systems shall be provided as a part of major renovation projects. Wet pipe type system is preferred. Partially renovated buildings shall be considered for automatic wet sprinkler fire protection coverage during the design scope of the project.

2.1.2. Refer to UI Fire Safety Department Guide Specifications.

2.1.3. All projects shall be hydraulically recalculated to prevent incorrect information from old hydraulic calculations.

2.1.4. System shall be designed in accordance with NFPA and FM Global for the application intended.

2.1.5. Each individual floor shall be isolated into its own sprinkler zone.

2.1.6. Size exterior fire department connections according to requirements of the local authorities having jurisdiction.

2.1.7. Sprinkler system tamper and flow valves shall be monitored by the building’s fire alarm panel.

2.1.8. Use dry pipe system in non-heated areas in lieu of chemical system.

2.1.9. Fire pump room shall have outdoor and direct interior access.

2.2. Piping and Pumps:

2.2.1. Piping:

2.2.1.1. Mains shall be run in hallways and corridors.

2.2.1.2. Mechanical joint piping systems may be used for fire protection systems. If mechanical joint systems are used, fittings shall be rolled grooved fittings. Mechanical joint systems shall not be cut grooved. Plain-end fittings shall not be used.
2.2.2. Pumps:

2.2.2.1. 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.

2.2.2.2. Electric fire pump controllers shall be equipped with automatic transfer switch (emergency power). The transfer switch shall be equipped with its own listed disconnect means.

2.3. Accessories:

2.3.1. Valves: Refer to Section IV for information.

2.3.2. Drains:

2.3.2.1. 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.

2.3.2.2. Main drain shall be parallel with the sprinkler riser.

2.3.2.3. 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.

2.3.2.4. Design system to drain back to its individual floor zone valve.

2.3.2.5. If auxiliary or test drains are needed, coordinate with Fire Safety.

2.3.3. Sprinklers: Refer to Section IV for information.

(4) Refer to Section IV for information.

2.3.4. Fire Extinguishers: Refer to Section IV for fire extinguisher information.

2.3.5. Fire Extinguisher Cabinets

2.3.5.1. Extinguishers shall be installed in a cabinet for all new construction.

2.3.5.2. Cabinets shall be used in all public areas, i.e. corridors, lounges, lobbies, gathering spaces.

3. PLUMBING SYSTEMS

3.1. General

3.1.1. Campus water distribution systems operate between 60 and 100 psig. Coordinate need for pressure reducing stations, or other application specific requirements, with Owner.

3.1.2. Domestic water heating systems shall be designed in accordance with Chapter 49 ASHRAE Handbook, HVAC System and Applications.

3.1.3. Desired temperature for normal faucet applications is a maximum of 110 degrees F at the point of usage.
3.1.4. 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.

3.2. Insulation:

   e. All insulation shall comply with ASHRAE 90.1 and shall be asbestos-free.

3.2.1. Refer to HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) Insulation requirements, Section III D 3.

3.3. Instrumentation:

   3.3.1. Domestic Water Systems shall have ¾ inch pathway to a central location for water metering.

3.4. Piping and Pumps:

   3.4.1. General: Refer to Section IV for information.

   3.4.2. Domestic Water: Refer to Section IV for information.

   3.4.3. Sanitary Waste and Vent:

      3.4.3.1. Equipment requiring indirect waste (backflow preventers, ice machines, autoclaves, etc.) shall be served by a drain. More than one (1) piece of equipment may be served by a drain, provided equipment is in close proximity.

      3.4.3.1.1. Size drain for combined load.

      3.4.3.1.2. Floor drains are preferred.

      3.4.3.2. Drain piping shall not be routed across walkways, maintenance areas, or other traffic areas.

   3.4.4. Storm Sewer:

      3.4.4.1. All surface water shall be directed to a storm sewer system.

      3.4.4.2. Storm water shall not be placed in a sanitary sewer system.

   3.4.5. Special Systems: Refer to Section IV for information.

   3.4.6. Pumps: Refer to Section IV for information.

      f. Pumps

         (1) Refer to Section IV for information.

3.5. Equipment:

   3.5.1. Water Heaters:
3.5.1.1. Water heaters and hot water storage tanks shall meet efficiencies set forth in the current edition of ASHRAE/IES Standard 90.1. Water heaters shall meet the requirements of State of Iowa Administrative Rules, Chapters 94 and 95, for state registration purposes.

3.5.1.2. **Steam is** instantaneous, tankless water heating systems, using campus utility steam or hot water are the preferred heat source for all hot water systems on the Main Campus.

3.5.1.3. Heated water shall be outside the tube if anticipate rapid fouling due to heavily mineralized water.

(2) **Instantaneous, steam, tankless water heating systems are preferred.**

3.5.1.4. If a natural gas combustion unit is selected, provide Owner with manufacturer, model and maximum capacity information.

3.5.1.5. 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. Contact Owner for further information.

3.5.2. Expansion Tanks:

3.5.2.1. Dumping excess water due to expansion shall not be allowed.

3.5.3. Water Softeners:

3.5.3.1. Main Campus: Potable hot water systems shall have water softening. Other water systems shall be softened only in specific applications.

3.5.3.2. The University of Iowa Research Park (Oakdale Campus): All systems shall have water softening.

3.5.3.3. Design water softening systems to supply water at less than 1 grain of hardness.

3.5.3.4. 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). Coordinate project specific hardness with Owner.

3.5.3.5. The Design Professional shall coordinate the sizing and specifications of water softeners with Owner.

3.5.4. Backflow Preventers:

3.5.4.1. Domestic water systems shall have backflow prevention devices at the point of building entry.

3.5.4.2. Metering devices, taps, or other fittings shall be located upstream of backflow preventers. 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.

3.6. Fixtures:

3.6.1. General

3.6.1.1. Water flow control devices shall be water conserving.
3.6.1.2. Waterless urinals shall not be allowed.

3.6.1.3. Fixtures shall be wall-mounted.

3.6.2. Water Coolers:

3.6.2.1. Water coolers shall be dual level, refrigerated type.

3.6.2.2. Provide Hydration Stations (water cooler with bottle filler) in high traffic areas. Review locations with Owner.

3.6.3. Hose Bibbs and Wall Hydrants:

3.6.3.1. Hose bibbs and wall hydrants shall comply with UPC standards listed in chapter 6, i.e. ASSE 1001 or CSAB 64.2.1.1.

3.6.3.2. A hose connection shall be installed on roofs and in each mechanical room.

3.6.3.3. Hose connections shall be located on the exterior of each building. A minimum of one (1) hose connection shall be installed on each side of the building. Spacing for hose connections is one (1) every 100 feet. Hose connections shall be installed within 15 feet of the main entrance to the building, if feasible.

3.6.4. Floor Drains:

3.6.4.1. Mechanical rooms shall have a minimum of one (1) floor drain. 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.

3.6.4.2. Mechanical room floor drains shall not be connected to the storm sewer system.

3.6.4.3. Flooring shall pitch toward the floor drain to eliminate standing water.

3.6.4.4. Provide floor drains in all toilet rooms. Square drains shall be used for tile floors, round drains for concrete floors.

3.6.5. Emergency Showers and Eyewash Stations:

3.6.5.1. Emergency showers and eyewashes shall be provided as required by OSHA or project program requirements. Coordinate with Owner.

3.6.5.2. Piping to emergency showers and eyewashes shall comply with ANSI Z358.1 2004.

3.6.5.3. In new construction, any situation requiring an emergency shower shall be onto the floor (no floor drain), unless directed otherwise by Owner.

3.6.5.4. Emergency showers shall have a local alarm.

4. HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

4.1. General
4.1.1. Heating and cooling system loads for the purpose of sizing systems and equipment shall be determined in accordance with procedures described in the ASHRAE Handbook - Fundamentals.

4.1.2. 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.

4.1.3. Heating design temperature shall not be lower than the 99 percent dry-bulb (dB).

4.1.4. Cooling design temperature shall be 92 F dB, 76 F wb and for cooling towers 79 F wb.

4.1.5. Winter humidification shall not be provided for general comfort applications.

4.1.6. Humidification shall be provided for 100 percent outdoor air systems or special areas (e.g. labs, museums, rare books).

4.1.7. Ventilation systems shall be designed to provide outdoor air ventilation rates in accordance with ANSI/ASHRAE Standard 62.

4.1.8. Exhaust/return fans shall be included in the HVAC design. Single fan systems are prohibited.

4.1.9. Fresh air intakes shall be designed above grade and shall be no closer than 50 feet to parking areas.

4.1.10. Piping systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.

4.1.11. 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.

4.1.12. Centralized heating and chilled water are preferred systems, where available. For 100 percent outside air requirements, a steam heat exchanger shall be used to incorporate antifreeze protection for preheat coils. Reheat applications shall incorporate a steam-to-hot-water heat exchanger for better temperature control.

4.1.13. Electric heating systems shall not be used.

4.1.14. Vibration and sound transmission from mechanical equipment and systems shall not exceed ASHRAE sound criteria design guidelines, Table 42, ASHRAE HVAC Applications Handbook, Chapter 47.

4.1.15. 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.

4.1.16. The water velocity in piping shall not exceed 7 feet/second. Maximum design pressure drop of 4 feet/100 feet of equivalent pipe length.

4.1.17. 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.
4.1.18. The use of once-through cooling of any equipment is prohibited. Water-cooled systems shall use chilled water.

4.1.19. Geothermal Systems:

4.1.19.1. Geothermal systems shall not be used where central utilities are available.

4.1.19.2. Open loop systems shall not be used.

4.1.20. Refrigerant Management

4.1.20.1. Owner is required to comply with Title VI of the Clean Air Act relating to ozone depleting substances.

4.1.20.2. Owner’s preference is to use HFC refrigerants for comfort, commercial, and industrial process cooling. Class I refrigerants (CFCs) shall not be allowed.

4.1.20.3. Design Professional shall notify Owner when project includes cooling equipment that contains over 50 pounds of refrigerant.

4.1.20.4. 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.

4.2. Piping

4.2.1. General

4.2.1.1. Expansion tanks shall be bladder-type and located on the suction side of pumps.

4.2.1.2. 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:

4.2.1.2.1. Loads are widely-spread throughout the project scope area.

4.2.1.2.2. 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.

4.2.1.2.3. The project scope area is greater than 5,000 square feet.

4.2.1.2.4. The hydronic system flow rate for the project scope area is greater than 25 gpm.

4.2.1.3. Hydronic piping systems shall always utilize a reverse return piping arrangement in the following situations:

4.2.1.3.1. Multiple identical devices require equal flow proportions from a common supply.

4.2.1.3.2. Multiple devices are served by a common zone valve or circulator (e.g. several fin tube elements served by one (1) zone valve)

4.2.2. Hot Water Piping:
4.2.2.1. Combination air/dirt separators are required on all systems and shall be coalescing-type.

4.2.3. Chilled Water Piping:

4.2.3.1. Chilled water loops shall be two (2) pipe systems.

4.2.3.2. 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.

4.2.3.3. Some applications (large temperature rise, water quality issues) may require separation of the chilled water and the medium cooling the device.

4.2.3.3.1. 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.

4.2.3.3.2. Control chilled water flow to the heat exchanger according to the temperature of the departing chilled water.

4.3. Insulation:

4.3.1. Heating and Chilled Water piping Insulation shall comply with the requirements of ASHRAE 90.1, version adopted by the State of Iowa.

4.3.1.4. Storm drain bodies shall be fiberglass, flexible unicellular foam, or cellular glass insulated. Horizontal storm piping immediately downstream of the drain bodies shall be insulated to the first vertical elbow.

g. Closed cell (Armaflex) insulation is acceptable on refrigerant piping.

4.3.3. Exposed sanitary piping in occupied spaces shall be insulated.

4.3.2. Provide insulation on equipment, pipes, and ducts where:

4.3.2.1. Heat transmitted shall significantly affect ambient temperatures in temperature controlled spaces.

4.3.2.2. Heating or cooling effects shall be significantly affected due to heat flow into or out of pipes or ducts.

4.3.2.3. Condensation will occur as a result of surface temperature approaching dew point of the ambient air.

4.3.2.4. Significant energy loss would result from heat transfer.

4.3.2.5. External surface temperature is greater than 120 degrees F.

(1) Continuous vapor barrier on all cold surfaces shall be insulated.

4.4. Air Distribution:

4.4.1. Ductwork:

4.4.1.1. Supply/return air systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.
4.4.1.2. Return air shall be ducted.

4.4.1.3. Return air ceiling plenum systems shall not be permitted.

4.4.2. Accessories: Refer to Section IV for information.

4.5. Equipment:

4.5.1. General: Refer to Section IV for information.

4.5.2. Refrigerant Systems:

4.5.2.1. Mechanical room installations shall comply with ASHRAE Standard 15.

4.5.2.2. Air-cooled condensing units shall not be placed in conditioned spaces or machine rooms.

4.5.2.3. Design all roof-mounted condensing units to 115 degrees F outside air temperature.

4.5.2.4. 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.

4.5.3. Pumps: Design Professional shall evaluate the need for vibration isolation on the pump.

4.5.4. Air Handling Equipment: Refer to Section IV for information.

4.5.5. Humidifiers:

4.5.5.1. Reverse Osmosis water shall be used for humidification.

4.5.5.2. Direct-steam humidification systems shall not be used.

4.5.6. Corrosion Coupon Rack: Refer to Section IV for information.

4.5.7. Chemical Pot Feeders: Refer to Section IV for information.

4.5.8. Bag Filters: Refer to Section IV for information.

4.6. Lab Systems:

4.6.1. General

4.6.1.1. Lab HVAC system shall be designed as 100 percent outside air, Variable Air Volume (VAV) supply and exhaust system. Constant Air Volume (CAV) applications, system or zones, shall not be used without a Deviation Request.

4.6.1.2. Lab exhaust systems shall be designed for continuous operation. Any component of the exhaust air system requiring routine maintenance access shall be accessible, without human exposure to the exhaust airstream, while the exhaust system is in operation.

4.6.1.3. Where feasible, ventilation to offices, conference rooms, corridors, and other non-lab spaces shall be provided from a different air handling system.
4.6.1.3. Exception: Lab office space where air is transferred to adjacent laboratory to maintain airflow direction requirements.

4.6.1.4. Serve special use lab spaces, such as animal holding, BSL-3, etc., from a dedicated supply and exhaust system.

4.6.1.5. 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. Airflow and/or pressure relationships shall be clearly identified in the documents.

4.6.1.6. In lab spaces where the dominant design consideration is sensible cooling load, a stand-alone cooling systems served by a year-round chilled water loop shall be evaluated for potential energy savings over a traditional all air system.

4.6.1.7. Design Professional shall determine the required ventilation rates to maintain air quality and safety of the room while minimizing overall energy use. Minimum air changes shall be as follows:

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<td>Unoccupied</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

4.6.1.8. Written notification shall be submitted to the owner if a space requires ventilation rated other than indicated minimums.

4.6.1.9. Indicate design minimum air changes on the Room Airflow Matrix. Refer to Section III, Mechanical.

4.6.1.10. 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. Design Professional shall not oversize HVAC control devices.

4.6.1.11. Lab spaces shall have dedicated and separate exhaust air systems from non-research functions in the building.

4.6.1.12. 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.

4.6.1.13. Lab HVAC systems, including fume hoods and safety cabinets, shall be fully commissioned.

4.6.2. Redundancy: 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. 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. Systems utilizing a fan array design approach may also be considered to meet these requirements.

4.6.3. Heat Recovery

4.6.3.1. Heat recovery shall be used in all lab HVAC systems.

4.6.3.2. Total (sensible and latent) energy recovery wheels shall be the default design condition. Other considerations shall include run around loops and heat pipe systems based on life cycle cost or lab-specific application.

4.6.3.3. Energy recovery wheels for laboratory systems shall be evaluated based on programmatic use of the building, analysis of the hazardous materials and chemicals planned in use, and factory and field performance testing to verify allowable cross contamination limits.

4.6.3.4. Energy Wheels

4.6.3.4.1. Energy recovery wheels are permitted if purge system is used to limit cross contamination to 0.04% of the exhaust air concentration by volume. The transfer media shall be coated with 3 angstrom molecular sieve desiccant.

4.6.3.4.2. Silica gel desiccants allow significant cross contamination from exhaust to supply streams and are not permitted.

4.6.3.5. Combination heat recovery-preheat coils shall not be used due to complications in controllability and the possibility of overheating intake air in summer time.

4.6.4. Temperature Controls

4.6.4.1. 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.

4.6.4.2. Space temperature deadbands shall be as follows:

<table>
<thead>
<tr>
<th>Time-of-Day Schedule</th>
<th>Occupancy Sensor Occupied</th>
<th>Occupancy Sensor Unoccupied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupied</td>
<td>+/- 1</td>
<td>+/- 3</td>
</tr>
<tr>
<td>Unoccupied</td>
<td>+/- 1</td>
<td>+/- 6</td>
</tr>
</tbody>
</table>

4.6.5. Pressure and Airflow Control

4.6.5.1. Supply and exhaust air shall be monitored by airflow measuring stations (AFMS) to maintain positive or negative pressure relationships. Through-the-wall room pressurization controllers shall be avoided.
4.6.5.2. 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.

4.6.6. Ductwork:

4.6.6.1. Fully duct supply, exhaust, and outside air systems for all spaces.

4.6.6.2. 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.

4.6.6.3. Smoke dampers and/or fire dampers shall not be installed in laboratory exhaust ducts serving fume hoods, safety cabinets, or other containment equipment.

4.6.6.4. Duct materials shall be evaluated with vapors being exhausted. 304 stainless steel shall be used as the design basis for most solvents and potentially flammable vapors. All stainless steel duct seams and joints shall be welded.

4.6.6.5. Plastic laboratory exhaust duct shall be FM Global approved for use without automatic sprinkler protection.

4.6.7. Fume Hoods:

4.6.7.1. Fume hoods shall:

4.6.7.1.1. Be restricted air bypass-style type and set up for variable air volume (VAV) control.

4.6.7.1.2. Be designed for a minimum face velocity of 100 FPM at a sash working height of 18 inches.

4.6.7.1.3. Be provided with proximity sensors and automatic sash closures

4.6.7.1.4. Have a face velocity no lower than 80 FPM.

4.6.7.1.5. Have been tested and certified for the proposed face velocities by the latest version of ASHRAE Standard 110.

4.6.7.1.6. 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. Such hoods shall

4.6.7.1.6.1. Have a face velocity no lower than 80 FPM.

4.6.7.2. Have been tested and certified for the proposed face velocities by the latest version of ASHRAE Standard 110. 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.

4.6.7.3. Hoods shall not be located near doors or primary walkways.
4.6.7.4. Ambient air velocity, caused by supply outlets, etc., shall not exceed 30-40 FPM at the hood face.

4.6.7.5. 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. 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.

4.6.8. Biological safety cabinets (BSCs):

4.6.8.1. Class II, Type A1 or Type A2 (recirculated), shall not be hard-ducted to the building exhaust system.

4.6.8.2. Class I, Class II-B1 (partially exhausted) and Class II-B2 (fully exhausted) shall be hard ducted to a dedicated building exhaust air system.

4.6.8.3. 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.

4.6.8.4. Exhaust systems serving BSC shall include variable frequency drive to increasing the system static pressure to compensate for loading of the HEPA filters.

4.6.9. Storage Cabinets:

4.6.9.1. Flammable storage cabinets shall not be vented.

4.6.9.2. Locate vented corrosive storage cabinets underneath fume hoods, if present.

4.6.10. Exhaust Fans:

4.6.10.1. 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.

4.6.10.2. 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.

4.6.10.3. Exhaust fans shall be located to provide full access for maintenance and be as close to the exhaust stack as possible.

4.6.10.4. It is preferred that the fan be located exterior to the building. When the exhaust fan must be located in an interior mechanical space, provide minimum exhaust of one air change per hour in that space.

4.7. Steam Systems:

4.7.1. General

4.7.1.1. The campus pumped condensate return system operates with low pressure and is by gravity flow in most areas.

4.7.1.2. Low pressure steam is 20-25 psig. Medium pressure steam is defined as having 20 to 85 psig.
4.7.1.3. Building systems shall be designed for a maximum operating pressure of 15 psig.

4.7.1.4. Sizing of control valves, PRV, traps, etc., shall be based on a delivery pressure setting up to 30 psig.

4.7.2. Piping, Pumps and Valves

4.7.2.1. Pumps: Refer to Section IV for information.

4.7.2.2. PRVs: Refer to Section IV for information.

4.7.2.3. Medium and Low Pressure Steam - Above Grade: Refer to Section IV for information.

4.7.3. Equipment

4.7.3.1. Heat Exchangers:

4.7.3.1. Heat exchangers shall be ASME approved and shall be installed with relief valves, rated for the service, on both steam and hot water systems.

4.7.3.1.2. Locate heat exchangers to allow removal of the bundle.

4.7.3.1.3. Refer to HOT WATER CONVERTOR STEAM AND CONDENSATE PIPING DETAIL in Appendices.

4.7.3.1.4. Pressure powered pump/receiver shall have a condensate receiver inlet reservoir of welded steel construction, mounted above the pump and sized in accordance with the manufacturer’s recommendations.

4.7.3.2. Condensate receiving tank shall have a drain installed.

4.7.3.2.1. Heat exchangers shall be ASME approved and shall be installed with relief valves, rated for the service, on both steam and hot water systems.

4.7.3.2.1.1. Locate heat exchangers to allow removal of the bundle.

4.7.3.3. Install gauges and thermometers to indicate the following:

4.7.3.3.1. Pressure of entering steam.

4.7.3.3.2. Pressure and temperature of entering water.

4.7.3.3.3. Pressure and temperature of leaving water.

4.7.3.4. Install expansion tanks on the water side of all heat exchangers with a sight glass and provisions for draining and venting.

4.7.3.5. Condensate tanks shall be sized at a minimum of three (3) times the calculated peak flow in gpm and shall have two (2) separate vents.

4.7.3.6. All coils shall be tube-in-tube, non-freezing type with a minimum 1 inch O.D. tubing.
(3) Designer shall consider the use of integral face and bypass coils, especially in situations using steam to pre-heat outside air. Provide two (2) steam traps with bypass for all pre-heat coils.

4.8. Snowmelt Systems:

4.8.1. Snowmelt system feasibility shall be evaluated during early design for all new buildings and any building renovation involving entrance steps or ramps.

4.8.2. Snowmelt system use shall be limited to the following:

4.8.2.1. Main building entrances, and building entrances on the north and west building faces a maximum of 10 feet from the building. Discuss the use of snowmelt on the south and east building entrances with Owner and stakeholders.

4.8.2.2. Stairways and ramps at building entrances.

4.8.2.3. 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 and stakeholders.

4.8.2.4. Truck delivery points where delivery ramp is sloped.

4.8.2.5. Snowmelt systems shall not be used in the following:

4.8.2.5.1. On public sidewalks or roadways further than 10 feet from building entrance.

4.8.2.5.2. 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).

4.8.3. Snowmelt systems shall provide 24/7 protection from accumulation of snow and ice at major building entrances and ADA ramps.

4.8.4. Snowmelt systems shall circulate Dowfrost propylene glycol under low pressure through closed-loop piping embedded in concrete. Design Professional shall coordinate acceptable glycol mix ratio from owner prior to design.

4.8.5. Snowmelt systems shall be controlled through the Building Automation System (BAS). Snowmelt is enabled if Outside Air Temperature = or < 40 F and below; Snowmelt is disabled if OAT > 40 F. Snowmelt system shall be manually enabled through the BAS. BAS shall provide an email notification to BLS every morning at 7 AM that the snowmelt system is enabled.

4.8.6. Design snowmelt systems for a maximum 150 Btu-h per square foot heat input.

4.8.7. All snowmelt systems shall have a BTU meter installed to measure energy usage. The data from the BTU meter shall be mapped back to the BAS and be included in the snowmelt graphic screen. Points to be mapped are BTU, flow, Supply and Return Temperatures.

5. INSTRUMENTATION

5.1. Meters:
5.1.1. Domestic Water Meters: Design Professional shall coordinate sizing and location of meters with Owner.

(4) Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices.

6. CONTROLS

6.1. General

6.1.1. All systems shall be fully compatible and integrate into the existing University building automation network.

6.1.2. 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.

6.1.3. Existing Buildings:

6.1.3.1. Control systems in existing buildings shall be an extension of the existing system. Integration of multiple control systems is not acceptable.

6.1.3.2. 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.

6.1.3.3. Minor renovations in buildings with pneumatic zone control may re-use existing components with prior approval. New components shall utilize DDC technology.

6.1.4. Field controllers shall be able to accept program uploads and downloads across the network.

6.1.5. Control networks shall be engineered to accommodate point collection, trending, and alarm points available from third-party vendor devices, networked on a dedicated communication bus and master controller. Size network with to accommodate use of 50 percent of available third-party vendor trends, alarms, etc. Size network to provide an additional 20 percent capacity.

6.1.6. Occupancy Sensor Zone Control:

6.1.6.1. Provide occupancy sensor HVAC zone control in areas subject to extended unoccupied periods during normal building occupied hours

6.1.6.1.1. Refer to the table in section IV-E-3-a for specific locations where HVAC integration is recommended.

6.1.6.1.2. 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.

6.1.6.2. Refer to section IV-E-3-a design guidelines on sensor locations.

6.1.6.3. Design system to allow airflow to ramp down to the supply and return fan minimum speeds.

6.1.6.4. Space temperature deadbands shall be as follows. Refer to Lab Systems for temperature deadbands in laboratory spaces.
### Table: Occupancy Mode and HVAC Status

<table>
<thead>
<tr>
<th>Occupancy Mode</th>
<th>Description of Mode</th>
<th>HVAC Status</th>
<th>Temperature Deadband (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupancy Sensor Occupied</td>
</tr>
<tr>
<td>Primary Occupancy</td>
<td>Standard Occupancy Hours</td>
<td>ON</td>
<td>+/- 1</td>
</tr>
<tr>
<td>Secondary Occupancy</td>
<td>Not standard occupancy hours, but the building is available to occupants</td>
<td>ON</td>
<td>+/- 1</td>
</tr>
<tr>
<td>Unoccupied</td>
<td>Building is unoccupied, HVAC is scheduled off</td>
<td>OFF</td>
<td>+/- 8</td>
</tr>
</tbody>
</table>

#### 6.1.7. CO2 Ventilation Control:

6.1.7.1. CO2 sensor-driven Demand Control Ventilation strategies shall not be used without prior approval.

6.1.7.2. CO2 sensors shall not be installed in zones if not controlling ventilation air volumes to the space.

6.1.7.3. 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.

6.1.7.4. Sensor Accuracy: +/-2%

6.1.7.5. Measuring Range: 0-2000 ppm

6.1.7.6. Reliability: 3 years of reliable calibration

6.1.7.7. Acceptable manufacturers: Johnson Controls, Kele, Schneider

6.1.7.8. 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.

6.1.7.9. BACnet Integration:

6.1.7.10. 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 100 percent of the Sequence of Operation.

6.1.7.11. Design Professional shall be responsible to insure that third party BACnet controllers are able to adhere to the same point capabilities as the building automation system.

6.1.7.12. 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.
6.2. Scopes of Work: Refer to Section IV for information.

6.3. User Interface: Refer to Section IV for information.

2. User Interface
   a. Refer to Section IV for information.

6.4. Sensors and Equipment: Sensors and equipment shall be standard nonproprietary components regularly manufactured for this and/or other systems and not custom-designed specifically for this project.

6.5. Installation: Refer to Section IV for information.

6.6. Air Flow Matrix:

   6.6.1. Design Professional shall provide an Air Flow Matrix for the Contractor using the Air Flow Matrix Detail below.

   6.6.2. VAV box flow shall be selected within the readable range of the selected product. When using differential pressure style airflow stations in VAV boxes, the minimum airflows shall not be less than:

   (1) 5 inch VAV – 53 cfm
   (2) 6 inch VAV – 75 cfm
   (3) 7 inch VAV – 102 cfm
   (4) 8 inch VAV – 135 cfm
   (5) 9 inch VAV – 170 cfm
   (6) 10 inch VAV – 210 cfm
   (7) 12 inch VAV – 302 cfm
   (8) 14 inch VAV – 410 cfm
   (9) 16 inch VAV – 537 cfm
   (10) 18 inch VAV – 680 cfm
   (11) 20 inch VAV – 840 cfm
   (12) 22 inch VAV – 1016 cfm
   (13) 24 inch VAV – 1210 cfm

<table>
<thead>
<tr>
<th>VAV Size</th>
<th>Min. CFM</th>
<th>VAV Size</th>
<th>Min. CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 inch</td>
<td>53 cfm</td>
<td>14 inch</td>
<td>410 cfm</td>
</tr>
<tr>
<td>6 inch</td>
<td>75 cfm</td>
<td>16 inch</td>
<td>537 cfm</td>
</tr>
<tr>
<td>7 inch</td>
<td>102 cfm</td>
<td>18 inch</td>
<td>680 cfm</td>
</tr>
<tr>
<td>8 inch</td>
<td>135 cfm</td>
<td>20 inch</td>
<td>840 cfm</td>
</tr>
<tr>
<td>9 inch</td>
<td>170 cfm</td>
<td>22 inch</td>
<td>1016 cfm</td>
</tr>
<tr>
<td>10 inch</td>
<td>210 cfm</td>
<td>24 inch</td>
<td>1210 cfm</td>
</tr>
</tbody>
</table>
6.6.3. Air Changes Per Hour (ACPH):

6.6.3.1. For positive rooms, the ACPH shall be based on the minimum supply airflow.

       6.6.3.2. For negative rooms, the ACPH shall be based on the minimum exhaust/return airflow.
### Air Flow Matrix

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Supply VAV ID</th>
<th>Associated AHU</th>
<th>Supply VAV Inlet Size</th>
<th>Supply VAV AREA</th>
<th>Occ Supply CLG Max CFM</th>
<th>Occ Supply HTG Max CFM</th>
<th>Occ Supply HTG/CLG Min CFM</th>
<th>Unoc Supply CLG Max CFM</th>
<th>Unoc Supply HTG Max CFM</th>
<th>Unoc Supply HTG/CLG Min CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>LSV 1</td>
<td>LAHU 1</td>
<td>8&quot;</td>
<td>0.349</td>
<td>635</td>
<td>635</td>
<td>250</td>
<td>525</td>
<td>525</td>
<td>140</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exhaust VAV ID</th>
<th>Associated EF</th>
<th>Exhaust VAV Inlet Size</th>
<th>Exhaust VAV AREA</th>
<th>Occ Exhaust Max CFM</th>
<th>Occ Exhaust Min CFM</th>
<th>Unoc Exhaust Max CFM</th>
<th>Unoc Exhaust Min CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEV 1</td>
<td>LEF 1</td>
<td>8&quot;</td>
<td>0.349</td>
<td>670</td>
<td>285</td>
<td>560</td>
<td>175</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fume Hood VAV ID</th>
<th>Associated EF</th>
<th>Fume Hood VAV Size</th>
<th>Fume Hood Area</th>
<th>Fume Hood Max CFM</th>
<th>Fume Hood Min CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHV 1</td>
<td>LEF 1</td>
<td>8&quot;</td>
<td>0.349</td>
<td>550</td>
<td>165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Room Bias CFM</th>
<th>Room Pressure</th>
<th>Room Volume Ft³</th>
<th>Occ ACPH</th>
<th>Unoc ACPH</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>neg 200</td>
<td>neg 0.01&quot;</td>
<td>4500</td>
<td>6.00</td>
<td>4.53</td>
<td></td>
</tr>
</tbody>
</table>

**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.
VI. ELECTRICAL

The following information is provided as a general guideline in establishing Electrical Engineering design requirements.

1. GENERAL

1.1. General

1.1.1. New building main power supplies and distribution panels 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.

1.1.2. Only UL or equivalent approved appliances and equipment shall be specified.

1.1.3. When installing or changing electrical equipment, the Design Professional shall evaluate available fault currents and size the ampere interruption capacity accordingly.

1.1.4. Provide separate demolition and construction drawings.

1.1.5. Show conduit sizes, routings, number and sizes of conductors for all feeder and homerun circuits.

1.1.6. Show lighting and power circuits on the drawings. Identify the panel terminal point for each circuit.

1.1.7. Provide a schematic wiring diagram of power and lighting related control circuits on the construction drawings.

1.1.8. New buildings or building additions may require ground fault zone interlocking. Review options with Owner regarding project needs.

1.1.9. Provide a riser diagram for each system covered under Division 26.

1.1.10. Show electrical schedules for panel boards, distribution boards, motor control centers and related items on the drawings. Indicate connected demand load.

1.1.11. Electrical distribution equipment shall not be located in stairwells.

1.1.12. The design for buildings that house sensitive laboratory or data processing equipment shall clearly address the power quality requirements and location for the equipment. Separate neutrals, oversized neutrals and isolated grounds shall be installed where necessary.

1.1.13. Electrically heated snow/ice melting systems are not allowed.

1.1.14. The Design Professional shall evaluate anticipated building loads for potential harmonic design requirements.

1.1.15. Power circuits shall not share neutrals.

1.1.16. Provide lighting and GFCI receptacles in all accessible pipe spaces, pipe shafts, duct shafts, attic spaces, tunnels and mechanical equipment rooms.

1.1.17. Fire alarm and miscellaneous signals shall be in conduit.

1.2. Identification:

1.2.1. The Design Professional shall clearly indicate the required wording of all labels.

1. Arc Flash


b. It is the Owner’s intent to avoid arc flash hazards greater than NFPA 70E, 2015 Edition, PPE Category 2.
c. Design and Construction Submittals
   (1) Preliminary design assessment(s) shall be conducted as soon as feasible, no later than 50% through the Construction Document Phase.

   1.3. Any condition resulting in an Arc Flash PPE Category of 3 or higher shall be identified in writing to the Owner. Include options for lowering the PPE Category.
      (a) To be accepted by the Owner, conditions identified as Arc Flash PPE Category 3 or higher shall be documented in a Deviation Request.
      (b) Provide electrical riser diagram showing preliminary breaker settings, ratings, available fault current, hazard levels in Construction Documents.

   (2) Record Arc Flash Assessment shall be conducted using as-installed equipment and conditions.
      (a) Any condition resulting in an Arc Flash PPE Category of 3 or higher shall be identified in writing to the Owner. Include options for mitigating the PPE Category.
      (b) Document any condition of Arc Flash PPE Category 3 or higher through a Deviation Request.
      (c) Provide as-installed electrical riser diagram showing final breaker settings, ratings, available fault current, hazard levels.
      (d) Submit as-installed riser diagram, assessment calculations and model file to Owner for record.
      (e) Design Professional shall provide to the Contractor data to comply with NFPA 70E labeling requirements.

d. Coordinate breaker sizing and setting requirements for the service protector with all downstream circuits and protective devices in the building.

e. Evaluate available fault currents and size ampere interruption capacity for all new or modified equipment.

1.4. Grounding:

   1.4.1. Buried loop is the preferred method for establishing grounding. In new construction, establish grounding through use of concrete reinforcing steel.

   1.4.2. Driven grounds shall not be specified where soil conditions consist of rock. In such conditions, use a counterpoise system or another approved alternative.

   1.4.3. Building steel shall not be used for grounding unless specifically designed and tested for this application.

   1.4.4. Building columns, roof steel, and steel reinforcing shall be made electrically continuous for grounding purposes.

   1.4.5. Water lines, building steel, and a grounding conductor from existing building shall be bonded together.

   1.4.6. Grounding electrode shall have a resistance to ground between 2 to 5 ohms.
1.4.7. Ground systems shall be connected to the primary power system ground mat serving the facility.

1.4.8. All grounding system conductors shall be copper.

1.4.9. Provide a separate grounding conductor with all circuits.

2. MEDIUM-VOLTAGE (601 VOLTS – 69k VOLTS) ELECTRICAL

Refer to Section IV for information.

3. LOW-VOLTAGE ELECTRICAL

3.1. Equipment:

3.1.1. Design:

3.1.1.1. 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.

3.1.1.2. Service entrance switchboards shall have a main circuit breaker.

3.1.1.3. Phase, neutral and ground buss shall be copper.

3.1.1.4. 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.

3.1.1.5. Provide a minimum 20 percent spare, usable space in new switchboards, panelboards, and motor control centers.

3.1.1.6. In existing buildings, new switchboards, panelboards, motor control centers, enclosed switches, circuit breakers and VFD shall match existing.

3.1.2. Transient Voltage Surge Suppression:

3.1.2.1. Locate suppression equipment in the enclosure of the equipment being served.

3.1.2.2. Provide a disconnecting means to isolate the suppression equipment.

3.1.3. Switchboards:

3.1.3.1. Provide continuous ground bus the full length of the switchboard.

3.1.3.2. All switchboards shall have separate neutral and grounding busses.

3.1.4. Panelboards:

3.1.4.1. Provide continuous ground bus the full length of the panelboard.

3.1.4.2. All panelboards shall have separate neutral and grounding busses.

3.1.5. Motor Control Center:

3.1.5.1. Starters shall have fusible disconnects rather than circuit breakers.

3.1.5.2. Control circuit voltage shall be 120 volts or less.
3.1.5.3. Provide a minimum of two (2) additional auxiliary contacts (1 N.O. and 1 N.C.) in magnetic starters.

3.1.5.4. Design each motor control center section so starter units may be rearranged, removed or added.

3.1.6. Breakers, Fuses and Safety Switches:

3.1.6.1. Renewable fuses shall not be used.

3.1.6.2. Equipment shall be specified with fuse holders that accept fuses dimensionally the same as Class H fuses.

3.1.6.3. 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.

3.1.6.4. Locate equipment disconnects adjacent to equipment served. If not feasible, locate per NEC.

3.1.6.5. Tandem branch circuit breakers shall not be used.

3.1.7. Variable Frequency Drive (VFD):

3.1.7.1. Provide analysis of VFD input current harmonics on the distribution system. Specify harmonic criteria and require field testing of harmonic performance. Total harmonics shall not exceed 3 percent.

3.1.7.2. Bypass shall not be provided.

3.1.7.3. Critical applications shall require a spare VFD as identified by the Owner.

3.1.7.4. A VFD shall not serve more than one (1) piece of equipment.

3.2. Devices:

3.2.1. Receptacles shall be provided on the ground floor of all stairwells and in all elevator lobbies.

3.2.2. Locate floor maintenance receptacles so that all areas are accessible with a 25 foot cord.

3.2.3. GFCI receptacles shall be used in lieu of GFCI breakers.

3.3. Raceways, Boxes and Supports:

3.3.1. Raceway and Boxes:

3.3.1.1. All systems shall be installed in conduit. Flexible wiring systems shall not be used.

3.3.1.2. 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.

3.3.1.3. A red plastic tracer tape shall be buried 18 inches above all underground cable or conduit installations.

3.3.1.4. PVC conduit for Blue Cap phones and parking gates shall be sized a minimum of 1 inch.
3.3.1.5. To reduce sound transmission, wall outlet boxes shall not be installed back-to-back in a partition stud space.

3.3.1.6. Maintain a 6 inch minimum from top of ceiling tile support grid to any raceway.

3.3.2. Supports: Refer to Section IV for information.

3.4. Wire and Cable:

3.4.1. Neutral conductors shall be a minimum of full size. Neutral conductor capacity shall be increased as necessary for harmonics.

3.4.2. Conductors and buss shall be copper. Aluminum conductors or buss shall not be used.

3.4.3. 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.

3.4.4. Conductors carrying more than 150v to ground shall not be installed in conduits with conductors carrying less than 150v to ground.

3.5. Metering and Switchgear: Refer to Section IV for information.

4. EMERGENCY AND BACKUP POWER SYSTEMS

4.1. Life Safety Backup Power:

4.1.1. Packaged Generator Assemblies

4.1.1.1. Life safety backup power shall be by an Uninterruptible Power Supply (UPS). Generators require an approved Deviation Request.

4.1.2. Uninterruptible Power Supplies (UPS):

4.1.2.1. Provide cooling, ventilation, and maintenance access space in battery rooms and battery cabinets.

4.1.2.2. Provide containment systems in battery rooms.

4.2. Non-Life Safety Backup Power:

4.2.1. Non-life safety backup power will only be served by natural gas engine generators. Diesel engine generators shall require an approved Deviation Request.

4.2.2. Packaged Generator Assemblies:

4.2.2.1. If a diesel engine generator is installed:

4.2.2.1.1. Fuel day tanks in generator rooms shall be 660 gallon maximum, provided with spill containment and leak detection. All fuel piping shall exit the top of the tank.
4.2.3. Load Shedding Generation:

4.2.1.4.3.1. In general, the Owner will not seek to utilize generators for load shedding purposes. If load shedding is desired, requirements shall be determined via discussion with the Owner.

4.3.4.4. Generator Environmental and Code Compliance:

4.3.1.4.4.1. All Generators shall be in compliance with New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and other applicable environmental regulations.

4.3.1.1.4.4.1.1. Engine shall be certified to emission standards and certificate provided to the Owner.

4.3.1.2.4.4.1.2. NSPS requires installation of a non-resettable hour meter. Consult Owner with regard to type of monitor and communications requirements.

4.3.2.4.4.2. The generator fuel system shall be arranged to automatically shut down upon a fire or detected leak.

4.4.3. Consult with the Owner for information on generator air construction permits, and Spill Prevention Control and Countermeasures (SPCC) Plan requirements if a diesel engine is used. Permit requirements.

4.3.2.1.4.4.3.1. Owner shall file permit and registration application and complete air dispersion modeling.

4.3.2.1.4.4.3.1.1. 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.

4.3.2.1.2.4.4.3.1.2. Engines having maximum capacity less than 400 bhp require a registration with the Iowa Department of Natural Resources.

(1) Consult with the Owner regarding information needs for Owner to file permit and registration application and complete air dispersion modeling.

4.3.2.2.4.4.3.2. All 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.

4.3.2.3.4.4.3.3. Stack height requirements shall be determined by the Owner based on dispersion modeling to meet ambient air quality standards.

4.4.4. Refer to ENVIRONMENTAL COMPLIANCE for Spill Prevention Control and Countermeasures (SPCC) requirements.

4.4.4.1. SPCC requirements apply to gear boxes and fuel tanks.

4.4.4.5. Monitoring and Data Transmission:
4.4.1.4.5.1. UPS condition shall be monitored by the Building Automation System.

4.4.2.4.5.2. All Generators shall be continuously monitored to provide, at a minimum:

4.4.2.4.5.2.1. Engine run-hours

4.4.2.4.5.2.2. Engine power produced (kWh)

4.4.2.4.5.2.3. Engine fuel consumption

4.4.3.4.5.3. Engines shall be connected to the Utility Network or building automation system for purposes of collecting and sharing the monitoring data. Consult with Owner to determine connections for each project.

4.5.4.6. Transfer Switches:

4.5.4.6.1. Closed transition transfer switches shall be installed for all generators.

4.5.2.4.6.2. Provide a minimum of two (2) sets of auxiliary form-C contacts for normal and emergency transfer switch positions.

5. LIGHTING

5.1. General

5.1.1. Conform to IES recommended foot-candle levels.

5.1.2. 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).

5.1.3. Lighting quality shall be considered in the design of all artificial and natural lighting systems. Lighting design shall conform to IES DG-18-08 Light + Design: A Guide to Designing Quality Lighting for People and Buildings.

5.1.4. 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.

5.1.5. 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.

h. Submittals and shop drawings

(1) Submit legible, dimensioned drawings of lighting fixtures.

(2) Submit a separate sheet for each light fixture, lamp, and ballast, assembled in order of luminaire “type” designation. Clearly indicate fixture type, manufacturer, model number, and accessories for each item.

(3) Submit a “Lamp and Ballast Schedule” noting fixture type, lamp designation, lamp manufacturer, and local supplier for each fixture.
5.1.6. Warranties:

5.1.6.1. Contractor shall be capable of being onsite within 4 hours for all warranty calls during the warranty period.

5.1.6.2. All LED fixtures shall carry a five (5) year manufacturer’s warranty. Warranty shall include LED board/chip set, driver and all other components involved with the performance of the LED product. Warranty shall include color shift of less than three (3) Macadam Ellipses and lumen depreciation faster than the manufacturer’s published L70 rating.

5.2. Interior Lighting:

5.2.1. Design:

5.2.1.1. The lighting design shall maximize the use of recessed and volumetric 2 foot by 4 foot luminaires using linear fluorescent or LED fixtures.

5.2.1.2. Interior light sources shall be fluorescent or LED, except as follows:

5.2.1.2.1. When installed in high ceiling spaces (over 12 feet) in finished areas, interior light sources shall be LED fixtures.

5.2.1.2.2. 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.

5.2.1.2.3. Three (3) and four (4) lamp fluorescent fixtures shall not be used.

5.2.1.3. Coordinate luminaire locations with architectural features and adjacent structural and mechanical elements.

5.2.1.4. Wholly indirect lighting systems are not acceptable.

5.2.1.5. Where the control of glare is a consideration, parabolic louvers are preferred.

5.2.1.6. In rooms where video display terminals are used, fixtures shall have a minimum 0.7 visual comfort probability (VCP) value.

(4) Three (3) and four (4) lamp fluorescent fixtures are prohibited.

5.2.1.7. Restrooms: Lighting shall be accessible from a ladder for maintenance and cleaning. Fixture coves shall not be located above or behind water closets or counters.

5.2.1.8. Interior lighting systems shall operate at either 277 volt or 120 volt.

5.2.1.9. Lighting Designer shall work with the architect and/or Interior Designer to specify high reflectivity interior finishes achieving the following minimum reflectance values:

5.2.1.9.1. Ceilings: 90 percent

5.2.1.9.2. Walls: 50 percent

5.2.1.9.3. Floors: 20 percent
5.2.1.9.5.2.1.10. Efficacy:

5.2.1.9.5.2.1.10.1. Non-LED type fixtures shall carry a Luminaire Efficacy Rating (LER) of 55 or greater.

5.2.1.9.5.2.1.10.2. All LED products shall carry a Lighting Facts label listing the LPW for that product.

5.2.1.9.5.2.1.10.3. All LPW ratings shall be at the color temperature (CCT) used on the project.

5.2.1.9.5.2.1.10.4. LED type fixtures shall carry a Lumens per watt (LPW) with minimum values as follows:

5.2.1.9.5.2.1.10.4.1. Recessed LED troffer style: 95 LPW

5.2.1.9.5.2.1.10.4.2. Recessed linear LED: 70 LPW

5.2.1.9.5.2.1.10.4.3. Recessed LED downlights: 50 LPW

5.2.1.9.5.2.1.10.4.4. Linear indirect or indirect/ direct LED fixtures: 80 LPW

5.2.1.9.5.2.1.10.4.5. LED cove lights: 75 LPW

5.2.1.9.5.2.1.10.4.6. LED step lights: 30 LPW

5.2.1.9.5.2.1.10.4.7. LED under cabinet or task lighting: 60 LPW

5.2.1.9.5.2.1.10.4.8. LED track lighting fixtures: 45 LPW

5.2.1.10.5.2.1.11. Efficiencies:

5.2.1.10.5.2.1.11.1. Non LED type fixtures shall have the minimum following efficiencies:

5.2.1.10.5.2.1.11.1.1. Recessed linear fluorescent – 80 percent

5.2.1.10.5.2.1.11.1.2. Linear indirect/ direct – 85 percent

5.2.2. Daylighting:

5.2.2.1. Incorporate natural daylighting to the greatest extent possible to replace or supplement artificial lighting. Use manual and/or automatic control devices, such as blinds, diffusers, and light shelves to control distribution, brightness, and glare.

5.2.2.2. Design team shall ensure that the contribution from daylighting is included in HVAC loads. One (1) system shall not be sacrificed for the benefit of another.

5.2.2.3. All daylighting shall be incorporated free of glare to the occupants.

5.2.2.4. Uplighting under skylights is prohibited. Downlights in skylight wells or adjacent spaces shall be controlled thru automatic daylight dimming or switching.
5.2.2.5. Arrange interior lighting systems so appropriate areas can be switched or dimmed when adequate natural light is present. Where applicable, provide control by the following means:

5.2.2.5.1. Wall switches placed for occupant convenience

5.2.2.5.2. Automated dimming controls, which may include multi-level stepping or switching

5.2.2.5.3. Photo sensors

5.2.2.5.4. Programmable central control systems

5.2.3. Ballasts

5.2.3.1. Ballasts shall be high efficiency, NEMA premium, electronic-type selected to match the lamp and output of fixture.

5.2.3.1.1. Programmed Rapid Start (PRS) ballasts are required in all applications where occupancy sensors may turn the lights on and off more than five (5) times per day.

5.2.3.1.2. Instant Start (IS) ballasts can be used in any area where the lights are on for longer durations, 12 hours or longer, or in areas not controlled by occupancy sensors.

5.2.3.1.3. Ballast factor (BF) – The ballast factor shall be specified on all lighting fixture types. Specifier shall use standard (0.88) ballast factors to greatest extent possible. Where required, high ballast factors (1.15 - 1.2) or low ballast factors (0.7), can be used to tune the lighting to achieve a higher lighting level or to save energy.

5.2.3.1.4. Limit the ballast factor in each building to a maximum of one (1) ballast factor per lamp type.

5.2.4. Lamps

5.2.4.1. In new construction, building shall have no more than six (6) lamp types.

5.2.4.2. All lamps shall be TCLP compliant (low mercury).

5.2.4.3. Energy-saving lamps shall not be used in cold temperature applications (below 50 degrees F) or where fluorescent emergency lighting or dimming systems are used.

5.2.4.4. There shall be only one (1) type of T8 or one (1) type of T5 within a building. Renovation projects shall match existing lamps.

5.2.4.5. Incandescent, compact fluorescent, halogen, or metal halide lamps are prohibited.

5.2.4.6. Refer to the following table of Campus-wide standard fluorescent lamp types.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>RATED LIFE</th>
<th>MANUFACTURER</th>
</tr>
</thead>
</table>

SECTION III – GENERAL DESIGN STANDARDS 143
### 5.2.5. Lighting Fixtures (Luminaries):

5.2.5.1. Custom lighting fixtures are prohibited.

5.2.5.2. All recessed can lighting shall be LED.

5.2.5.3. Exposed fixture housing surfaces, trim frames, door frames, and lens frames shall be free of light leaks.

5.2.5.4. Lens doors shall close in a light tight manner.

5.2.5.5. Hinged door closure frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

5.2.5.6. Fluorescent lamp holder contacts shall be biting edge-type or phosphorous bronze with silver flash contact surface-type, conforming to requirements of UL 542.

5.2.5.7. Contacts for recessed double-contact lamp holders and slim-line lamp holders shall be silver plated.

5.2.5.8. Lamp holders for bi-pin lamps shall be telescoping compression-type or single-slot entry-type, requiring a ¼-turn of the lamp after insertion.

5.2.5.9. Light Transmitting Components for Fluorescent Fixtures

5.2.5.9.1. 100 percent virgin acrylic plastic or water white, annealed, crystal glass.

5.2.5.9.2. Flat lens panels shall have minimum 1/8 inch average thickness.

5.2.5.9.3. Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners.

5.2.5.9.4. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches, and safety catches to facilitate safe, convenient cleaning and relamping.
5.2.5.9.5. Vapor tight fixtures shall have pressure clamping devices in lieu of latches.

5.2.5.10. Open-tube Fluorescent Fixtures:

5.2.5.10.1. Provide two (2) self-locking sockets or lamp retainers, per lamp.

5.2.5.10.2. Lamps shall have non-yellowing shatter-resistant coating, shall be nominal thickness of 1/8 inch and minimum 97 percent light transmission.

5.2.5.10.3. Clear polycarbonate protective sleeve with end caps shall be provided over lamp, minimum 95 percent light transmission. Sleeve shall be rated to withstand the thermal profile of the lamp and ballast.

5.2.5.11. Metal Finishes:

5.2.5.11.1. Interior light reflecting finishes shall be white with minimum 85 percent reflectance.

5.2.5.11.2. Exterior finishes shall be a baked, electrostatic powder coat.

5.2.6. LED Lamps and Fixtures:

5.2.6.1. 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.

5.2.6.2. Interior LED fixtures shall have a minimum color rendering index (CRI) of 80. Exterior LED fixtures shall have a minimum color rendering index (CRI) of 70. Color temperature of the chip sets/light engines of both interior and exterior LED fixtures shall be 4000k.

5.2.7. Emergency Egress Lighting Fixtures and Exit Signs

5.2.7.1. Systems shall provide a minimum of 90-minutes emergency use.

5.2.7.2. Acceptable systems, in order of Owner preference

5.2.7.2.1. Fixtures and signs connected to compliant building backup power system, such as a generator.

5.2.7.2.2. Self-contained fixture or sign battery units.

5.2.7.2.3. Central inverter based system. These systems allowable by deviation request only require written approval from Owner.

5.2.8. Fixture Installation:

5.2.8.1. All light fixtures shall be accessible without scaffolding.

5.2.8.2. Lighting fixtures shall not be installed above stair treads.

5.2.8.3. Lighting fixtures at landings shall meet ADA requirements for mounting heights.
5.2.8.4. Luminaires installed in occupancies such as laboratories and workshops shall be oriented parallel to benches and centered over the edge of the working surface. Space luminaires to maintain a maximum uniformity ratio of 2:1.

5.3. Interior Lighting Controls:

5.3.1. Design:

5.3.1.1. Conform to IECC and ASHRAE 90.1 requirements for automated lighting controls.

5.3.1.2. All rooms require lighting controls. Rooms with more than one (1) entry shall have lighting controls reviewed with Owner.

5.3.1.3. Develop Sequence of Operation with the Owner.

5.3.1.4. Use daylighting strategies and occupancy sensors to control lighting in areas subject to extended unoccupied periods during normal hours of occupancy.

5.3.1.5. Provide multi-level switching or dimming capabilities in areas where variable levels of illumination are required by users or for energy conservation. Such areas can include auditoriums, lecture halls, classrooms, gymnasiums, laboratories, offices, and workshops.

5.3.2. Central Dimming Controls: Refer to Section IV for information.

5.3.3. Sensors:

5.3.3.1. Wall switch sensors shall be factory-set to vacancy mode (manual on/auto off).

5.4. Exterior Lighting:

5.4.1. Illuminance Targets:

5.4.1.1. 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.

5.4.1.2. No adjustment to illuminance targets shall be made for mesopic adaptation.

5.4.2. Uniformity:

5.4.2.1. The illuminance uniformity levels shall be based on the ratio of the average illuminance to the minimum illuminance in the calculation area. This ratio is a maximum and should not be exceeded. Lower uniformity ratios are acceptable.

5.4.3. Special Applications:

5.4.3.1.1. Sports Lighting: Exterior sports lighting shall be designed to meet current IESNA recommendations based on the specific application. Coordinate design criteria with Owner.

5.4.3.2.1.1. Parking Garages: Shall be designed to meet the controllability and lighting power density requirements of ANSI/ASHRAE 90.1-2010. Refer to Table 1 for specific illuminance and uniformity requirements.
### Exterior Illuminance Levels

<table>
<thead>
<tr>
<th>AREA</th>
<th>Horizontal Minimum @ grade</th>
<th>Horizontal Uniformity Average to Minimum</th>
<th>Vertical Minimum (1)</th>
<th>Vertical Uniformity Average to Minimum</th>
<th>Lighting Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike Rack</td>
<td>2</td>
<td>4:1</td>
<td>0.5 (2)</td>
<td></td>
<td>Table 4.1 Cat H</td>
</tr>
<tr>
<td>Building Entrance</td>
<td>2.0 (canopy)</td>
<td>2:1</td>
<td>1.0</td>
<td>4:1</td>
<td>Table 22.2, High Activity, LZ2</td>
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<tr>
<td>Bus Stop</td>
<td>2</td>
<td>4:1</td>
<td>0.5 (2)</td>
<td></td>
<td>Table 4.1 Cat H</td>
</tr>
<tr>
<td>Open Parking Lot</td>
<td>0.6</td>
<td>4:1</td>
<td></td>
<td></td>
<td>Table 26.2, High Activity, LZ2 Table 4.1, Category D</td>
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<tr>
<td>Roadway</td>
<td>0.6 (6)</td>
<td>4:1</td>
<td></td>
<td></td>
<td>Section 26.2.14 Table 4.1, Category D</td>
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<tr>
<td>Walkway</td>
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<td>4:1</td>
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<td></td>
<td>Table 26.2, High Activity, LZ2 Table 4.1, Category C</td>
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<tr>
<td>Walkway Stairs and Ramps</td>
<td>0.6 (3)</td>
<td>5:1</td>
<td>0.2 (2)</td>
<td>10:1</td>
<td>Section 26.2.8, Table 34.2, High Activity; LZ2</td>
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<td>Plazas</td>
<td>0.4</td>
<td>5:1</td>
<td>0.2 (2)</td>
<td>10:1</td>
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<td>Facades (4)</td>
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<td>4.0</td>
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<td>Drive Under Canopy (Porte_Cocheres)</td>
<td>4.0</td>
<td>2:1</td>
<td>2.0 (2)</td>
<td>4:1</td>
<td>Table 22.2, High Activity; LZ2</td>
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<td>Parking Garages (5)</td>
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<td>Ramps (day)</td>
<td>Basic X 2</td>
<td>4:1</td>
<td>Basic X 2</td>
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<tr>
<td>Ramps (night)</td>
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<td>Basic</td>
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<tr>
<td>Entry/Exit (day)</td>
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<td>Basic X 10</td>
<td>Section 26.2.5.1</td>
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<tr>
<td>Entry/Exit (night)</td>
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<td>4:1</td>
<td>Basic</td>
<td>Section 26.2.5.1</td>
<td></td>
</tr>
</tbody>
</table>

5.4.2. Uniformity:

5.4.2.1. The illuminance uniformity levels shall be based on the ratio of the average illuminance to the minimum illuminance in the calculation area. This ratio is a maximum and should not be exceeded. Lower uniformity ratios are acceptable.

5.4.3. Special Applications:

5.4.3.1. Sports Lighting: Exterior sports lighting shall be designed to meet current IESNA recommendations based on the specific application. Coordinate design criteria with Owner.

5.4.3.2. Parking Garages: Shall be designed to meet the controllability and lighting power density requirements of ANSI/ASHRAE 90.1-2010. Refer to Table 1 for specific illuminance and uniformity requirements.

5.4.4. Exterior Illuminance Table Notes:

5.4.4.1. Vertical illuminance measured at 5 feet above grade.

5.4.4.2. Vertical illuminance in at least two primary directions of circulation.

5.4.4.3. Illuminance at treads and landings.

5.4.4.4. Provide lighting reduction control in accordance with ASHRAE 90.1-2010

5.4.4.5. Refer to IESNA interior recommended illumination levels for parking ramp stairways and elevator lobbies.

5.4.4.6. Select roadways may require additional illumination due to pedestrian conflict. Coordinate requirements with University project manager.

5.4.5. Light Trespass:

5.4.5.1. Projects located at the edge of the campus shall be in compliance with the written published light trespass requirements of the adjoining municipality. No other portions of the municipal ordinances shall apply to University projects.

5.4.5.2. The University Owner may have project specific light trespass requirements near residence halls or light sensitive areas. Coordinate requirements with Owner.

5.4.6. Exterior Lighting Calculations:
5.4.6.1. Lumen Maintenance: Base Lamp Lumen Deprecation (LLD) on the manufacturer’s estimated lumen maintenance at 100,000 hours of operation. The LLD may be adjusted for an average ambient nighttime temperature of 50 degrees F (10 degree C) based on manufacturer testing. The Luminaire Dirt Depreciation (LDD) factor shall be at least 5%.

5.4.6.2. Obstructions: Lighting calculations shall model any obstructions that may have an impact on illumination levels in the project area. Obstructions include trees, fences, retaining walls and architectural elements.

5.4.6.3. Calculation Grid: Calculation grids shall be selected to provide a reasonable sampling of the project area.

5.4.7. Exterior Lighting Design Submittals:

5.4.7.1. Design Professional to submit photometric lighting calculations and results tables for each calculation area.

5.4.7.1.1. Tables shall include maximum, average, and minimum illumination levels, average to minimum uniformity ratio, and lighting power density.

5.4.7.2. Include horizontal point by point plots as well as vertical foot candle levels at the property line and 15 feet beyond the property line. Include consideration adjacent lighting.

5.4.7.3. Calculation shall identify the fixture mounting heights.

5.4.7.4. Clearly note light loss factors.

5.4.7.5. Provide manufacturer’s photometric data (IES file).

5.4.7.6. Compliance shall be reviewed and approved by the Owner at the conclusion of schematic design, design development and contract document phases.

5.5. Exterior Lighting Controls:

5.5.1. All exterior lighting shall be controlled in accordance with the requirement of ANSI/ASHRAE 90.1-2010.

5.5.2. Exception: 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 90.1-2010 9.4.1.7(c).

6. COMMUNICATIONS

6.1. General

6.1.1. Telephone, Wired Network, and Wireless Network hardware shall be included within the project scope. Cost and quantity estimates shall be provided by ITS.

6.1.2. Telephone, Wired Network, and Wireless Network infrastructure shall be included within the project scope. Cost and quantity estimates shall be provided by Design Professional.

6.1.3. Wireless connectivity shall not replace wired connections, but rather is a supplement.
6.1.4. There exists a Utility Network separate from the ITS network, BAS, Fire Alarm, and Access Controls systems. Refer to Section IV for information.

6.2. Telecommunication Pathways: Refer to Section IV for information.

6.3. Grounding and Bonding: Refer to Section IV for information.

6.4. Data and Voice Horizontal Infrastructure: Refer to Section IV for information.

6.5. Fiber Optic and Copper Backbone and Riser Cable: Refer to Section IV for information.

6.6. Outdoor Plant Fiber Optic Cable: Refer to Section IV for information.

6.7. Copper: Refer to Section IV for information.

6.8. CATV Distribution and Horizontal Infrastructure: Refer to Section IV for information.


7. ELECTRONIC SAFETY AND SECURITY

7.1. Electronic Access Control and Security (AMAG):

7.1.1. General

7.1.1.1. Owner shall be involved in the planning and design of all AMAG projects.

7.1.1.2. Renovations and additions shall use the Owner’s existing software license.

7.1.1.3. Identify Stairwell Fire Re-entry Requirements in the Door Sequence of Operations in the documents. Provide card reader at Fire Alarm Control Panel or as directed by the Owner and Authority Having Jurisdiction, shall be specifically identified in the Door Sequence of Operations in the documents. Refer to Section IV for information.

7.1.1.4. Design Professional shall review condition of existing doors and hardware and shall advise the Owner of necessary or recommended replacements or upgrades.

7.1.1.5. Access Control Function shall be identified on the door schedule and access controls narrative. Use Access Control Function definitions included in this section.

7.1.2. Definitions:

7.1.2.1. Monitored: Utilizes door position switch, latch bolt monitor, and/or request to exit.

7.1.2.2. Controlled: Any monitored opening that utilizes electronic locking and unlocking.

7.1.3. Access Control Function Designations and Definitions:

7.1.3.1. RDR - Single Card Reader Entrance, Acceptable Exit: Single proximity card reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts.
7.1.3.2. **DRDR** – Dual Card Reader Entrance: Dual card reader (card in / card out), electrically unlocking door hardware, latch bolt monitoring, door position contacts.

7.1.3.3. **HRDR** – Hand Geometry Reader Entrance, Acceptable Exit: Hand geometry reader, electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts.

7.1.3.4. **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.

7.1.3.5. **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.

7.1.3.6. **PEAE** – Programmable Entrance Acceptable Exit: Electrically unlocking door hardware, request to exit, latch bolt monitoring, door position contacts. Unlocked via programming, no reader.

7.1.3.7. **AEO** – Acceptable Exit Only: Request to exit, latch bolt monitoring, door position contacts. Cannot be electrically unlocked.

7.1.3.8. **EES** – Emergency Exit with Sounder: Latch bolt monitoring, door position contacts, locally audible piezo sounder connected to access control system.

7.1.3.9. **EEO** – Emergency Exit Only: Latch bolt monitoring, door position contacts.

7.1.3.10. **DCO** – Door Contact Only: Door position contacts.

7.1.3.11. **RRDR** – Stairwell reentry doors with fail safe 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.

7.1.4. **Building / Space Security Level Definitions:**

7.1.4.1. Security level designations correspond to internal University Security processes and protocols.

7.1.4.1.1. Definitions are provided to establish minimum security requirements.

7.1.4.1.2. Individual spaces within a building may have differing Security Levels. All spaces shall be reviewed with the Owner.

7.1.4.2. **Level 1: Low Risk** - Spaces are accessible during normal working hours and locked after hours. Exterior doors have alarms that register in the software and self-closers. Scheduled exterior doors have electronic locks. Occupants are responsible for security of interior doors.

7.1.4.3. **Level 2: Moderate Risk** – Spaces are locked when unoccupied. All items in Level 1, plus self-closers on all interior public corridor doors. Alarms may be required on some interior doors.

7.1.4.4. **Level 3: Substantial Risk**. 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. Door alarms may also be local, audible alarms.
7.1.4.5. Level 4: High Risk – Building and spaces have restricted access. All items in Level 3, plus intrusion detection system, card reader on main door to exit, some areas require 2-factor authentication to enter.

7.1.4.6. Level 5: Extremely High Risk – Building and spaces have restricted access. All items in Level 4, plus video recording system and 2-factor authentication

7.1.5. Openings, General:

7.1.5.1. When the entry door into a space has access control functionality, all other doors into that space shall be electronically monitored.

7.1.5.2. Each opening utilizing request to exit function shall be wired to an individual reader port on a central door controller.

7.1.5.3. Openings with multiple doors shall have a single card reader controlling a single opening.

7.1.5.4. Any opening with a reader shall have keyed override.

7.1.5.5. Access control readers shall control only one (1) opening.

7.1.5.6. Secure side door operator actuator shall only be active when door is electrically unlocked.

7.1.6. Openings, Exterior:

7.1.6.1. All exterior doors shall be controlled or monitored.

7.1.6.2. Overhead doors shall be monitored, less latch bolt monitor.

7.1.6.3. Main entrances shall be monitored. One opening shall be controlled via reader(s), Remaining doors to be exit only.

7.1.6.3.1. One (1) door shall be controlled via reader(s).

7.1.6.3.2. Remaining doors to be exit only.

7.1.7. Openings, Interior:

7.1.7.1. Main entrances into general assignment classrooms and auditoriums shall be controlled by reader(s).

7.1.7.2. Document requirements:

7.1.7.1.1. The Design Professional shall develop a Sequence of Operations narrative and include sequence in documents.

7.1.7.1.2. The documents shall include an access control door schedule for all monitored and controlled doors.

7.1.7.1.2.1. Schedules shall identify the door/room served, Door Function, list of device(s) on opening, special functionality, and location.
7.1.7.1.2. Door function to be identified according to the Access Control Function Designations and Definitions listed above.

7.1.7.2. Openings into General Assignment Classrooms with occupancy of fifty (50) or more and auditoria with occupancy of fifty (50) or more shall have auto-lock and auto-unlock features through the access control system.

7.1.7.3. Spaces shall have emergency locking pushbutton switches located near the lectern.

7.1.7.4. A single emergency pushbutton shall operate all doors.

7.1.7.5. The Access Control Head-end equipment shall be located in the ITS Equipment Room and shall have:

7.1.7.5.1. 120 volt emergency power circuit, installed by Electrical Contractor, direct-wired into outlet strip. Outlet strip provided by the Access Control Contractor. A circuit from an ITS electrical panel may be used.

7.1.7.5.2. All lock power supplies shall be direct-wired from a dedicated 120 volt circuit.

7.1.7.6. Entry door into space shall have an RDR function.

7.1.7.7. 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.

7.1.7.8. Dedicated Ethernet port shall be located on wall adjacent to the equipment.

j. Contractor submittals shall include product data, system block diagram(s), door details, controller schedule, door schedule, and camera schedule. Schedules shall reference room numbers, door numbers, and equipment numbers, as applicable.

7.2. Video Surveillance Systems:

7.2.1. Video surveillance systems require Owner approval.

7.2.2. Video recording for IP cameras shall be on a server managed and maintained by ITS.

7.2.3. The video license for each camera shall be purchased as part of the project.

7.2.4. Design Professional shall indicate camera and equipment locations on Construction Documents.

7.3. Security Alarm/Intrusion Alarm Systems:

7.3.1. Shall be approved by Department of Public Safety.

7.3.2. Shall utilize AMAG or a system approved by Department of Public Safety.

7.3.3. If AMAG is used, the area that is protected by the security system shall be set up as its own company within the software.

7.4. Fire Alarm and Detection Systems:
7.4.1. General

7.4.1.1. Refer to BUILDING FIRE ALARM SYSTEM DETAILS in Appendices for existing building system manufacturer and model.

7.4.1.2. AHU shut-down circuit shall automatically reset after FACP is reset.

7.4.1.3. Refer to UI Fire Safety Department Guide Specifications.

7.4.1.4. Any proposed changes affecting the fire alarm system require Owner approval.

7.4.2. Fire Alarm Control Panel (FACP):

7.4.2.1. General

7.4.2.1.1. Systems shall include capacity for handling a minimum of 20 percent more circuits and alarm causing and signaling devices.

7.4.2.1.2. A separate Signaling Line Circuit shall be installed per floor.

7.4.2.1.3. FACP Bypass Switches:

7.4.2.1.3.1. Access Level 3:

7.4.2.1.3.1.1. City disconnect (for both alarms and troubles)

7.4.2.1.3.1.2. Audio by-pass

7.4.2.1.3.1.3. Visual circuit by-pass

7.4.2.1.3.1.4. Electronic door latches / locks

7.4.2.1.3.1.5. Air handler by-pass

7.4.2.1.3.2. Access Level 1:

7.4.2.1.3.2.1. Dampers by-pass

7.4.2.1.3.2.2. Elevator by-pass

7.4.2.1.3.2.3. Fire Door by-pass

7.4.2.1.3.3. Provide separate fan shutdown switches for each air handler.

7.4.2.1.3.4. Provide smoke purge by-pass (where applicable) required.

7.4.2.2. System Resets:

7.4.2.2.1. A fire alarm resets shall require a security level access level of 3.

7.4.2.2.2. Equipment that has been bypassed in software shall not change state-of-condition during a reset.
7.4.2.3. Voice Control Point Switches:

7.4.2.3.1. “All Clear” message.

7.4.2.3.2. “Weather Alert” message.

7.4.2.3.3. “All Speakers” talk switch.

7.4.2.3.4. Audio zone momentary contact switches to manually select the following individual speaker circuits:

7.4.2.3.4.1. Each Elevator Car
7.4.2.3.4.2. Each stairwell, connected to adjacent floor zone.
7.4.2.3.4.3. Each building level and approved fire zone.
7.4.2.3.4.4. Outside speakers.

7.4.2.4. LED Lights:

7.4.2.4.1. Only fire alarm zone lights and device type lights shall annunci ate with a red LED.
7.4.2.4.2. Device type, address, and exact location shall announce on the digital readout.
7.4.2.4.3. Any bypass, disable or trouble condition shall announce with an amber LED, a trouble sounder and announce on the digital readout.
7.4.2.4.4. When speakers or phone circuits are active, green LEDs shall announce the appropriate speaker circuits.
7.4.2.4.5. Individual speaker circuits shall be capable of being activated without a pass code.
7.4.2.4.6. Individual speaker control shall be possible with loss of A/C power.

7.4.2.5. Communications:

7.4.2.5.1. DACT shall be installed within fire panels. New installations require fiber optic network connection.

7.4.2.5.2. Send the following signals to The University of Iowa Police Dispatch Office:

7.4.2.5.2.1. Alarms (Zone 1).
7.4.2.5.2.2. Troubles (Zone 3).
7.4.2.5.2.3. Supervisory (Zone 4).

7.4.2.5.3. The DACT trouble signal shall track the FACP trouble piezo.
7.4.2.5.4. Provide a ¾ inch conduit with pull string from the fire alarm control panel to designated telephone switch room.

7.4.2.5.5. Communication for FACP shall have two (2) copper lines and one (1) 6-strand fiber optic line run from the telecommunications room to the main FACP panel box.

7.4.2.5.6. Radio repeaters shall be installed as required by local fire department and AHJ.

7.4.2.6. Audio Systems:

7.4.2.6.1. Amplifiers shall be a 100-watt minimum, except in dual-channel applications where the elevator channel may use 25-watt amplifiers.

7.4.2.6.2. Amplifiers shall have redundant back-up amplifier(s) that automatically transfer.

7.4.2.6.3. Amplifier sizing calculations:

7.4.2.6.3.1. One (1) watt per interior speaker (in restrooms and small rooms set taps to ¼ watt).

7.4.2.6.3.2. Two (2) watts per outside and mechanical room speaker.

7.4.2.6.3.3. Each audio amplifier shall be sized to include 20 percent spare capacity for future connection of audio speakers.

7.4.2.7. Minimum Sprinkler Systems Monitoring Points:

7.4.2.7.1. Fire pump items include pump running, fire pump power, and fire pump phase reversal.

7.4.2.7.2. Jockey pump power.

7.4.2.7.3. Water flow switches by fire zone with separate address for each device.

7.4.2.7.4. Tamper switches by fire zone with separate address for each device.

7.4.2.8. All hardware devices and software for off-line programming, complete with manuals and software files shall be required to be turned over to the Owner.

7.4.3. Releasing Panels:

7.4.3.1. The main FACP shall not be used as a releasing panel for special hazard or alternative suppression systems.

7.4.3.2. Key pad controls shall be within visual distance of releasing agent location.

7.4.3.3. The main FACP may be used for releasing sprinkler pre-action or dry systems.

7.4.4. Initiation Devices:

7.4.4.1. General
7.4.4.1. Comply with NFPA 80 for smoke detector location and quantity.

7.4.4.1.2. End-of-line resistors shall be located at the device that is farthest away from the panel or module.

7.4.4.1.3. Detectors shall be placed so that they can be tested directly from the floor level.

7.4.4.1.4. Each device shall have a separate address.

7.4.4.1.5. When Ceiling mounted applications are required, devices:

- Shall be mounted to have minimum 80 percent surface coverage or larger. They shall not be installed in pockets or out of sight areas.

7.4.4.2. Device Locations:

7.4.4.2.1. Photo Electric Smoke Detectors shall be located in the following spaces:

- Corridors
- Custodial rooms
- Telephone Rooms
- Libraries
- Storage rooms
- Laboratories (where required) (See Heat Detectors are preferred, but a variance is required, below)
- Mechanical rooms (except high temperature areas)
- Elevator Lobbies

7.4.4.2.2. Heat Detectors shall be located in the following spaces:

- Copy centers, vending rooms, kitchens
- High temperature mechanical rooms

- Labs (A variance is required)

7.4.4.2.3. Duct Smoke Detectors shall be located in the following spaces:

- Supply Air Handlers greater than 2,000 CFM.
- Return Air Handlers greater than 15,000 CFM or when AHU serves more than one (1) floor.
7.4.4.2.4. Pull Stations shall be located in the following spaces:

7.4.4.2.4.1. At exits leading to the exterior.
7.4.4.2.4.2. At stairwell exits on each floor.
7.4.4.2.4.3. As required by NFPA and fire code official reviews.
7.4.4.2.4.4. Maximum distance between pulls shall be less than 200 feet.

7.4.4.3. Smoke Detectors:

7.4.4.3.1. Shall provide a solid red LED on the detector or base when the device is in an alarm condition.
7.4.4.3.2. Smoke detectors shall be low-profile analog.

7.4.4.4. Duct Detectors:

7.4.4.4.1. Duct detectors shall be installed when the conditions listed in NFPA 72E and NFPA 90A-14, Sec. 4-2 through 4-4 are met.
7.4.4.4.2. Duct smoke detectors shall be used only in duct larger than 12 inches in diameter.

7.4.4.5. Heat Detectors:

7.4.4.5.1. Heat detectors shall be restorable and provide a red LED on the detector or base when the device is in the alarm condition.
7.4.4.5.2. Heat detectors shall be analog addressable unless high temperature devices.
7.4.4.5.3. All detectors shall be magnet-testable.

7.4.4.6. Beam Detectors:

7.4.4.6.1. If beam detectors are proposed, design shall be reviewed by University of Iowa - Fire Safety for appropriate application, maintenance, and accessibility.
7.4.4.6.2. Provide a beam detector test switch for each detector.
7.4.4.6.3. All beam detectors shall have a transmitter and a mirror, no receiver.
7.4.4.6.4. All beam detectors shall have a key or magnet test station.

7.4.5. Annunciation Devices:

7.4.5.1. General

7.4.5.1.1. Signaling devices shall be placed so that they shall provide a sound of 15 dBA above the ambient noise level in all areas.
7.4.5.1.2. Place outside, weatherproof speakers at all major entrances.
7.4.5.1.3. Visual devices shall be a single combo unit when both devices are required.

7.4.5.1.4. Message Boards shall be used only in ADA selected areas.

7.4.5.2. Strobe Devices:

7.4.5.2.1. Strobe intensity shall be determined by ADA requirements.

7.4.5.2.2. All strobes within line of site shall be synchronized.

7.4.5.2.3. Each strobe circuit shall be capable of being individually controlled in software and shall be sized to include 20 percent spare capacity for future connection of strobes.

7.4.5.2.4. Each fire floor and fire zone shall have individual strobe circuit control.

7.4.6. Other Devices:

7.4.6.1. General

7.4.6.1.1. All devices being controlled by the fire alarm control panel (i.e., dampers, doors, etc.) shall be operated by the use of control modules and not by relay-type devices in detector bases or relay cards.

7.4.6.1.2. Auxiliary equipment shall not be directly connected to an addressable control module.

7.4.6.1.3. 24 volt DC power shall be supervised at each device. Each control module shall activate a supervised 24 volt DC relay with red LED when in the alarm condition.

7.4.6.2. Smoke Dampers:

7.4.6.2.1. Smoke damper indicator lights shall be Select-A-Switch, Model SL53413-6-BG.

7.4.6.2.2. Place damper indicator lights in corridors whenever possible. Graph displays are not allowed.

7.4.6.3. Door Hold Open:

7.4.6.3.1. Door magnets shall be powered by 24 volt power source other than the FACP.

7.4.6.3.2. Powering down the FACP shall not automatically close the fire doors. Door hold-opens shall not close on loss of power to the FACP.

7.4.6.3.3. Electronic door hold-opens shall be 24 volt DC.

7.4.6.3.4. Electronic door hold-opens with built-in smoke detectors shall not be allowed.

7.4.6.4. Building Automation Controls:

7.4.6.4.1. The fire alarm system shall provide dry contacts for Direct Digital Control (DDC) system to control HVAC or purge system during alarm.
7.4.6.5. Fire Shutters:

7.4.6.5.1. Fire shutters shall not be used without written approval from Owner. If use is required, shutters shall be readily-accessible and motorized, with remote push-button to re-open the shutter.

7.4.7. Raceways, Boxes, and Cables:

7.4.7.1. Each floor shall have a separate conduit feed.

7.4.7.2. All fire alarm devices, junction and pull boxes shall be easily accessible without removing light fixtures, equipment, conduits, junction boxes or other items.

7.5. Area of Refuge Phone: Refer to Section IV for information

7.5.6. Automatic External Defibrillator (AED):

7.5.6.1. Automatic external defibrillators are optional and shall be approved by the Department.

7.5.6.2. UI Department of Public Safety shall be notified when an AED will be included in a project.

k. Refer to Section IV for information.

END OF SECTION III – GENERAL DESIGN STANDARDS
SECTION IV - OUTLINE SPECIFICATIONS AND DETAILS

This section contains information to be used by Design Professionals in the preparation of project specifications.

The criteria represent minimum levels of performance, quality and/or standardization that shall be enhanced by the Design Professional and made project specific.

I. GENERAL

The following information is provided as a general guideline in establishing project specific requirements.

1. ACCESSIBILITY

1. The detectable warning plate shall be Neenah Foundry in cast iron and unpainted.

1.1. Adequate and safe detour(s) shall be provided when sidewalks and/or building entrances are closed and blocked.

1.1.1. Use audible and visual signage to give advance notification of closures ahead and inform pedestrians of alternate accessible routes.

1.1.2. On signage, use terms such as “universal” and “accessible” and the International Symbol of Accessibility. The terms “ADA” or “handicap” shall not be used.

1.1.3. Locate accessible parking signs where they are not obscured by parked vehicles, trees, or other obstructions and as required by Iowa Administrative Code, Chapter 18.

2. COMMISSIONING

2.1. For commissioning requirements, please refer to the Owner’s Document 01 91 13, Commissioning. The document is available, found at the following web site link: http://www.facilities.uiowa.edu/pdc/consultants/?submenuheader=2

3. ENERGY

3.1. Refer to Section III for information.

4. HAZARDOUS MATERIALS

4.1. Polychlorinated Biphenyl (PCB):

4.1.1. PCB containing ballasts shall not be discarded.

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

4.2. Mercury:

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

4.2.2. Lamps containing mercury shall not be discarded.
4.3. Mold:

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


4.4. Acid:

4.4.1. Underground acid neutralization tanks shall not be used.

5. DEMOLITION

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

5.2. Demolition materials other than those required to complete the construction project and designated for return to Owner, shall become the property of the Contractor 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.

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

II. CIVIL

The following information is provided as a general guideline in establishing Civil Engineering project specific requirements.

1. GENERAL: Refer to Section III for information.

2. SUBSURFACE INVESTIGATION

2.1. For purposes of identifying and measuring rock, which may be encountered during classified excavation, the following definitions shall be used. The definitions are based on minimum equipment requirements, which shall be equaled or exceeded by the Contractor. If the Contractor chooses to use equipment of lesser size, capacity, or power than specified for excavating purposes, the Contractor shall assume all responsibility for the cost and method of removal of material resembling rock, which cannot be removed with their equipment. Therefore, contract unit prices submitted by the Contractor for rock excavation shall only be applicable if the Contractor’s equipment equals or exceeds equipment requirements specified below:

2.1.1. Open Excavation:

2.1.1.1. 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.

2.1.1.2. 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.

2.1.2. Pit and/or Trench Excavation:
2.1.2.1. 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.

2.1.3. Drilled Pier Excavation:

2.1.3.1. 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.

2.1.3.2. 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. The minimum size drill rig is rated positive crowd force of 37,000 pounds and a continuous torque rating of 25,000 foot pounds.

2.2. Backfill and subgrade compaction shall conform to Geotechnical Engineer’s recommendations. For projects without a geotechnical report, the following criteria shall be specified:

2.2.1. 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. Excavation to undisturbed soils is not considered adequate.

2.2.2. Backfill for foundations shall be compacted to a minimum of 88 percent and a maximum of 92 percent of maximum density under landscaped areas and a minimum of 95 percent of maximum density under other areas at optimum moisture content (+/-2 percent) standard proctor. Backfill shall be installed in no more than 12 inch lifts. Specific soils or situations may require smaller lifts.

2.2.3. Backfill for trenches shall be well graded, granular materials ¾ inch to 1 inch clean material vibrated in lifts. Provide sand envelope around pipe.

2.3. Proof rolling shall be specified for areas to be paved and shall conform to the Geotechnical Engineer’s recommendations. For projects without a Geotechnical Engineer’s recommendation, the following criteria shall be specified:

2.3.1. 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. 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. 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. All proof rolling shall be performed in the presence of Owner.

3. SITE SURVEY: Refer to Section III for information.

1. Refer to Section III for information.

4. LANDSCAPING

4.1. General
4.1.1. Owner shall be notified prior to grade changes during backfilling and prior to the establishment of the “rough grade” (existing grade prior to application of top soil or growing medium for turf or other plants).

4.1.2. Owner shall be notified prior to applying top soil or growing medium for turf or plants for the purpose of establishing the finish grade.

4.1.3. Soil or growing medium for turf or plants shall be examined and approved by Owner.

4.1.4. 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.

4.1.5. Plant material list, including cultivar, shall be included in the Operations and Maintenance Manuals.

4.2. Soils:

4.2.1. The prevention and or alleviation of soil compaction are crucial to plant success. Contractor shall limit the use of heavy equipment to hardscape areas whenever possible. Allow wet areas to dry before tilling or grading.

4.2.2. Grading:

4.2.2.1. Notify Owner prior to grade changes, start of backfill, and the establishment of rough grade.

4.2.2.2. Final grade of planting beds and small turf areas shall be done by hand to avoid compaction and ensure all debris and clods over 1 inch are removed. Large scale seeding or sodding projects may be graded using small tractors, gills, etc.

4.2.2.3. Notify Owner upon completion of final grade. Contractor shall not install planting material or turf until final grade has been approved by Owner.

4.2.3. Topsoil Testing:

4.2.3.1. Contractor shall have a sample of all imported topsoil tested by Iowa State University. The results of the soil analysis shall be provided to owner prior to incorporation of the topsoil.

4.2.3.2. Results must fall within the Iowa State University recommended guidelines for lawns, flowerbeds, or tree and shrub beds. Submit results to Owner for review.

4.2.3.3. Schedule test a minimum of 6 weeks prior to allow for processing and review by Owner.

4.2.4. Tilling:

4.2.4.1. Excavated areas shall be backfilled with 8-12 inches of topsoil. Subsoil shall be tilled and blended with topsoil layer to avoid sharp transitions in the soil profile.

4.2.4.2. Unexcavated areas to be planted or seeded shall be tilled to a depth of 4 to 6 inches before incorporating topsoil or other amendments.

4.2.4.3. Do not till within the drip line of existing trees.
4.2.5. Erosion Control:

4.2.5.1. Hydromulch with tackifier shall be applied at a minimum of 2500 pounds per acre. Application shall be in accordance to the manufacturer’s guidelines.

4.2.5.2. Erosion Control Matting shall contain only bio-degradable netting. Mats and matting that contain Polypropylene netting shall not be used.

4.3. Plantings:

4.3.1. Trees and Shrubs:

4.3.1.1. Tree Pit Configurations:

4.3.1.1.1. Tree pits should be as large as possible to allow for ample growing space for tree roots and crown. Minimum tree pit size shall be 5 feet by 10 feet by 3 feet deep with a soil volume of 150 cubic feet.

4.3.1.1.2. Tree pits shall be continuous for group plantings.

4.3.2. Contractor/Constructor shall stake all plant locations prior to plant installation. The Owner shall review and approve all locations prior to planting.

4.3.3. All baskets, burlap, containers, wires, twine, etc. shall be completely removed from all plant material prior to planting. Refer to LANDSCAPE PLANTING DETAILS in Appendices.

4.3.4. Proper planting depth requires the root flare above finished grade. Specifications shall incorporate language and details to insure proper planting depth.

4.3.5. Landscape plant materials shall be in accordance with the American Association of Nurserymen’s Standards. The Owner shall review and approve all plant materials prior to installation.

4.3.6. Planting Schedule:

4.3.6.1. Trees, Shrubs, and Perennials:

4.3.6.1.1. Plant Materials shall not be installed in July or August.

4.3.6.1.2. Oak varieties shall only be planted between April 1 and May 31.

4.3.6.2. Turf shall be installed between April 15 and June 15.

4.4. Landscape Furniture and Fixtures:

4.4.1. All site furniture shall be surface-mounted on concrete.

4.4.2. Bicycles:

4.4.2.1. Bicycle racks shall be the Bike Rib Series Linear Rack as manufactured by Function First, Inc. Finish shall be black thermoplastic coating applied to galvanized pipe.
4.4.3. Benches:
   4.4.3.1. Stone and concrete benches shall not be used.
   4.4.3.2. Benches shall be from Landscape Forms.

4.4.4. Recycling and Landfill Receptacles:
   4.4.4.1. Receptacle shall be from Landscape Forms.

4.5. Exterior Building Signage: Refer to Section III for information.

5. ROADWAYS, PARKING LOTS AND WALKWAYS

5.1. General
   5.1.1. Refer to Section III for information.

5.2. Roadways:
   5.2.1. Asphalt and Portland Cement Concrete Paving:
      5.2.1.1. Asphalt/Portland cement concrete pavement shall be designed according to the following guidelines:
         5.2.1.1.1. Roadways, rigid and flexible shall follow AASHTO Guidelines for the Design of Pavement Structures.
         5.2.1.1.2. Parking Lots
            5.2.1.1.2.1. Rigid - Portland Cement Association
            5.2.1.1.2.2. Flexible - The Asphalt Institute
         5.2.1.1.3. Walkways shall have a minimum compressive strength of 4000 psi for twenty-eight (28) days.
         5.2.1.1.4. Exposed concrete, including precast concrete, shall be air entrained.
      5.2.1.2. 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.
      5.2.1.3. Concrete surfaced parking lots shall have a minimum cross section of 6 inches of concrete and 4 inches of Type 1 aggregate for base. The concrete shall be Portland cement concrete with a heavy broom finish. All joints shall be shown on the plans and shall be sealed with traffic-grade caulking.
      5.2.1.4. Concrete strengths shall be specified in accordance with actual requirements. Concrete mix shall be specified with minimum cement content, as well as maximum water/cement ratio.
      5.2.1.5. Fibers (non-asbestos) can may be used in addition to steel to control shrinkage cracking.
5.2.1.6. Design Professional shall specify inspection and testing requirements and shall include procedures for evaluation of test data. The Owner shall retain services of a Testing Firm. Contractor shall be responsible for scheduling the tests. Contractor shall be required to notify the Owner a minimum of 48 hours prior to all placement of concrete.

5.2.1.6.1. Specifications shall require strength, air entrainment, temperature, and slump tests, and shall indicate allowable limits for each measure. Strength tests shall require 4 cylinders (three (3) shall be broken and one (1) spare). Test results shall be sent directly to the Contractor, Architect, and the Owner, as specified.

5.2.1.6.2. Concrete shall be tested at the minimum rate of one (1) test for the first 25 cubic yards (CY) placed each day and one (1) test for each additional 50 CY placed. Concrete may be tested more often at the discretion of the Owner. 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.

5.2.1.7. All concrete walks and drives shall be constructed on a minimum of 4 inches of compacted, crushed, stone base course. Gradation of the crushed stone shall be as required for Type 1 aggregate.

5.2.1.8. Sand shall be from local sources meeting ASTM C-144 for mortar and ASTM C-33 Size 67 for concrete.

5.2.1.9. 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. Patch shall extend 1 foot minimum outside the trench. Patch surface shall be concrete with abutting concrete paving or 2 inches of asphaltic concrete/tack coat with abutting asphalt surface.

5.2.1.10. Joints and Concrete Flatwork:

5.2.1.10.1. Expansion joints shall be installed to provide for thermal expansion of concrete pavements. Generally expansion joints shall be provided at the PC and PT of curves (where the deflection angle is greater than 30E) and intersections. If required for load transfers, expansion joints shall be detailed with dowel bars to allow load transfer and expansion of the concrete slabs. Non-extruding expansion joint material shall be used with expansion joints.

5.2.1.10.2. Portland cement concrete flatwork shall be isolated from manholes, existing walls, etc. by use of expansion joints.

5.2.1.10.3. Contraction joints shall be tooled during finishing or saw cut within 18 hours of concrete placement.

5.2.1.10.4. Construction joints shall be located at expansion joint locations wherever possible. Construction joints at other locations shall be keyed.

5.2.1.10.5. All expansion joints on Institutional Roads shall be sealed with traffic grade, non-asphalt, non-extruding sealant.
5.2.1.10.6. Joint spacing and joint detail shall be shown on the drawings.

5.2.1.11. Parking Lot Striping:

5.2.2. Paint colors 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.

5.3. Parking Lots: Refer to Section III for information.

a. Refer to Section III for information.

5.4. Walkways:

5.4.1. The Detectable warning plate (truncated dome) shall be cast iron, factory painted “brick red”.

5.4.2. Acceptable manufacturers:

5.4.1. Neenah Foundry in cast iron and unpainted. Co.

5.4.2. East Jordan Iron Works

6. TEMPORARY TRAFFIC CONTROL

6.1. General

6.1.1. Refer to Section III for information.

6.2. Vehicular Traffic:

6.2.1. Refer to Section III for information.

6.3. Pedestrian Traffic:

6.3.1. Refer to Section III for information.

7. SANITARY SEWER

7.1. General

7.1.1. Piping shall have sand pipe bedding and envelope. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to 98 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

7.1.2. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

7.1.3. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

7.1.4. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within ± 3 percent of optimum moisture content before delivery to the project site.

7.1.5. Install warning tape 12 inches to 18 inches above piping.

7.2. Piping:
7.2.1. The minimum service line size shall be 6 inches.

7.2.2. The minimum sewer line shall be 8 inches.

7.2.3. Piping shall be either

7.2.3.1. PVC cement filled truss pipe (Owner preference).

7.2.3.2. Ductile iron pipe with restrained joints, Class 53.

7.3. Accessories

7.3.1. Manholes and Lids

7.3.1.1. Manholes shall be precast concrete, minimum 4 feet inside diameter, unless otherwise noted.

7.3.1.2. Rings and lids for sanitary sewers shall be East Jordan model number 1045ZPT, bolt down assembly. The lids shall be marked, “University of Iowa, Sanitary Sewer”.

7.3.1.3. Rings and lids for grated openings shall also use the 1045 ring, with the appropriate grated lid.

7.3.1.4. Lid extension ring height shall not exceed 12 inches.

7.3.1.5. Drop piping into manholes may be required.

7.3.1.6. Bases shall be poured into the bottom of manholes and a formed invert from pipe to pipe installed to create flow path.

7.3.2. Cleanouts

7.3.2.1. Cleanouts are required on service lines outside building footprint and at horizontal or vertical bends in a service line.

7.3.2.2. The deflection shall utilize a wye with the cleanout as an upstream extension of the downstream line’s alignment.

7.3.2.3. Cleanout material shall be ductile iron.

7.3.2.4. Frame and casting shall be Neenah R-1976, Deeter 1830. Casting shall be anchored by a 2 foot by 2 foot by 8 inch thick concrete pad, 6 inches below finished grade. Separate concrete from pipe with two (2) layers of building paper.

7.3.2.5. Cleanouts may be used at the end of a sewer line where the distance to the downstream manhole is 150 feet or less.

7.3.2.6. End-of-line cleanouts shall use long radius bends and include a concrete cradle under the bends.

7.3.2.7. PVC shall not extend above grade.

8. STORM SEWER
8.1. General


8.1.2. Backfill material shall be crushed stone or other granular material meeting the requirements of Class-2 material as defined in ASTM D2321.

8.1.3. The drain basin body shall be cut at the time of the final grade. No brick, stone or concrete block shall be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring shall be poured under and around the grate and frame.

8.1.4. Piping shall have sand pipe bedding and envelope. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to 98 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

8.1.5. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

8.1.6. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

8.1.7. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within ± 3 percent of optimum moisture content before delivery to the project site.

8.1.8. Install warning tape 12 inches to 18 inches above piping.

8.2. Piping:

b. Pipe shall be

8.2.1. Up to 12 inch:

8.2.1.1. 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.

8.2.1.2. Polyvinyl chloride (PVC) conforming to ASTM D2241, PVC 1120, DR 21, PR 200 (SDR-21).

8.2.1.3. HDPE conforming to ASTM F2688 and F2306

8.2.2. 12 inch and larger:

8.2.2.1. Reinforced Concrete Pipe (RCP) conforming to ASTM C76 or AASHTO M170, Class 3 Minimum

8.2.2.2. HDPE conforming to ASTM F2688 or F2306.

8.2.2.3. Polypropylene pipe conforming to ASTM F2736, F2764 or F2881

8.2.3. The minimum pipe size for storm drains, except roof drains, is 15 inches.

8.2.4. Perforated pipe for subgrade drains shall be SDR-35, Schedule 40 PVC, or HDPE conforming to ASTM F2688 or F2306.
8.2.4.1. Pipe shall be installed in a geotextile envelope with clean rock.

8.2.4.2. Perforated pipe in a ‘sock’ shall not be allowed.

8.3. Accessories:

8.3.1. Ductile iron grates shall be Nyoplast for sizes 8, 10, 12, 15, 18, 24 and 30 inches. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas and H-10 loading for pedestrian areas. 12 and 15 inch square grates shall be hinged to the frame using pins.

8.3.2. Inlets and junction boxes may be cast-in-place or precast conforming to ASTM C478.

8.3.3. Storm manholes and junction boxes shall be East Jordan Model 1045 non-bolt down. Lid shall be lettered with the words ‘University of Iowa Storm Sewer’ or ‘University of Iowa Storm Drain’.

8.3.4. 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.

8.3.5. Above and below-ground knife-gate valve applications shall be Sure Flow Equipment, Model KG150SSVIRC. The valves shall conform to TAPPI TIS 405.8 face-to-face and shall be tested to MSS SP-81 standards. Valve body shall be full lug style, drilled and tapped to ASME Class 150 and material shall be SA351 CG8M cast 317 stainless steel.

8.3.6. With Owner approval, Nyoplast, PVC sub-surface drainage inlets, inline drains and catch basins may be used in landscaped areas with Owner approval.

9. DOMESTIC WATER

9.1. General

9.1.1. 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 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

9.1.2. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

9.1.3. Backfill material shall be placed in continuous layers not exceeding 8 inches in compacted depth.

9.1.4. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within + 3 percent of optimum moisture content before delivery to the project site.

9.1.5. Install warning tape 12 inches to 18 inches above piping.

9.1.6. Underground piping systems shall have a #12 AWG copper wire attached to the pipe for tracing. Wire shall be labeled and terminated in an accessible location. No splices in wire allowed.

9.1.7. Provide 1 inch insulation and vapor barrier on all domestic water piping that is not direct buried.

9.1.8. Operation of all valves, both new and existing, shall be by the Owner.

9.1.9. Coordinate post indicator valve locations with Owner.
2. Piping

9.2. Testing:

9.2.1. Disinfection - Domestic Water:

9.2.1.1. Disinfections shall be performed Monday through Thursday, starting between 8:00 AM and 9:00 AM.

9.2.1.2. Pipes shall be disinfected according to AWWA standards.

9.2.1.3. Disinfection shall take place over a period of twenty-four (24) hours (no longer or shorter).

9.2.1.4. Disinfection shall be performed before hydro testing. Hydro testing shall not begin until bacteria results have been returned from the lab. Constructor shall anticipate a three (3) working day turn-around time from the time that the sample is taken until the results are returned.

9.2.2. Method of Chlorination:

9.2.2.1. Piping shall be filled with water at a rate no greater than 1 foot per second within the main. Precautions shall be taken to ensure that air pockets are eliminated.

9.2.2.2. Water shall remain in the pipe for twenty-four (24) hours. If the water temperature is below 41 degrees F, water shall remain in the pipe for forty-eight (48) hours.

9.2.2.3. Take Chlorine residue tests at each sampling point after the twenty-four (24) hour period. Report results to Owner.

9.2.2.4. Owner shall provide 5-g calcium hypochlorite required for dose of 50 mg/L.

9.2.3. Flush - Domestic Water:

9.2.3.1. Remove air relief vents after testing. Provide GPS locations for each vent.

9.2.3.2. Constructor shall supply all equipment and personnel required to perform flush.

9.2.3.3. Constructor shall contact the Owner for water source.

9.2.3.4. Flushing shall be started between 8:00 AM and 9:00 AM, Monday through Thursday.

9.2.3.5. Systems shall be flushed two (2) times, with two (2) samples per flush.

9.2.3.6. Flushing shall take place for approximately four (4) hours.

9.2.3.7. Constructor shall install a temporary hydrant at the end of the water main for flushing purposes. The temporary hydrant shall be full-sized.

9.2.3.8. It is the Constructor’s responsibility to route the flushed water to the storm sewer as indicated in the documents or directed by the Owner.

9.2.4. Notify the Owner of de-chlorination plan prior to disposal of heavily chlorinated water.
9.2.5. Neutralizing chemical shall be applied to the waste water to neutralize thoroughly the residual chlorine.

9.2.6. Contact Federal, State, provincial, and local regulatory agencies to determine provisions for disposal of heavily chlorinated water.

9.2.7. Cleaning:
   
   9.2.7.1. Piping shall be free of all foreign materials. Joint surfaces shall be free of lumps and blisters.
   
   9.2.7.2. Piping shall be power-washed clean inside and out. Owner shall witness cleaning.

9.2.8. Water Sampling - Domestic Water only
   
   9.2.8.1. Water sampling shall be performed by the Owner. The Owner shall collect the sample, take the sample to the lab, and notify the Constructor of the results.
   
   9.2.8.2. The Constructor shall supply equipment and personnel required to perform the tests.
   
   9.2.8.3. Water sampling shall take place at approximately 11:30 AM.
   
   9.2.8.4. Following the sampling, the Constructor shall allow three (3) days for laboratory processing before hydro test.
   
   9.2.8.5. Testing shall be completed and passed prior to connecting to any existing lines.

9.2.9. Hydro Test:
   
   9.2.9.1. Hydro test all piping.
   
   9.2.9.2. Testing shall not begin until satisfactory biological test results have been received from the Owner.
   
   9.2.9.3. Tests shall be made against capped ends. Test pressure shall be 1 ½ times working pressure, and a minimum of 150 pounds. All piping shall be capped by mechanical caps and restraint joints.

   9.2.9.4. Owner shall witness all hydro tests.
   
   9.2.9.5. Test shall be for four (4) hours. No tests started after 12:00 PM.
   
   9.2.9.6. Test may only lose 5 psig.
   
   9.2.9.7. Gauges shall be Owner provided.

9.3. Piping:
   
   9.1.10.9.3.1. Ductile Iron piping shall be class 53 restrained piping for all sizes.
   
   9.1.11.9.3.2.Pipe shall be cement lined.

   9.1.12.9.3.3. Plain end fittings shall not be used.
9.1.13. Changes in direction shall be made with 45-degree, 22 ½-degree or 11 ¼-degree fittings. 90-degree fittings shall not be used without written approval from the Owner.


9.1.15. Field cut joints shall use Mega Lug series 1100 restraint. Piping manufacturer’s field kits shall not be used.

9.1.16. Piping shall be encased in minimum 8 mils polyethylene sheathing.

9.1.17. Wall and floor penetrations shall be sealed with Link-Seal.

9.1.18. Anchor through wall and through floor penetrations. Refer to per 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.

9.2.9.4. Accessories:

9.2.1. Fire hydrants shall be provided in accordance with the requirements of the local fire district or department. Fire hydrants shall be Mueller Super Centurion 250, Model A-423, open right. Color shall be safety yellow.

9.2.2. All water meters shall be located inside buildings with a ¾ inch raceway to the Utility Ethernet connection. Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices.

9.2.3. Valves:

9.2.3.1. Valves 14 inches and smaller shall be Clow F-6100 resilient wedge gate valve.

9.2.3.2. Valves 16 inches and larger shall be gear-operated butterfly valves.

9.2.3.3. Valves shall be designed, manufactured and tested in accordance with ANSI/AWWA C504. Valves shall be proof of design tested in accordance with ANSI/AWWA C504, and certified by ANSI/NSF 61 Drinking Water System Components – Health Effects. Manufacturer shall have a quality management system that is certified to ISO 9001:2000.

9.2.4. Connections:

9.2.4.1. 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.

9.2.4.2. Mechanical joint end connections shall fully conform to ANSI/AWWA C111/A21.11.

9.2.4.3. Wafer end connection shall be designed for installation between ANSI B16.1 Class 125 Iron flanges or ISO 7005-2 PN10 or PN16 flanges.

9.2.5. Design:
9.2.3.5.1.9.4.3.5.1. Valve shafts shall be through-type for sizes 3 to 24 inches. 30 inch and larger shall be stub-type. Shafts shall be locked to the disc by O-Ring sealed taper pins retained with stainless steel nuts.

9.2.3.5.2.9.4.3.5.2. Valve discs shall be solid-type without external ribs or vanes to obstruct flow. Resilient seats shall be located on the valve disc and shall provide a 360-degree, continuous, uninterrupted stainless steel body seat ring.

9.2.3.5.3.9.4.3.5.3. Resilient seats shall be field adjustable and replaceable and shall not require hypodermic needles or pressure vessels to replace or adjust.

9.2.3.5.4.9.4.3.5.4. Sleeve bearings shall be provided in the valve hubs and shall be Nylatron or woven Teflon, fiberglass backed, self-lubricating.

9.2.3.5.5.9.4.3.5.5. Thrust bearings shall be provided and shall be adjustable on valves 30 inches and larger.

9.2.3.5.6.9.4.3.5.6. Shaft seals shall be of the V-type and shall be replaceable without removal of the valve or shaft.

9.2.3.6.9.4.3.6. Materials:

9.2.3.6.1.9.4.3.6.1. Body

9.2.3.6.1.1.9.4.3.6.1.1. Class 150B valve bodies shall be ASTM A126, Class B gray iron or ASTM A536 Grade 65-45-12 ductile iron. Class 250B valve bodies shall be ASTM A536 Grade 65-45-12 ductile iron.

9.2.3.6.1.2.9.4.3.6.1.2. Optional body material is ASTM A536, Grade 65-45-12 ductile iron.

9.2.3.6.2.9.4.3.6.2. Valve disc shall be ASTM A536 Grade 65-45-12 ductile iron.

9.2.3.6.3.9.4.3.6.3. Shafts

9.2.3.6.3.1.9.4.3.6.3.1. Shafts shall be ASTM A276 type 304, or ASTM A564, Type 630 stainless steel.

9.2.3.6.3.2.9.4.3.6.3.2. Optional shaft material is ASTM A276, Type 316 stainless steel.

9.2.3.6.4.9.4.3.6.4. Resilient seat shall be Buna-N and mate to a Type 316 stainless steel body seat ring.

9.2.3.6.5.9.4.3.6.5. All seat-retaining hardware shall be Type 316 stainless steel.

9.2.3.6.6.9.4.3.6.6. Valve exteriors for above ground service shall be coated with a universal, alkyd primer.

9.2.3.6.7.9.4.3.6.7. Valve exteriors for buried service shall be coated with fusion bonded epoxy coating.
9.2.3.6.8.9.4.3.6.8. Valve interiors shall be coated with an ANSI/NSF 61 fusion bonded epoxy coating approved for potable water.

9.2.3.6.9.9.4.3.6.9. Provide manual, electric or cylinder actuation.

9.2.3.6.9.9.4.3.6.10. 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”.

9.2.3.6.11.9.4.3.6.11. T-bolts shall be fluorocarbon coated by Birmingham Fasteners.

9.2.3.6.12.9.4.3.6.12. Use manufacturer provided gasket unless the site is identified as an Iowa DNR Register UST site. Designer shall determine the appropriate gasket required for contaminants.

3. Testing

9.2.4.1.1.1 Disinfection - Domestic Water

9.2.4.1.1.1.1 Disinfections shall be performed Monday through Thursday, starting between 8:00 AM and 9:00 AM.

9.2.4.1.1.1.2 Pipes shall be disinfected according to AWWA standards.

9.2.4.1.1.1.3 Disinfection shall take place over a period of twenty-four (24) hours (no longer or shorter).

(1) Disinfection shall be performed before hydro testing. Hydro testing shall not begin until bacteria results have been returned from the lab. Contractor shall anticipate a three (3) working day turn-around time from the time that the sample is taken until the results are returned.

b. Method of Chlorination

9.2.4.1.1.1.4 Piping shall be filled with water at a rate no greater than 1 foot per second within the main. Precautions shall be taken to ensure that air pockets are eliminated.

9.2.4.1.1.5.1 Water shall remain in the pipe for twenty-four (24) hours. If the water temperature is below 41 degrees F, water shall remain in the pipe for forty-eight (48) hours.

9.2.4.1.1.6 Take Chlorine residue tests at each sampling point after the twenty-four (24) hour period. Report results to Owner.

9.2.4.1.1.7 Owner shall provide 5-g calcium hypochlorite required for dose of 50 mg/L.

9.2.4.1.1.8 Flush - Domestic Water Remove air relief vents after testing. Provide GPS locations for each vent.

(1) Contractor shall supply all equipment and personnel required to perform flush.

9.2.4.1.1.9 Contractor shall contact the Owner for water source.

9.2.4.1.1.10 Flushing shall be started between 8:00 AM and 9:00 AM, Monday through Thursday.
9.2.4.11.1.1.1. Systems shall be flushed two (2) times, with two (2) samples per flush.

9.2.4.12.1.1.1.1. Flushing shall take place for approximately four (4) hours.

9.2.4.13.1.1.1.1. Contractor shall install a temporary hydrant at the end of the water main for flushing purposes. The temporary hydrant shall be full-sized.

9.2.4.14.1.1.1.1. It is the Contractor's responsibility to route the flushed water to the storm sewer as indicated in the documents or directed by the Owner.

9.2.5.1.1.1. Notify the Owner of de-chlorination plan prior to disposal of heavily chlorinated water.

9.2.6.1.1.1. Neutralizing chemical shall be applied to the waste water to neutralize thoroughly the residual chlorine.

9.2.7.1.1.1. Contact Federal, State, provincial, and local regulatory agencies to determine provisions for disposal of heavily chlorinated water.

9.2.7.1.1.1.1. Cleaning Piping shall be free of all foreign materials. Joint surfaces shall be free of lumps and blisters.

9.2.7.2.1.1.1.1. Piping shall be power-washed clean inside and out. Owner shall witness cleaning.

9.2.8.1.1.1. Water Sampling - Domestic Water only

(2) Water sampling shall be performed by the Owner. The Owner shall collect the sample, take the sample to the lab, and notify the Contractor of the results.

9.2.8.1.1.1.1. The Contractor shall supply equipment and personnel required to perform the tests.

9.2.8.2.1.1.1. Water sampling shall take place at approximately 11:30 AM.

9.2.8.3.1.1.1. Following the sampling, the Contractor shall allow three (3) days for laboratory processing before hydro test.

9.2.8.4.1.1.1. Testing shall be completed and passed prior to connecting to any existing lines.

9.2.8.5.1.1.1. Hydro Test Hydro test all piping.

9.2.8.6.1.1.1. Testing shall not begin until satisfactory biological test results have been received from the Owner.

9.2.8.7.1.1.1. Tests shall be made against capped ends. Test pressure shall be 1 ½ times working pressure, and a minimum of 150 pounds. All piping shall be capped by mechanical caps and restraint joints.

9.2.8.8.1.1.1. Owner shall witness all hydro tests.

9.2.8.9.1.1.1. Test shall be for four (4) hours. No tests started after 12:00 PM.

9.2.8.10.1.1.1. Test may only lose 5 psig.
9.2.8.11.1.1.1.1. Gauges shall be Owner provided.

9.3.9.5. Final Connections to Existing Domestic Water Main:

9.3.1.9.5.1. Water mains and appurtenances shall be flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connection to the active distribution system.

9.3.2.9.5.2. Follow sanitary construction practices during final connection so that no foreign material or groundwater contamination enters the adjacent piping.

10. NATURAL GAS

10.1. Gas Mains and services shall have a minimum of 24 inches of cover.

10.2. 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.

10.3. Piping downstream of meter shall be above-grade.

11. CHILLED WATER

11.1. General

11.1.1. Piping shall have sand pipe bedding and envelope. Piping shall be laid in a sand bed with a minimum 12 inch sand envelope.

11.1.2. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to 98 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

11.1.3. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

11.1.4. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

11.1.5. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within ±3 percent of optimum moisture content before delivery to the project site.

11.1.6. Install warning tape 12 inches to 18 inches above piping.

11.1.7. Operation of all valves, both new and existing, shall be by the Owner.

Contractor shall furnish and install a PLC cabinet for chilled water interfaces and metering.

(1) Location of PLC cabinet shall be indicated on the documents. Confirm final location with Owner.

(2) Raceways

(a) Contractors shall provide raceways.

(b) Raceways for chilled water devices shall be separate from raceways used for steam metering devices.
(c) Raceways and junction boxes shall be separate for each voltage class to include separating AC from DC. 480 VAC is to be at least 12 inches away from any lower voltage signal cabling raceways.

(d) Raceways for the utilities PLC shall not be shared with the raceways used for building automation systems.

3. PLC cabinet shall be lockable NEMA 12 and 4 rated, 36 inch by 36 inch by 12 inch deep unless otherwise stated by Owner. Cabinet is to include backplane and 19 inch rack mount.

4. Electronic components inside cabinet will be furnished and programmed by Owner.

5. All penetrations into the PLC shall be from the bottom. All penetrations into or out of cabinet should be set out 4 inches minimum from back of cabinet.

6. Metering and Control cabling to be consolidated to a minimum 12 inch by 12 inch by 6 inch metal junction box, provided and installed by Contractor.

7. Owner shall provide, pull, and terminate all utility network cabling and provide, install, and program network accessories inside cabinet.

8. Contractor shall provide 120V, 20 amp dedicated circuit with duplex receptacle, located inside of PLC cabinet.

9. Contractor shall provide a raceway from PLC to Utility Network Cabinet. 2 inch minimum rigid metal if in tunnel, otherwise EMT is acceptable, all with a minimum bend radius of 6 inches.

11.1.8. Refer to UTILITY DISTRIBUTION PLC CABINET DETAIL in Appendices.

11.2. Testing:

11.2.1. All piping shall be cleaned prior to testing. Disinfection is not required. Cleaning shall be as follows:

11.2.1.1. Piping shall be free of all foreign materials. Joint surfaces shall be free of lumps and blisters.

11.2.1.2. Piping shall be power-washed clean inside and out. Owner shall witness cleaning.

11.2.2. Chilled Water piping shall be video recorded to verify cleanliness prior to being filled for hydro test. Submit video to Owner for review.

11.2.3. Hydro Test Requirements:

11.2.3.1. Hydro test all piping.

11.2.3.2. Test pressure shall be 150 pounds.

11.2.3.3. Owner shall witness all hydro tests.

11.2.3.4. Test shall be for four (4) hours.

11.2.3.5. Test may only lose 5 psig.
11.2.3.6. Gauges shall be provided by Owner.

11.2.11. Piping:

11.2.1.11.3. Ductile Iron piping shall be class 53 restrained piping for all sizes.

11.2.2.11.3. Pipe shall be cement lined.

11.2.3.11.3. Plain end fittings shall not be used.

11.2.4.11.3. Changes in direction shall be made with 45-degree, 22 ½-degree or 11 ¼-degree fittings. 90-degree fittings shall not be use without written approval from the Owner.

11.2.5.11.3. Approved manufacturers: Griffin Snap Lok, US Pipe TR Flex, Clow TR Flex, and American Pipe Flex Ring.

11.2.6.11.3. Field cut joints shall use Mega Lug series 1100 restraint. Piping manufacturer’s field kits shall not be used.

11.2.7.11.3. Piping shall be encased in minimum 8 mils polyethylene sheathing.

11.2.8.11.3. Wall and floor penetrations shall be sealed with Link-Seal.

11.2.9.11.3. Anchor through wall and through floor penetrations per 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.

11.3.11.4. Accessories:

11.3.1.11.4. Valves:

11.3.1.1.11.4.1. Valves 14 inch and smaller shall be Clow F-6100 resilient wedge gate valve or approved equal.

11.3.1.2.11.4.1.2. Valves 16 inches and larger shall be gear-operated butterfly valves.

11.3.1.3.11.4.1.3. Valve boxes shall be East Jordan model number 8550, or approved equal. Valve box lids shall be East Jordan labeled “University of Iowa, (with either) Chilled Water Supply or Chilled Water Return”.

11.3.2.11.4.2. Elbows:

11.3.2.1.11.4.2.1. Changes in direction shall be made with 45-degree, 22 ½-degree, or 11 ¼-degree bends. 90-degree elbows are not allowed.

11.3.3.11.4.3. Building service piping shall have a strainer and chilled water meter installed at the point of entry into the building.

4. Testing

11.3.4.1.1.1. All piping shall be cleaned prior to testing. Disinfection is not required. Cleaning shall be as follows:
11.3.4.1.1.1.1.1.1. Piping shall be free of all foreign materials. Joint surfaces shall be free of lumps and blisters.

11.3.4.2.1.1.1.1.1. Piping shall be power-washed clean inside and out. Owner shall witness cleaning.

11.3.5.1.1.1. Chilled Water piping shall be video recorded to verify cleanliness prior to being filled for hydro test. Submit video to Owner for review.

11.3.5.1.1.1.1. Hydro Test Requirements. Hydro test all piping.

11.3.5.2.1.1.1.1. Test pressure shall be 150 pounds.

11.3.5.3.1.1.1.1. Owner shall witness all hydro tests.

11.3.5.4.1.1.1.1. Test shall be for four (4) hours.

11.3.5.5.1.1.1.1. Test may only lose 5 psig.

11.3.5.6.1.1.1.1. Gauges shall be provided by Owner.

12. STEAM AND CONDENSATE DISTRIBUTION

12.1. General

12.1.1. Piping shall have sand pipe bedding and envelope. Trench backfill shall be IDOT Gradation 11 Class A road stone compacted to 98 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

12.1.2. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

12.1.3. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

12.1.4. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within ± 3 percent of optimum moisture content before delivery to the project site.

12.1.5. Install warning tape 12 inches to 18 inches above piping.

12.1.6. Weld requirements:

12.1.6.1. Contractor shall submit welder certifications.

12.1.6.2. Each welder shall be assigned an identification number or letter. This identification shall be etched or stamped on each weld after completion of the weld. Any weld without an identification shall be rejected.

12.1.7. Pipe material requirements:

12.1.7.1. All piping shall be marked with an identification code consisting of longitudinal color stripe, painted the entire length of each piece of pipe to identify ASTM designation of material.
12.1.7.2. Provide the Owner with the identification code.

12.1.7.3. Any fabrication off the jobsite shall have the identification color coded the entire length of fabrication.

12.1.7.4. Owner shall have the right to reject any pipe which cannot be readily identified as to the material because the color coding was not installed on the piping.

12.2. Testing:

12.2.1. Pressure pipe welding requirements:

12.2.1.1. Pressure piping shall be examined and tested in accordance with ASME B31.1 and AWS B1.11.

12.2.1.2. Additional weld testing beyond visual inspections of welds may be performed including but not limited to radiography, ultrasonic, liquid penetrate and magnetic particle methods.

12.2.2. 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. No tests shall begin after 12:00 PM (Noon).

12.2.3. Piping shall have high point vents to allow complete filling of pipe for the hydrostatic test. Remove Air relief vents after testing. Provide GPS locations for each vent.

12.2.4. Steam Blow:

12.2.4.1. Provisions shall be made for a steam-blow of new steam piping to clean out debris.

12.2.4.2. Steam-blow plans shall be developed in consultation with a licensed Engineer. The Constructor shall design steam-blow temporary piping. Plan shall be approved by a licensed Engineer.

12.2.4.3. Owner shall furnish a steam muffler for the purpose of a steam-blow.

12.2.4.4. The Constructor shall pick up, transport, and return muffler.

12.2.4.5. Connections to the muffler shall be the responsibility of the Constructor.

12.2.4.6. The steam-blow shall be coordinated by the Owner. Valve operation shall be by the Owner.

12.2.4.7. Minimum of two (2) blows shall be required. The Constructor and Engineer shall be required to be on site.

12.2.4.8. At the completion of the steam blow the Constructor shall disconnect the temporary piping and make all permanent connections.

12.2.12.3. Piping:

12.2.1.12.3.1. Carrying piping material shall be as follows:

12.2.1.1.12.3.1. Steam - All Locations:
12.2.1.1.1.12.3.1.1.1.2 inches and Smaller Schedule 40 A106 Gr B seamless, threaded.

12.2.1.1.2-12.3.1.1.2.2 ½ inches and Larger STW A106 Gr B seamless, butt-weld.

12.2.1.2.12.3.1.2.2 Condensate in Tunnels and Tank Rooms:

12.2.1.2.1.2 12.3.1.2.1 2 inches and Smaller Schedule 40 A106 Gr B seamless, threaded

12.2.1.2.2.12.3.1.2.2 2 ½ inches and Larger, Schedule 10S A312 Type 304L stainless steel.

12.2.1.3.12.3.1.3.1 Condensate in Direct Bury Systems:

12.2.1.3.1.1.2 12.3.1.3.1 2 inches and Smaller Schedule 40S A312 Type 304L stainless steel socket weld – no threaded piping.

12.2.1.3.2.12.3.1.3.2 2 ½ inches and Larger Schedule 10S A312 Type 304L stainless steel.

12.2.2.12.3.2 Piping shall be sloped ¼ inch per 10 feet of pipe to a drip leg. Pipe shall be sloped down in the direction of steam flow.

12.2.3.12.3.3 Thread tape, including Teflon or any other materials, shall not be used on distributed piping.

12.2.4.12.3.4 Welds shall be visually inspected.

12.2.5.12.3.5 Flanges on screwed piping shall be back-welded.

12.2.6.1.1.1 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. No tests shall begin after 12:00 PM (Noon).

12.2.7.1.1.1 Piping shall have high point vents to allow complete filling of pipe for the hydrostatic test. Remove Air relief vents after testing. Provide GPS locations for each vent.

12.2.8.12.3.6 Unions shall be Nicholson Uniflex Steel/Stainless. Pipe unions shall have replaceable gaskets.

12.2.9.12.3.7 Elbows shall be long radius.

12.2.10.12.3.8 Pre-insulated Piping (direct-bury):

12.2.10.1-12.3.8.1 Perma-Pipe Multi-Therm 500.

12.2.10.2-12.3.8.2 Steam and condensate shall be installed in separate casing pipes.

12.2.10.2.1-12.3.8.2.1 Steam is schedule 40 seamless steel piping.

12.2.10.2.2-12.3.8.2.2 Main Campus condensate piping shall be schedule 10 stainless steel.
12.2.10.2.3.12.3.8.2.3. The University of Iowa Research Campus condensate piping shall be schedule 80 seamless steel.

12.2.10.3.12.3.8.3. Provide for pipe expansion in vaults.

12.2.10.4.12.3.8.4. Casing pipe shall be air pressure tested and soaped at field joints.

12.2.10.5.12.3.8.5. Trapping vaults on the system shall be no more than 250 feet apart.

12.2.10.6.12.3.8.6. Engineering supervision is required during installation, as faulty installation cannot be detected by any post-construction test methods.

12.2.11.12.3.9. Piping Penetrations:

12.2.11.1.12.3.9.1. Penetrations of foundation walls shall be leak proofed. Approved manufacturers include Thunderline and Link-Seal.

12.2.11.2.12.3.9.2. Penetrations, except steam tunnels, shall be individual pipes or conduits. Groups of pipes or conduits in a common penetration shall not be allowed.

12.2.11.3.12.3.9.3. Minimum strength of pipe penetrating foundation walls shall be equal to Schedule 40.

12.2.11.4.12.3.9.4. The point of attachment for steam tunnels shall have a concrete, cast-in-place transition, with water-stopping material cast into the concrete. The water-stopping shall be embedded into the foundation wall according to the manufacturer’s recommendations.

12.2.11.5.12.3.9.5. Individual penetrations of steam and condensate lines shall be installed as follows

12.2.11.5.1.12.3.9.5.1. Sleeve penetration with a steel sleeve at least 6 inches beyond the penetration.

12.2.11.5.2.12.3.9.5.2. Weld flange to the sleeve and to the pipe on the interior side of the foundation wall with a continuous, waterproof weld. The exterior side of the penetration shall have waterproofing material applied.

12.3.12.4. Accessories:

12.3.1.12.4.1. Supports and Anchors:

12.3.1.1.12.4.1.1. Portions of pipe stanchions within 12 inches of concrete shall be 304L stainless steel.

12.3.1.2.12.4.1.2. Anchoring devices shall be stainless steel.

a. Meters

12.3.2.12.4.2. Meters shall be McCrometer V-cone, with Rosemount multi-variable transmitter with Tri-loop. Meters shall be installed upstream of any pressure reducing devices. Refer to UTILITY DISTRIBUTION STEAM METER AND TAPS DETAIL in Appendices. Coordinate sizing with UI Meters and Controls.
(1) Meters shall be installed in straight piping. The piping shall be free from bends, reducers, valves, and branch lines for a distance of 4 pipe diameters upstream from the meter and 3 pipe diameters downstream of the meter.

(2) Meters shall have visible flow direction arrows. The meters shall have 150 pound, raised face, flanged bodies and be sized for 20:1 turndown.

(3) Meter shall be provided by the Contractor.

(4) Contractor shall provide a raceway from each meter to Utility PLC. Raceway shall be 3/4 inch (min) RMC outside buildings, 3/4 inch (min) EMT in buildings, 2 inch (min) RMC, with #10 Cu wire for tracer, where buried.

(5) Cabling between meter and PLC shall be provided and installed by contractor. UI Meters and Controls to specify cabling types and terminate all connections.

(6) In the cases where there is not an existing PLC, contractor shall furnish a PLC cabinet and junction box for steam and/or condensate meters. Refer to Chilled Water section for PLC cabinet specification.

12.3.3.4.12.4.3. Pressure Reducing Valves (PRV):

- Each individual building shall be served by a dedicated PRV.
- PRVs shall be installed with isolation valves.
- PRVs shall be Cashco Ranger
- PRVs in the distribution system shall not contain a bypass.
- Locate pressure gauges on both sides of PRV.
- All PRVs shall be located and configured to allow for maintenance access. Provide a minimum clearance of 24 inches in all directions.
- Mount PRV below 8 feet AFF.

12.3.4.12.4.4. Valves:

- All valves on a project shall be by the same manufacturer and the same model.
- Valves 2 ½ inches and larger:
  - Manufacturers shall be Powell, NEWCO, Velan, or Crane.
  - 155 psig Steam shall be 300 pound class cast steel, butt-weld.
  - 20 psig Steam shall be 150 pound class cast steel, butt weld.
  - Hard-faced seat rings.
  - Direct-operated valves are preferred over gear-operated valves.
All valves shall be equipped with operating devices to allow operation from the ground.

Valves may be butterfly, lug-style, carbon steel body, and stainless steel disk, complete with gear operator and locking device and manual hand wheel.

Valves 2 inches and smaller:
- Manufacturer shall be NIBCO Model T-174-SS
- 155 psig Steam shall be 300 pound class screwed bronze.
- 20 psig Steam shall be 300 pound class screwed bronze.
- Rolled in stainless steel seat rings.

Safety Valves:
- 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.
- Multiple valves may be used in lieu of a single, larger valve.
- Valves 2 ½ inch outlet or smaller shall be Kunkle Figure 6010. Valves 3 inch outlet or larger shall be Kunkle Figure 300.
- The use of PRVs in series instead of a relief valve shall not be allowed.
- Each safety valve shall have an individual vent pipe to outside. Consult with the Owner for vent routing.
- Safety valve shall not be hard piped to vent line.
- 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.
- Vent lines from pressure powered pumps or condensate pumps shall not be connected to a relief vent pipe.

Check Valves:
- Check valves shall bronze or stainless steel seats and flappers.
- Bodies shall be bronze, cast steel or forged steel. Cast iron bodies are not acceptable.
- Valves on steam shall be 300 pound class.
12.3.5.1. Strainers shall have bronze, cast steel or forged steel bodies. Cast iron is not acceptable.

12.3.5.2. Strainers shall have 1/32 inch screens.

12.3.5.3. The blow down port of each strainer shall have a pipe nipple with a full port-sized gate valve and no cap.

12.3.5.4. Any strainer on 155 psig steam system shall be 300 pound class. Any strainer on 20 psig steam system shall be 150-pound class.

12.3.5.5. Manufacturers shall be Armstrong, Spirax Sarco, or Hoffman.

12.3.5.6. Strainers shall be Y-pattern, rated for steam, with stainless steel baskets.

12.3.6.1. Expansion Joints:

12.3.6.1.1. 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. Comply with ASTM F 1007.

12.3.6.2. Joints shall have internal and external guides, integral with joint gland and body. Joints shall be equipped with limit stop.

12.3.6.3. Joint shall allow the addition of new packing while joint is in service under full line pressure. The packing ram shall be steel, with no shutoff valve.

12.3.6.4. Base joint travel on 550 degrees F operating temperature. Joints shall be pre-pressed to allow shrinkage down to 0 degrees F.

12.3.6.5. Drain plugs shall be seal welded shut.

12.3.7.1. Gauges:

12.3.7.1.1. Provide McDaniel Gauges or approved equal.

12.3.7.2. Face Style shall be 4 inches or larger.

12.3.7.3. Range Selection:

12.3.7.3.1. 20 psig system gauges shall be 0 to 30 (psig).

12.3.7.3.2. Medium pressure (20 to 90 psig) gauges shall be 0 to 100 (psig).

12.3.7.3.3. 155 psig system gauges shall be 0 to 200 (psig).

12.3.7.4. Mounting shall be standard bottom connection.

12.3.8. Equipment:

12.3.8.1. General
12.3.8.1.12.4.8.1.1. Install air vents and vacuum breakers on steam equipment.

12.3.8.2.12.4.8.2. Condensate Pumps:

12.3.8.2.1.12.4.8.2.1. Pumps shall be electric, duplex-type.

12.3.8.2.2.12.4.8.2.2. Manufacturers include Sterling, Johnson, ITT, Spirax Sarco or Clark Reliance.

12.3.8.2.3.12.4.8.2.3. Pump shall be installed per manufacturer’s specifications.

12.3.8.2.4.12.4.8.2.4. Condensate tanks shall be vented.

12.3.8.2.4.1.12.4.8.2.4.1. Condensate pumps shall have two (2) full size vents, discharge into equipment room.

12.3.8.3.12.4.8.3. Heat Exchangers:

12.3.8.3.1.12.4.8.3.1. Exchangers shall be ASME approved, with relief valves, rated for the service, on both steam and hot water systems.

12.3.8.3.2.12.4.8.3.2. Locate heat exchangers to allow removal of the bundle.

12.3.8.3.3.12.4.8.3.3. Install gauges and thermometers to indicate the following:

12.3.8.3.3.1.12.4.8.3.3.1. Pressure of entering steam

12.3.8.3.3.2.12.4.8.3.3.2. Pressure and temperature of entering water

12.3.8.3.3.3.12.4.8.3.3.3. Pressure and temperature of leaving water

12.3.8.3.4.12.4.8.3.4. Install expansion tanks on the water side of all heat exchangers.

12.3.8.4.12.4.8.4. Coils:

12.3.8.4.1.12.4.8.4.1. Coils shall be tube-in-tube, non-freezing type with a minimum 1 inch O.D. tubing.

12.3.8.4.2.12.4.8.4.2. Use integral face and bypass coils for outside air preheat coils.

12.3.8.4.3.12.4.8.4.3. Provide two (2) steam traps with bypass for all pre-heat coils.

12.3.8.5.12.4.8.5. Pressure Powered Pump:

12.3.8.5.1.12.4.8.5.1. Pump shall be a pressure powered design, using 60 psig steam to pump low pressure steam condensate.

12.3.8.5.2.12.4.8.5.2. Pump shall be constructed with a cast iron body, designed for maximum operating pressure of 125 psig at 450 degrees F, bronze or stainless steel check valves on the inlet and outlet, and connections for high pressure steam and vent. All internal components shall be stainless steel.
12.3.8.5.3. Pump shall contain a float operated snap acting mechanism to actuate fill and discharge cycles.

12.3.8.5.4. Connections shall be threaded or flanged.

12.3.8.5.5. Pump shall be equipped with a gauge glass with brass cocks and manufacturer-furnished insulating jacket.

12.3.8.6. Pressure Powered Pump/Receiver:

12.3.8.6.1. Provide a condensate receiver inlet reservoir of welded steel construction, mounted above the pump and sized in accordance with the manufacturer’s recommendations for the pump capacity.

12.3.8.6.2. Condensate receiving tank shall have a drain installed.

12.3.9. Steam Trapping Stations:

12.3.9.1. Steam traps on mechanical distribution piping shall be Armstrong 2011 series or Spirax Sarco UIV30 Series, modular stainless steel inverted bucket traps.

12.3.9.2. Each trap shall have an upstream block valve, test valve, and strainer, a downstream swing check valve, a test valve, and a block valve.

12.3.9.3. There shall be no trap bypasses.

12.3.9.4. Trapping station piping and fittings shall be threaded. Welded fittings are not allowed.

12.3.9.5. Traps shall be piped from drip legs. Drip leg diameter shall be equal to the pipe size for pipes up to 4 inches and at least ½ the pipe diameter for pipes over 4 inches. Length of the drip legs shall be 1 ½ times the diameter of the pipe, with a minimum of 12 inches.

12.3.9.6. 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. Blow-down valves shall be piped from the bottom of the drip leg cap where possible.

12.3.9.7. 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.

12.3.10. Insulation:

12.3.10.1. Closed cell foam insulation shall not be used.

12.3.10.2. Insulation shall not be installed on steam traps and condensate return pumps.

12.3.10.3. All exterior piping insulation systems shall have aluminum jacket.

12.3.10.4. All piping exposed in occupied areas within 6 feet AFF shall have an aluminum jacket installed.
12.3.10.5.1. 12.4.10.5.1. Jacket:

12.3.10.5.2. 12.4.10.5.2. Jackets shall be 0.019 inch stainless steel or aluminum.

12.3.10.5.3. 12.4.10.5.3. All seams shall face downward.

12.3.10.5.4. 12.4.10.5.4. PVC shall not be used for this jacket.

12.3.10.6. 12.4.10.6. Steam Tunnel Insulation:

12.3.10.6.1. 12.4.10.6.1. Steam piping in tunnels shall have the following insulation:

12.3.10.6.1.1. 12.4.10.6.1.1. 850 CertainTeed fiberglass insulation, 3 ½ inches thick on high pressure steam and 2 ½ inches thick on low pressure steam.

12.3.10.6.1.2. 12.4.10.6.1.2. Insulation shall be installed in two (2) layers, using staggered joints and seams.

12.3.10.6.2. 12.4.10.6.2. Condensate piping in tunnels shall have the following insulation:

12.3.10.6.2.1. 12.4.10.6.2.1. 1 inch of 850 CertainTeed fiberglass insulation.

12.3.10.6.2.2. 12.4.10.6.2.2. In addition to the fiberglass insulation with the vapor barrier jacket, the insulation shall be covered with aluminum jacket with bands.

12.3.10.6.3. 12.4.10.6.3. Installation of insulation on steam piping shall be as per the following table:

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>SIZE</th>
<th>INSTALLATION METHOD</th>
<th>TOTAL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Pressure Steam</td>
<td>Over 20 pounds</td>
<td>All Sizes 2 inches first layer, 1 ½ inches second layer</td>
<td>3 ½ inches</td>
</tr>
<tr>
<td>Low Pressure Steam</td>
<td>Under 20 pounds</td>
<td>All Sizes 1 ½ inches first layer, 1 inch second layer</td>
<td>2 ½ inches</td>
</tr>
</tbody>
</table>

12.3.10.6.4. 12.4.10.6.4. Insulation shall be covered with aluminum jacket with bands.

12.3.10.6.5. 12.4.10.6.5. Where pipe is held in place with a spider guide that does not allow at least ¾ inch clearance between the insulation and the outer ring, the following procedures shall be used:

12.3.10.6.5.1. 12.4.10.6.5.1. The insulation shall neck down to a single layer approximately 6 inches before and after the guide.
12.3.10.6.5.2.12.4.10.6.5.2. The top layer of insulation shall be beveled at a 45-degree angle to allow for a smooth transition to a single layer.

12.3.10.6.5.3.12.4.10.6.5.3. 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.

12.3.10.7.12.4.10.7. Steam Vault Insulation:

12.3.10.7.1.12.4.10.7.1. Steam Piping in vaults shall have the following insulation:

12.3.10.7.1.1.12.4.10.7.1.1. Non-asbestos containing calcium silicate insulation.

12.3.10.7.1.2.12.4.10.7.1.2. Insulation shall be installed in two (2) layers, using staggered joints and seams.

12.3.10.7.2.12.4.10.7.2. All condensate lines in vaults shall have non-asbestos containing calcium silicate insulation.

12.3.10.7.3.12.4.10.7.3. Insulation shall be covered with aluminum jacket with bands.

12.3.10.7.4.12.4.10.7.4. The Non-asbestos containing insulation shall be:

12.3.10.7.4.1.12.4.10.7.4.1. Johns Manville - Kaylo T-12

12.3.10.7.4.2.12.4.10.7.4.2. Pabco-Caltemp

12.3.10.7.4.3.12.4.10.7.4.3. Manson-CALMAX

12.3.10.7.4.4.12.4.10.7.4.4. Temperlite 1200

12.3.10.7.4.5.12.4.10.7.4.5. Owens-Corning Pink

12.3.10.8.12.4.10.8. Steam Meter, Valve and Expansion Joint Insulation:

12.3.10.8.1.12.4.10.8.1. Meters, valves and expansion joints shall have removable/reusable insulation covers.

12.3.10.8.1.1.12.4.10.8.1.1. Covers for bodies 6 inches and below shall be one-piece.

12.3.10.8.1.2.12.4.10.8.1.2. Covers for bodies 8 inches to 12 inches shall be two-piece.

12.3.10.8.1.3.12.4.10.8.1.3. Covers for bodies 14 inches and larger shall be three-piece. Valve covers shall span 4 inches beyond welds or flanges.

12.3.10.8.1.4.12.4.10.8.1.4. Expansion joint covers shall be sized to accommodate thermal expansion.
12.3.10.8.2.12.4.10.8.2. Outer jacket, inner jacket, and gussets to be PTFE coated fiberglass, not less than 16.5 ounces per square yard.

12.3.10.8.3.12.4.10.8.3. Insulation thickness shall be as follows:

12.3.10.8.3.1.12.4.10.8.3.1. All steam and condensate piping 6 inches and below shall be 1 inch thick type-E needled fiberglass, 6-8 pound density.

12.3.10.8.3.2.12.4.10.8.3.2. All steam and condensate piping 8 inches or larger shall be 2 inch thick type-E needled fiberglass, 9-11 pound density.

12.3.10.8.4.12.4.10.8.4. The sewing thread shall be 10-strand 304 stainless steel.

12.3.10.8.5.12.4.10.8.5. Fastener belt shall be PTFE coated fiberglass with double D-rings and Velcro closure.

12.3.10.8.6.12.4.10.8.6. 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.

12.3.10.8.7.12.4.10.8.7. All hardware shall be 304 stainless steel.

12.3.10.8.8.12.4.10.8.8. Hog ring or staple construction shall not be used.

12.3.10.8.9.12.4.10.8.9. Provisions shall be made for the packing cylinders to ensure a snug fit along the entire expansion joint.

12.3.10.8.10.12.4.10.8.10. Refer to UTILITY DISTRIBUTION STEAM METER Station AND TAPS DETAIL in Appendices.

12.3.11.12.4.11. Steam Vaults:

12.3.11.1.12.4.11.1. Design vaults large enough to allow maintenance access.

12.3.11.2.12.4.11.2. Provide with lighting, GFCI maintenance receptacle, and 30 amp receptacle. Sump pumps shall not be connected to GFCI circuit. PVC conduit shall not be allowed.

12.3.11.3.12.4.11.3. Ventilation:

12.3.11.3.1.12.4.11.3.1. Vaults shall have a single speed fan with thermostat control, freeze stat, and On-Off-Auto switch. Fans shall draw air into vault.

12.3.11.3.2.12.4.11.3.2. All vault air ducts to louvered penthouses shall be ductile iron (push joint).

12.3.11.4.12.4.11.4. Vaults shall have Bilco spring-assisted access doors. Manhole covers are not acceptable. Doors shall be lockable with a key. Presray dead bolts are acceptable in areas where there is a potential for flooding. Consult with Owner for approval of all locking and security devices.
12.3.11.5.12.4.11.5. Vaults shall be cast-in-place concrete.

12.3.11.6.12.4.11.6. Vaults shall have a Q-door when not in drivable area.

12.3.11.7.12.4.11.7. Vaults shall have an H-20 J-door when in drivable area. No openings in roadways.

12.3.11.8.12.4.11.8. Vault doors shall be sized to allow largest equipment in and out.

12.3.11.9.12.4.11.9. All vaults shall have a painted or galvanized ladder.

12.3.11.10.12.4.11.10. Drainage:

12.3.11.10.1.12.4.11.10.1. Vaults shall have a gravity drain wherever possible.

12.3.11.10.2.12.4.11.10.2. Vaults shall have a sump hole at low point. Sump hole shall be 24 inches in diameter and 24 inches deep.

12.3.11.10.3.12.4.11.10.3. PVC fittings shall not be allowed.

12.3.11.10.4.12.4.11.10.4. Surface drainage shall be routed away from all openings.

12.3.11.12.4.11.11. Wall piping penetrations shall be sealed with link seals.

12.3.11.12.4.11.12. Walls and ceilings shall be waterproofed.

12.3.11.13.12.4.11.13. Supports and anchors below 12 inches AFF shall be stainless steel.


12.3.11.15.12.4.11.15. Supports for maintainable items shall be galvanized or painted.

5. Testing

12.3.12.1.1.1. Pressure pipe welding requirements:

12.3.12.1.1.1.1. Pressure piping shall be examined and tested in accordance with ASME B31.1 and AWS D1.11.

12.3.12.1.1.1.2. Additional weld testing beyond visual inspections of welds may be performed including but not limited to radiography, ultrasonic, liquid penetrate and magnetic particle methods.

12.3.13.1.1.1. Steam Blow:

12.3.13.1.1.1.1. Provisions shall be made for a steam blow of new steam piping to clean out debris.

12.3.13.1.1.1.2. Steam blow plans shall be developed in consultation with a licensed Engineer. The Contractor shall design steam blow temporary piping. Plan shall be approved by a licensed Engineer.

12.3.13.1.1.1.3. Owner shall furnish a steam muffler for the purpose of a steam blow.
(1) The Contractor shall pick up, transport, and return muffler. Connections to the muffler shall be the responsibility of the Contractor.

12.3.13.4.1.1.1.1. Connections to the muffler shall be the responsibility of the Contractor.

12.3.13.5.1.1.1.1. The steam blow shall be coordinated by the Owner. Valve operation shall be by the Owner.

(2) Minimum of two (2) blows shall be required. The Contractor and Engineer shall be required to be on site.

(3) At the completion of the steam blow the Contractor shall disconnect the temporary piping and make all permanent connections.

13. UTILITY TUNNELS

13.1. Tunnel floors shall be positively sloped towards a drain and sumps with sump pumps and discharge piping installed.

13.2. Tunnels shall be ventilated with supply fan with thermostat control, freeze stat, and On-Off-Auto switch. Fans shall draw air into vault.

13.3. Tunnel entrances shall be hinged, spring-assisted Bilco doors. Tunnel entrances shall not be placed within roadways.

13.4. Doors shall be key lockable. Dead bolt locks are not acceptable. No key shall be required to open door from inside the tunnel, and an exit lever shall be easily accessible.

13.5. At tunnel locations where serviceable items are located, tunnel chambers shall be installed with surface access.

13.6. Surface access shall allow hands-free upright entrance wherever possible.

13.7. Power and Lighting:

13.7.1. Provide lighting at 40 foot intervals (maximum). Provide two (2) separate lighting circuits on alternating lighting so that failure in one (1) circuit will not leave a tunnel dark.

13.7.2. Emergency lighting is not required.

13.7.3. Provide 30 amp receptacle at 60 foot intervals. Install in separate conduit from lighting circuits.

13.8. No plastic expansion anchors shall be used in the tunnel, including conduit.

13.9. Conduit shall be RGS. PVC, plastic pipe, or conduit is prohibited in tunnels and vaults.

13.10. All tunnel entrances shall have aluminum OSHA notice signs stating "Entry into Utility Tunnels requires approval! Daytime 319-335-5156/ 319-335-6103; Nights/Weekends 319-355-5137 (page Mechanical Distribution on-call person)" mounted just inside the entrance. These signs shall be furnished by Owner.

14. ELECTRIC DISTRIBUTION

14.1. General
14.1.1. Electric ductbank shall be backfilled with IDOT Gradation 11 Class A road stone compacted to 98 percent Standard Proctor Density under paving and suitable native fill compacted to 95 percent Standard Proctor Density under landscape areas.

14.1.2. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

14.1.3. Backfill material shall be placed in continuous layers not exceeding 8 inches in compacted depth.

14.1.4. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within +3 percent of optimum moisture content before delivery to the project site.

14.1.5. Install warning tape 12 inches to 18 inches above piping.

14.2. High Voltage Equipment:

14.2.1. Primary transformer/switchgear installations shall be designed using concrete equipment vault.

6. Ductbank

14.2.2. Duct Banks Switchgear in a room or vault shall be installed by qualified electrical Contractors on a 4 inch or taller concrete housekeeping pad.

   14.2.2.1. Minimum room height shall be 13 foot 0 inches from floor to lowest obstruction for bottom-fed equipment.

   14.2.2.2. Minimum room height shall be 15 foot 0 inches from floor to lowest obstruction for top-fed equipment.

14.3. Ductbank:

14.3.1. Provide type-EB PVC 5 inch duct equal to Carlon number 68716 and EB PVC 2 inch duct equal to Carlon number 68711.

14.3.2. Conduits shall terminate 2 inches inside walls with end bells equivalent to O-Z Gedney Type TNS.

14.3.3. Each ductbank shall contain a minimum of one (1) 2-inch conduit for telemetry.

14.3.4. Secondary ductbank from substation to electric room inside building shall contain a mini 2 inch telemetry raceway.

14.3.5. All duct bank shall be concrete encased. Provide concrete base, minimum 4 inch, reinforced.

14.3.6. Steel conduits are required as follows:

   14.3.6.1. Within 10 feet of manholes and building.

   14.3.6.2. At construction joints where concrete pours are interrupted.

14.3.7. Base and intermediate spacers shall be Carlon catalog numbers S288PL and S289PL. Spacers shall be provided on maximum 5 foot centers, minimum.
14.2.10.14.3.8. Duct and conduit couplings shall be water-tight. Duct shall be installed in such a manner to prevent accumulation of water.

14.2.11.14.3.9. Duct run shall pitch a minimum of 3 inches per 100 feet with no more than 350 feet between manholes.


14.2.13.14.3.11. All conduits shall be evenly spaced and aligned with each other.

14.2.14.14.3.12. Minimum reinforcing of the concrete shall be as follows:


14.2.14.2.14.3.12.2. 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.

14.2.14.3.14.3.12.3. All reinforcing steel shall have a minimum concrete cover of 1½ inch and shall be increased under all surfaces used for motor vehicle travel. Reinforcing shall be installed latitudinal, as needed to hold the above in place during placement of the concrete.

14.2.14.4.14.3.12.4. Each section of line (from manhole to manhole or from manhole to building) is intended to be poured complete in one (1) operation. Construction joints shall not be permitted between manholes.

14.2.15.14.3.13. The top of the concrete encasement shall be a minimum of 24 inches below final grade.

14.2.16.14.3.14. Concrete:

14.2.16.1.14.3.14.1. Concrete shall cover the duct a minimum of 3 inches in all directions, and a maximum of 6 inches.

14.2.16.2.14.3.14.2. 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. The color additive shall have a minimum concentration of 9 pounds per bag of cement and shall be mixed throughout all of the duct bank concrete.

14.2.16.3.14.3.14.3. Maximum aggregate size shall be ¾ inch.

14.2.16.4.14.3.14.4. Concrete shall not be placed with the aid of a mechanical vibrator.

14.2.17.14.3.15. After duct encasement is placed, and before backfill is installed, pull a mandrel or leather wipe through the ducts ¼ inch in diameter less than the ducts. If this test indicates that there are obstructions or 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.

14.2.18.14.3.16. Duct bank penetrations into manholes shall continue completely through the wall of the manhole using a single penetration. Where the concrete must stop outside the manhole, it shall be pinned to the manhole with steel pins to prevent differential settlement.

14.2.19.14.3.17. Install #10 copper wire in all unused duct cells for future use.
14.2.20.14.3.18. Duct bank penetrations of foundation wall shall comply with the following:

14.2.20.14.3.18.1. Concrete encased duct banks shall terminate at the exterior surface of the foundation wall. The conduit shall make individual penetrations of the foundation wall.

14.2.20.24.3.18.1. Duct banks shall be attached to the foundation wall in one (1) of two (2) manners.

14.2.20.24.3.18.2.1. 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.

14.2.20.24.3.18.2.2. In existing construction, drill and extend reinforcing using Hilti epoxy capsules.

14.2.21.14.3.19. The conduit shall penetrate the foundation wall in the following manner:


14.2.21.24.3.19.2. In existing construction, core drill. Sufficient space shall remain between the penetrations to maintain the structural integrity of the foundation wall.

14.2.21.34.3.19.3. Size sleeve or core opening per seal manufacturer’s recommendations.

14.2.21.44.3.19.4. Provide Link-Seal near the interior surface of the foundation wall. Provide waterproofing installed on the exterior side of the rubber seal. Grouting is prohibited.

15. COMMUNICATIONS DISTRIBUTION

15.1. General

15.1.1. Number and type of fiber shall be specified by ITS EI - Physical Infrastructure.

15.1.2. Fiber shall be installed in inner-duct within conduits.

15.1.3. Multiple fibers shall be pulled in the same inner-duct whenever possible.

15.1.4. Fiber shall be installed in one (1) continuous piece, unless prior approval is given by ITS EI - Physical Infrastructure.

15.1.5. 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.

15.2. Testing:

15.2.1. Test all underground pathways by drawing an appropriately sized mandrel through each duct to assure the integrity. Testing to be witnessed by Owner.

15.2.15.3. Underground Pathways:
15.2.1.15.3.1. All exterior underground conduits used for communications applications shall be 4 inch NEMA TC-6 type EB PVC plastic duct encased in concrete.

15.2.2.15.3.2. Install a minimum of six (6) 4 inch ducts between manholes and a minimum of three (3) 4 inch ducts into a building.

15.2.3.15.3.3. Encase all conduits in a 3 inch concrete envelope.

15.2.4.15.3.4. Install conduit 30 inches (minimum) below grade to the top of the structure. Install conduit 36 inches (minimum) below grade under roadways.

15.2.5.15.3.5. Concrete encasement shall contain ½ inch deformed steel reinforcing bars.

15.2.6.15.3.6. Changes in direction, either vertical or horizontal, shall be accomplished with bends of the appropriate angle (90, 45, 22 ½ or 11-degrees) to provide a smooth transition and mild pulling radius. The aggregate total of bends between structures (i.e., manhole to manhole, manhole to pole, building or pad) shall not exceed 180-degrees. All bends shall have a minimum radius of 60 inches.

15.2.7.15.3.7. Conduit joints shall be solvent-weld per manufacturer’s recommendations. Joints shall be staggered.

15.2.8.15.3.8. Conduits shall be spaced 2 inches apart both vertically and horizontally.

15.2.9.1.15.4.1. Test all conduits by drawing an appropriately sized mandrel through each duct to assure the integrity. Testing to be witnessed by Owner.

15.2.10.15.3.9. A pull-line, with a minimum tensile strength of 1200 to 1800 pounds and composed of a non-degradable material, shall be placed in all conduits.

15.4. Building Entrance Pathway:

15.4.1.15.4.1. Conduit from a manhole to a building shall consist of a one-by-three, flat configuration of three (3) 4-inch PVC conduits encased in concrete.

15.4.2.15.4.2. 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. Conduit to transition to a full 10 foot section of RGS at penetration to prevent shear.

15.4.3.15.4.3. The 4 inch conduits shall terminate inside the room equipped with bell-end fitting.

15.4.4.15.4.4. The 4 inch conduit entering the building beyond the point of penetration shall be installed in compliance with the National Electrical Code (NEC).

15.4.5.15.4.5. All conduits shall be sealed with rubber conduit plugs, Jackmoon U.S.A. Inc., part number S0D35SU, Carlon Telecom Systems, part number MAEPG8, General Machine Products Co. Inc., part number 66638.

15.5. Communication Manholes:

15.5.1. Precast Manholes:
15.4.1.1.15.5.1.1 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. Local conditions may dictate a different size or configuration for manhole, in which case it shall be approved by ITS EI - Physical Infrastructure.

15.4.1.2.15.5.1.2 Manholes shall be set with a minimum 2-foot of cover to top of concrete roof and, where possible, placed off of roadways in grass plots, medial strips or lawn areas.

15.4.2.15.5.2 Cast-in-place Manholes:

15.4.2.1.15.5.2.1 All cast in place manholes shall meet the American Association of State Highway and Transportation Officials (AASHTO) specifications.

15.4.2.2.15.5.2.2 All conduits entering or exiting manholes shall be placed the same elevation to permit pull-through cable placement.

15.4.2.3.15.5.2.3 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.

15.4.2.4.15.5.2.4 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.

15.4.3.15.5.3 Communication Manhole Equipment:

15.4.3.1.15.5.3.1 All manholes shall be equipped with 30-inch cast iron frames and covers. The castings shall be set in concrete collars parged to seal. Manholes shall be racked with all galvanized hardware.

15.4.3.2.15.5.3.2 Cast-in-place and nonstandard manholes shall have inserts cast in the walls.

15.4.3.3.15.5.3.3 Provide pulling in irons cast in the walls directly opposite the various duct entrances.

15.4.4.15.5.4 Frame and Cover Adjustments:

15.4.4.1.15.5.4.1 Provide extension rings to extend manhole openings to grade. Rings shall be ordered to fit the appropriate diameter (36-inch, 30-inch or 27-inch) and the appropriate rise required (1 ½-inch, 2-inch or 3-inch).

15.4.4.2.15.5.4.2 An epoxy-based cement be used on the contact surfaces of the extension ring. ITS EI - Physical Infrastructure shall determine the use of utilizing extension rings or requiring resetting of the frame.

15.5.15.6 Termination, Splicing and Testing:

15.5.1.15.6.1 Fiber shall be terminated in a Corning Closet Connector Housing (CCH) at each end to facilitate cross-connections.

15.5.2.15.6.2 Fiber shall be terminated with the following type connectors:

15.5.2.1.15.6.2.1 Corning CCH Pigtail Cassette CCH-CS12-59-POORE.
15.5.2.2 Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-59-POORE cassette loaded with SC connectors.

15.5.2.2.1 Contractor shall provide Owner with the following documentation:

15.5.3.1 OTDR trace from each end at 850 nm or 1300 nm 1310 nm 1550 nm.

15.5.3.2 Power meter loss measurements in both directions at a wavelength of 850 nm or 1300 nm 1310nm 1550 nm.

15.5.3.3 A printed copy of all fiber cable test results.

III. ARCHITECTURAL

The following information is provided as a general guideline in establishing Architectural project specific requirements.

1. GENERAL

1.1. Building Elevations:

1.1.1. Refer to Section III for information.

1.2. Standard Floor and Room Numbering:

1.2.1. Refer to Section III for information.

2. BUILDING ENVELOPE

2.1. General

2.1.1. Exterior Wall Insulation may be:

2.1.1.1. Semi rigid, blanket batt type, glass fiber, unfaced, complying with ASTM C665 and the following:

a. Shall have ASTM E84 values:

2.1.1.2.1 of flame spread less than 25.

2.1.1.2.1.3 Smoke development and fuel contributed less than 50.

2.1.2. Use closed cell extruded polystyrene insulation below grade on exterior walls or insulate on the interior face.

2.1.3. All foundation walls with accessible or occupied space on one (1) side and soil on the other shall be waterproofed below grade.

2.1.4. Drain tiles are to be installed at footings and tied to storm sewer system as allowed by local municipalities.

2.1.5. Down spouts shall be tied into storm sewers (in lieu of foundation drain tiles) and shall not discharge on grade.
2.1.6. Crawl spaces shall have concrete floor slabs, floor drains, ventilation and lighting.

2.2. Exterior Building Materials:

2.2.1. Refer to Section III for information.

2.3. Exterior Enclosure Performance Requirements:

2.3.1. Refer to Section III for information.

3. ROOFING

3.1. General

3.1.1. A Sheet Metal Contractor 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.

3.1.2. 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.

3.1.3. Abandoned or unused equipment and materials shall be removed on re-roofing projects. Verify specifics with Owner.

3.1.4. Approved manufacturers as follows:

3.1.4.1. EPDM – Black Membrane:

3.1.4.1.1. Carlisle Corporation

3.1.4.1.2. Firestone Building Products Company

3.1.4.2. PVC – White Membrane:

3.1.4.2.1. Sarnafil Corporation

3.1.4.3. KEE – White Membrane:

3.1.4.3.1. Seaman Corporation

3.1.4.4. Metal Roofing Systems:

3.1.4.4.1. ATAS Aluminum Corporation - Monarch

3.1.4.4.2. Butler Manufacturing Company - VSR

3.1.4.4.3. Centria - SRS

3.1.4.4.4. MBCI - LokSeam

3.1.4.4.5. Steelox Systems, Inc. - CF/SD

3.1.4.4.6. Vincent Metals - System 1
3.1.5. Roof Installation:

3.1.5.1. Roofing Contractor shall have the following qualifications:

3.1.5.1.1. A minimum of five (5) years of experience in installation of the specified roofing system.

3.1.5.1.2. Roof Manufacturer Certification as installer for specified roofing systems.

3.1.5.1.3. Roof Foreman and 50 percent of installing crew are trained and certified in the installation of specified roofing system.

3.1.5.1.4. Foreman shall be full-time, at project site, through roof completion.

3.1.6. Roof Warranties and Certification:

3.1.6.1. Roof Manufacturer and roof installer shall provide the following items:

3.1.6.1.1. Roofing Manufacturer shall 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. The system may include the following components:

3.1.6.1.1.1. Roofing membrane (built-up felts or single-ply), slate, shingles, or metal roofs

3.1.6.1.1.2. Flashing and counter-flashing

3.1.6.1.1.3. Insulation

3.1.6.1.1.4. Vapor barrier

3.1.6.1.1.5. Fasteners and adhesives

3.1.6.1.1.6. Sealants and caulking

3.1.6.1.1.7. Ballast and ballast stops

3.1.6.1.1.8. Walkway mats and pavers

3.1.6.1.1.9. Roof hatches, pitch pans and equipment curbs

3.1.6.1.1.10. Gutters, downspouts, and fascia panels

3.1.6.1.1.11. Roofing accessories, as required, making a complete roofing system

3.1.6.1.1.12. Coping

3.1.6.1.2. Warranted roof system components shall be identified in the Construction Documents. Roof materials and accessories shall be part of the approved system.
3.1.6.2. 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.

3.1.6.3. Warranty shall run concurrently with the roofing installer warranty.

3.1.6.4. Warranty shall cover labor and materials for the complete roofing system.

3.1.6.5. Manufacturer shall be liable for full replacement cost of the roof system, warranty shall have no-dollar limit. Contractor shall provide the Owner with Roof Warranty.

3.1.6.6. Warranty shall not exclude coverage as a result of winds less than the velocity coordinated with the Owner.

3.2. Roofing Systems:

3.2.1. Green Roof Systems:

3.2.1.1. Basis of Design shall be LiveRoof LLC.

3.2.1.2. Systems shall have irrigation water sources spaced no more than 100 feet apart.

3.2.2. Metal Roofing-Structural Standing Seam (SSR):

3.2.2.1. Roofing shall be pre-engineered metal running perpendicular to purlins supports. Provide glass batt insulation directly beneath the roofing and over the purlins.

3.2.2.2. Sheets shall have a steel or aluminum core, minimum 22-gauge, and corrosion protection provided by a Kynar-coated finish.

3.2.2.3. Ice guards are required on eaves over sidewalks.

3.2.3. Slate:

3.2.3.1. Use copper nails and ridge caps.

3.2.3.2. Ice guards are required on eaves over sidewalks.

3.2.4. Asphalt Shingles:

3.2.4.1. Provide a pre-finished metal sheet steel drip edge at eaves and gable rakes.

3.2.4.2. Shingles shall be nailed, not stapled.

3.3. Roofing Components:

3.3.1. Roof Membrane and Insulation Assemblies:

3.3.1.1. SBS Type Modified Bitumen Sheet System:
3.3.1.1.1. Membranes to consist of a base sheet, interply sheet and cap sheet of SBS type sheets bonded with cold-process adhesive.

3.3.1.1.2. Fire-rated sheet may be necessary to meet Class A requirements.

3.3.1.1.3. Polyester or fiberglass reinforcement is allowable, per manufacturer’s roof systems.

3.3.1.1.4. Standard test methods for sampling and testing Modified Bitumen material shall comply with ASTM D-5147, D-6162, D-6163, and D-6164.

3.3.1.1.5. 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.

3.3.1.1.6. The specified Insulation shall be compatible with the system and shall be included in the total system warranty.

3.3.1.1.7. It is required that insulation be installed in more than one (1) layer with staggered joints. Use of a recovery board is not considered a layer.

3.3.1.1.8. Substrate Board:

3.3.1.1.8.1. 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.

3.3.1.1.8.2. Substrate board shall be installed with staggered joints.

3.3.1.1.9. Surfacing shall be white, ceramic granule surfaced cap sheet.

3.3.1.1.10. Base Flashings:

3.3.1.1.10.1. SBS-type with polyester reinforcement only.

3.3.1.1.10.2. APP-type at non-nailable substrates shall not be used.

3.3.1.1.10.3. SBS-type with granule surfacing and polyester reinforcement as walkways.

3.3.1.1.11. Membrane shall be anchored with non-ferrous termination bars and stainless steel fasteners at wall and deck transition. Termination bars shall be covered with a reglet and counter-flashing.

3.3.1.2. EPDM (non-reinforced) - Fully Adhered:

3.3.1.2.1. Membrane:

3.3.1.2.1.1. Minimum 60 mil thick EPDM non-reinforced sheet.

3.3.1.2.1.2. Seam products shall be pre-manufactured as supplied and approved by manufacturer. Minimum field seam width shall be 5 ½ inches.
3.3.1.2.2. Insulation shall be selected per current ASHRAE 90.1 guidelines, and included in the total system warranty.

3.3.1.2.3. Polyisocyanurate shall have facers designed for EPDM adhesion and shall be approved or manufactured by primary membrane manufacturer.

3.3.1.2.4. Mechanical insulation fasteners, with locking caps, shall be used metal and wood decks.

3.3.1.2.5. Adhere with polyurethane adhesive over concrete substrate and vapor barriers.

3.3.1.2.6. 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.

3.3.1.2.7. Install insulation in more than one (1) layer with staggered joints. Use of a recovery board is not considered a layer.

3.3.1.2.8. Surfacing shall not be required. Use fire rated Class-A system for exterior fire resistance.

3.3.1.2.9. Base Flashings shall be 60 mil EPDM.

   3.3.1.2.9.1. Continue field membrane up walls and curbs using non-penetrating attachment methods.

   3.3.1.2.9.2. Use details that minimize uncured rubber.

   3.3.1.2.9.3. Termination bars shall be covered with a reglet and counter flashing.

3.3.1.2.10. Substrate Board shall be ½ inch thick siliconized gypsum core panel.

3.3.1.3. PVC (reinforced) - Fully Adhered:

   3.3.1.3.1. Membrane shall be minimum 60 mil thick fabric reinforced sheet with heat weld seaming.

   3.3.1.3.2. Insulation shall be selected per current ASHRAE 90.1 guidelines, and included in the total system warranty.

   3.3.1.3.3. 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.

   3.3.1.3.4. Install insulation in more than one (1) layer with staggered joints. Use of a recovery board is not considered a layer.

   3.3.1.3.5. Substrate Board shall be ½ inch thick siliconized gypsum core panel.

   3.3.1.3.6. Surfacing shall not be required.
3.3.1.3.7. Base Flashings shall be membrane coated metal or reinforced sheet and accessories provided by primary manufacturer.

3.3.1.3.8. 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 counter-flashing.

3.3.2. Roof Deck:
3.3.2.1. Roof deck material shall be a minimum 20-gauge metal deck or a cast in place concrete deck.
3.3.2.2. Lightweight concrete shall not be used.
3.3.2.3. All wood curbs, blocking, subfascias, etc. shall be preservative-treated material.

3.3.3. Vapor Retarders:
3.3.3.1. Refer to Section III for information.

3.4. Accessories:
3.4.1. Parapet wall coping shall be constructed with metal selected from one (1) of the following materials:
3.4.1.1. Sheet metal, 22-or 24-gauge, galvanized, factory finished with Kynar 500.
3.4.1.2. Copper, ASTM B370, 16 to 20 ounces.
3.4.1.3. Aluminum, .032 inch or .040 inch, factory finished with Kynar 500.
3.4.1.4. Stainless steel, .018 soft buff.
3.4.2. Gravel stop and fascia shall be 22-or 24-gauge, galvanized, factory finished with Kynar 500.
3.4.3. 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.
3.4.4. Sheet metal roof accessories shall be constructed with metal selected from one (1) of the following materials:
3.4.4.1. Sheet metal, 20-gauge, galvanized, factory finished with Kynar 500.
3.4.4.2. Copper, ASTM B370, 16 to 20 ounce.
3.4.4.3. Aluminum, ASTM B209, alloy 3003, AA-C22A41 clear anodized finish, minimum 20-gauge.
3.4.4.4. Solder, 50/50 ASTM B32.

4. DOORS AND WINDOWS
4.1. Doors:
4.1.1. General

4.1.1.1. Only door and frame types and manufactures listed in this section shall be used.

4.1.1.2. Doors and hardware shall be installed by the supplier furnishing the doors and frames.

4.1.1.3. Supplier shall have been in business at least five (5) years specializing in sales and installation of Contract Grade doors and hardware.

4.1.1.4. On-site supervising installer shall have at least five (5) years of experience installing doors and hardware.

4.1.1.5. One (1) additional member of the supplier’s installation crew shall have at least two (2) years of door and hardware installation experience.

4.1.1.6. Installer to follow Manufacturer instructions for templating and installation.

4.1.1.7. Pairs of exterior doors requiring exit devices shall have a Von Duprin keyed removable center mullion.

4.1.1.8. 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.

4.1.2. Hollow-Metal Frames:

4.1.2.1. All wood and hollow-metal doors shall be installed in hollow-metal frames.

4.1.2.2. All Hollow-metal frames in new construction shall be welded, ground and finished smooth.

4.1.2.3. Frames shall be reinforced with 12-gauge steel for all surface mounted hardware.

4.1.2.4. Grouted and Exterior door frames shall be A60 galvannealed and primed. Frames shall be factory-prime painted per ANSI/SDI A250.10-1998 (R2011).

4.1.2.5. Frames and anchors in interior, wash-down spaces shall be 316, #4 finish stainless steel.

4.1.2.6. Frames in masonry walls shall be grouted as the masonry units are laid. Use mortar, maximum 4 inch slump, hand trowel method.

4.1.2.7. Grouted frames shall be A60 galvannealed.

4.1.2.8. Install polystyrene rigid insulation fillers, cut to profile, to keep grout out of bottom 6 inches of frame.

4.1.2.9. Frames shall be braced at bottom and mid-point prior to grouting or installation of wall board.

4.1.2.10. Frames in stud walls shall be filled with fiberglass insulation.

4.1.2.11. Materials and installation shall comply with Steel Door Institute standards ANSI/SDI-100 A250.8-2003.
4.1.2.12. Exterior frames shall be 12-gauge. Interior high-frequency frames shall be 14-gauge. Interior, low-frequency frames shall be 16-gauge. Prior approval from Owner is required to designate low-frequency frames.

4.1.2.13. Shop or field applied prime and/or paint to match color of factory applied prime and/or paint.

4.1.3. Hollow-Metal Doors:

4.1.3.1. All doors shall be 1 ¾ inch thick.

4.1.3.2. Hollow-metal doors shall have steel stiffened cores. Steel ribs shall be 22-gauge, welded at both ends.

4.1.3.3. Exterior doors and doors in high moisture interior spaces shall be A60 galvannealed.

4.1.3.4. Doors in interior wash down spaces shall be A60 galvannealed or stainless steel.

4.1.3.5. 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.

4.1.3.6. Full lite doors shall have tubular stile and rail construction. Exterior door faces shall be 14-gauge steel and meet Level 4/Model 2 standards.

4.1.3.7. Interior door faces shall be 16-gauge steel and meet Level 3/Model 2 standards.

4.1.3.8. Doors shall be reinforced with 14-gauge steel for surface-mounted hardware.

4.1.3.9. All door seams shall 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 stiles.

4.1.3.10. Materials, storage and installation shall comply with current Steel Door Institute standards ANSI/SDI-100 A250.8-2003.

4.1.3.11. Doors shall be factory prime painted per current ANSI/SDI A250.10-1998.

4.1.3.12. Doors shall be Curries 747T or Steelcraft BW.

4.1.3.13. Shop or field applied prime and/or paint to match color of factory applied prime and/or paint.

4.1.4. Wood Doors:

4.1.4.1. Exterior wood doors are not allowed.

4.1.4.2. Wood doors shall be 5-ply solid-core and comply with WDMA IS 1A-11 Window and Door Manufacturers Association standards.

4.1.4.3. Performance standard to meet WDMA IS 1A-11, Extra Heavy Duty.

4.1.4.4. Aesthetic grade to meet WDMA IS 1A-11, Custom Grade.
4.1.4.5. Face veneers shall be A-grade, plane sliced, book and running matched. Allowable veneer species are red oak, select white birch, select white maple and cherry.

4.1.4.6. Doors shall be factory prefinished, System TR-6, per WDMA IS.1A-11. Finish shall be factory standard colors.

4.1.4.7. All doors shall be factory pre-machined for all mortise hardware, including face holes and race ways, as required for specified hardware.

4.1.4.8. Crossbands shall be wood-based composites, minimum thickness of 1/16 inch and extend the full width of the door.

4.1.4.9. Crossbands and face veneers shall be laminated to the core with Type 2 interior-use glue using the Hot Press process.

4.1.4.10. Non Fire-Rated:

4.1.4.10.1. Non fire-rated wood doors shall be Custom Grade and constructed using WDMA 5-ply hot press method for laminating door materials.

4.1.4.10.2. Core-type shall be Structural Composite Lumber Core (SCLC-5).

4.1.4.10.3. Stiles and rails shall be securely bonded to the core and then abrasively planed prior to veneering.

4.1.4.10.4. Stiles shall be hardwood, one (1) piece, laminated or veneered.

4.1.4.10.5. 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).

4.1.4.10.6. Constructions with laminated edges may use structural composite lumber, as an inner stile component.

4.1.4.11. Fire-Rated:

4.1.4.11.1. Fire-rated wood doors shall be WDMA 5-ply construction, using Hot Press method for laminating door materials.

4.1.4.11.2. 20 minute and 45 minute rated doors shall be Structural Composite Lumber Core (SCLC-5). 60 minute to 90 minute rated doors shall be Mineral Core.

4.1.4.11.3. Stiles shall consist of manufacturer’s standard laminated edge construction with improved screw-holding capability and split resistance.

4.1.4.11.4. Inner and outer stiles shall not contain salt treating.

4.1.4.11.5. Rails shall be solid wood or other material contained in manufacturer’s fire door approvals.

4.1.4.11.6. For mineral core doors, top rails shall be minimum 5 inch, bottom rails shall be minimum 5 ½ inch bottom. Minimum lock block size shall be 4 ½ inches by 10 inches.
4.1.4.11.7. Doors with exit devices shall also have hinge-edge blocking and top and bottom latch blocking to match specified exit devices.

4.1.4.11.8. Fire ratings shall comply with positive pressure requirements UL 10C/UBC7-2-97, with concealed intumescent.

4.1.5. Aluminum and Glass Storefront Doors and Framing:

4.1.5.1. Kawneer 500 Tuffline doors shall be used as the basis of design. Kawneer 560 Insulclad framing shall be used as the basis of design.

4.1.5.2. 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.

4.1.5.3. Frame walls and door extrusions to be 3/16 inch thick.

4.1.5.4. Top and bottom of rails shall be welded to stiles. All welds shall be concealed.

4.1.5.5. Exterior doors shall have a sealed, flush top cap and weather-stripping.

4.1.5.6. Exterior doors shall not have thermal break construction.

4.1.5.7. Exterior aluminum storefront framing shall have thermal break construction.

4.1.5.8. Storefronts shall comply with American Architectural Metal Association (AAMA) standards.

4.1.6. Rolling fire doors and fire shutters activated by fusible link, local smoke/fire detector or central smoke/fire alarm system.

4.1.6.1. Rolling fire doors shall only be permitted to avoid atriums.

4.1.6.2. Doors shall automatically release only when activated by an alarm signal.

4.1.6.3. Doors shall maintain an average closing speed not to exceed 9 inches (229 mm) per second during closing.

4.1.6.4. Manual push buttons shall be inoperable when automatic closure is activated.

4.1.6.5. Doors shall be connected to emergency power.

4.1.6.6. Doors shall have motor operated reset.

4.2. Hardware:

4.2.1. General

4.2.1.1. Only Hardware Types and Manufactures listed in this section shall be used.

4.2.1.2. Doors and hardware shall be installed by the supplier furnishing the doors and frames.

4.2.1.3. Supplier shall have been in business at least five (5) years specializing in sales and installation of Contract Grade doors and hardware.
4.2.1.4. On-site supervising installer shall have at least five (5) years of experience installing doors and hardware.

4.2.1.5. One (1) additional member of the supplier’s installation crew shall have at least two (2) years of door and hardware installation experience.

4.2.1.6. Installer to follow Manufacturer instructions for templating and installation.

4.2.1.7. Installer, supplier, Contractor, Design Professional and Owner shall convene for a pre-installation meeting prior to installation of doors and hardware.

4.2.2. Submittals and Shop Drawings:

4.2.2.1. Hardware schedule submittals shall be in vertical format.

4.2.2.2. All openings with electrified hardware shall include a function narrative.

4.2.2.3. Submittal shall include a Project Keying Schedule as indicated below. Submit electronic file in Microsoft Excel.

<table>
<thead>
<tr>
<th>Door No.</th>
<th>Lock Function</th>
<th>Room Number</th>
<th>Room Description</th>
<th>Hardware Set No.</th>
<th>By Contractor</th>
<th>By Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>L001</td>
<td>CR x xCN8805FL x 626</td>
<td>L001A</td>
<td>Chemical Storage</td>
<td>3A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.3. Exit only doors shall have hardware on the egress side only.

4.2.4. Panic devices on doors with access controls shall utilize electronic trim.

4.2.5. Doors with power operators shall have electronic latch retraction and electrified trim.

4.2.6. Exterior trim shall be fail secure.

4.2.7. Electronic strikes shall not be used.

4.2.8. Hardware finish shall be either US32D (BHMA 630) or US26D (BHMA 626 or 652).

4.2.9. Hinges:

4.2.9.1. Manufacturers shall be Stanley or McKinney.

4.2.9.2. All hinges shall be concealed ball bearing.

4.2.9.3. Exterior door hinges shall be heavy weight, 5 inches by 4 ⅜ inches by 0.190 inches. Interior door hinges shall be 4 ½ inches by 4 ⅜ inches. Medium and high frequency interior doors shall be heavy weight, .180 metal thickness. Low frequency doors to have standard weight, .134 metal thickness.
4.2.9.4. 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.

4.2.9.5. All doors 3 foot 6 inches wide or wider shall be hung with four (4) hinges.

4.2.9.6. Hinges in stainless steel frames shall be stainless steel.

4.2.9.7. All exterior door hinges shall be stainless steel.

4.2.9.8. All hinges in moist and corrosive environment areas to be stainless steel.

4.2.9.9. All exit only or lockable out-swinging doors shall have non-removable pins.

4.2.10. Locksets and Latchsets:

4.2.10.1. Locksets and latchsets shall be mortise type.

4.2.10.2. Approved manufacturers for new buildings are Yale 8800 CRCN, Sargent 8200 LW1J, or Schlage L series 03N.

4.2.10.3. Refer to LOCKSET TYPES BY BUILDING DETAILS in Appendices for manufacturer and models to match existing buildings.

4.2.10.4. Electronic locksets shall have request to exit and latch bolt monitoring switches.

4.2.10.5. Electromagnetic locks are not allowed.

4.2.11. Cylinders and Keying:

4.2.11.1. Construction keying and cylinders shall be provided and installed by the Contractor. Two (2) construction and control keys shall be provided to Key & Access Services.

4.2.11.2. All permanent cores shall be provided by the Contractor. Keying and installation of the permanent cores and cylinders shall be provided by the Owner. Cutting of all final keys shall be by Owner.

4.2.11.3. Contractor shall provide ten (10) key blanks for each cylinder keyed to building user key system. Furnish one key blank for each cylinder on access controlled doors and Facilities Management doors.

4.2.11.4. Key system for new buildings shall be Schlage Small Format Interchangeable Core, B or R Series restricted keyway.

4.2.11.5. Key systems for existing buildings shall be verified with Owner.

4.2.11.6. Lock cylinders used in ITS telecommunication rooms, Facilities Management electrical, mechanical, elevator, and custodial rooms and doors receiving access control hardware shall accept Schlage small format interchangeable core.

4.2.11.7. Electronic mortise locks and panic devices shall have a keyed cylinder and be fail-secure on all exterior doors.
4.2.11.8. 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.

4.2.12. Exit Devices:

4.2.12.1. Exit devices shall be Von Duprin 98 series.

4.2.12.2. 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.

4.2.12.3. In multiple-door entries, only one (1) doorway shall be keyed from the exterior.

4.2.12.4. Provide cylinder dogging on all non-rated devices except exit only doors.

4.2.12.5. 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.

4.2.12.6. Electronic Non-Rated Exit Devices:

4.2.12.6.1. Exit devices with latch retraction hall have special center case “SD” dogging.

4.2.12.6.2. Exit devices with electric trim shall have cylinder dogging.

4.2.12.6.3. Entrance doors requiring a power operator, exit device, and access control shall use Von Duprin LX-RX-LC-SD-EL x XP98L-E996L-03 (FSE) exit device.

4.2.13. Pulls and Push Plates:

4.2.13.1. Pulls shall be straight with no offset, 1 ¾ inch diameter, 2 ½ inch clearance between back of pull and face of door, fastened with 3/8 inch diameter through bolts. Rockwood RM301 shall be basis of design.

4.2.13.2. Provide pull backup plates at all push/pull doors, except stainless steel or aluminum. Backup plate shall be minimum 4 inches by minimum 16 inches, 0.050 stainless steel.

4.2.13.3. Push plates shall be minimum 6 inches by minimum 24 inches, 0.050 stainless steel.

4.2.14. Flushbolts:

4.2.14.1. Flushbolts shall be Ives FB51T, constant latching, top bolt only.

4.2.14.2. Where required by code, provide Ives FB31T or FB32 automatic on metal doors or Rockwood 1960 on wood doors, less fired bolt on non-rated wood doors.

4.2.15. Door Closers:

4.2.15.1. Door closers shall be LCN 4040XP.

4.2.15.2. Classrooms or auditoriums with occupancy of 50 or more shall require LCN 4410HSA, electric, motion sensor hold open closers.

4.2.15.3. All closure covers shall be plastic.
4.2.15.4. All labeled doors with LCN 4410HSA closers shall be connected to the building fire alarm system.

4.2.15.5. Closures shall be mounted on side of door for least visibility, unless required for maximum door swing or to protect closure from the environment, moisture, or carts.

4.2.15.6. Closers in moist and corrosive environment areas to have SRI primer.

4.2.15.7. All door closers shall be through bolted to door.

4.2.15.8. Adjust all closures at installation. After all mechanical systems are operating, field readjust as required.

4.2.15.9. Supplier shall furnish all drop plates and mounting brackets as required for proper installation.

4.2.16. Power Operators:

4.2.16.1. Power operators shall be Record 8100 series.

4.2.16.2. Actuators shall be Essex Electronics PHSS1-US. Exterior actuators shall have illuminated spy housing Essex Electronics SH-345I-12 with PS-12DC power supply.

4.2.16.3. Actuators shall be located 36 inches AFF.

4.2.16.4. Actuator to be located a minimum of 36 inches from the leading edge of the door, in the open position.

4.2.16.5. Automatic operators on exterior doors and their corresponding vestibule door shall be wired for sequential operation.

4.2.16.6. All on/off and hold-open switches shall be concealed.

4.2.16.7. All door operator arms shall be through bolted to door.

4.2.16.8. Adjust all operators at installation. After all mechanical systems are operating, field readjust as required.

4.2.16.9. Supplier shall furnish all drop plates and mounting brackets as required for proper installation.

4.2.17. Coordinators:

4.2.17.1. Coordinators shall be Trimco 3092 or Rockwood 1700.

4.2.18. Protection Plates:

4.2.18.1. Bottom of protection plates shall be mounted ¼ inch from the bottom of the door.

4.2.18.2. Protection plate height shall be minimum 10 inches high by door width, less 1 ½ inch, centered horizontally on door, 0.050 stainless steel.
4.2.18.3. Custodial rooms 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.

4.2.18.4. Protection plates shall be fastened with countersunk, oval head, under cut screws.

4.2.18.5. All four edges shall be beveled.

4.2.18.6. Where subject to cart damage Provide Rockwood R115LPB protection bars for lever handles and Rockwood HD2230 protection bars for exit devices.

4.2.19. Door Stops and Holders:

4.2.19.1. Wall bumpers shall be Rockwood 400 or Ives WS402CVZX, cast brass or bronze housing. All wall bumpers in stud walls shall have backing.

4.2.19.2. Overhead door stops shall only be used with prior approval from Owner. Overhead door stops shall be Glynn-Johnson 90 series, manual.

4.2.19.3. Overhead stops/holders shall be surface-mounted.

4.2.19.4. All exterior doors that have overhead stops shall have floor stops. Floor stops shall be Rockwood 466 or 467 or Ives FS18S and FS18L.

4.2.19.5. Floor stops shall not be used on interior doors.

4.2.20. Weather-Strip:

4.2.20.1. Weather-strip shall be Reese 769C with TEK screws and polyurethane rubber.

4.2.20.2. Install a screw maximum 1 inch from ends of weather strip.

4.2.20.3. Weather strip piece at hinge jamb shall be installed on face of door to compress against stop.

4.2.21. Sweeps:

4.2.21.1. Sweeps shall be Reese 772C with TEK screws and polyurethane rubber.

4.2.21.2. Install a screw maximum 1 inch from ends of sweep.

4.2.22. Gasketing:

4.2.22.1. Gasketing shall be Reese 797, white or black to match color of frame.

4.2.23. Thresholds:

4.2.23.1. Unless prohibited by sill condition, thresholds shall be Reese S471A with thermal break.

4.2.23.2. Furnish threshold 4 inches longer than door opening and cope around frame face.

4.2.24. Power Transfers:

4.2.24.1. Power transfers shall be Securitron CEPT-10.
4.2.24.2. Electric hinges may only be used with existing frames or 1 inch face jambs.

4.2.24.3. Power transfers and electric hinges shall have two (2) 18-gauge wires and six (6) or eight (8) 22- or 28-gauge wires.

4.2.25. Electronic Hold Opens:

4.2.25.1. Magnetic hold opens shall be LCN 7800 series, 24 volt, wall-mounted. Housings shall be metal. Floor mounted magnetic closure shall only be used with prior approval from Owner.

4.2.25.2. Electronic hold open/closures shall be LCN 4040SE 24 volt, Sentronic. Electronic hold open/closures shall only be used when magnetic hold opens are not feasible.

4.2.26. Power Supplies:

4.2.26.1. Power supply shall be Von Duprin PS914 900-2RS 900-BBK.

4.2.26.2. 900 KL key-lock shall be used for installations in public areas.

4.2.26.3. Power supplies for electronic latch retraction panic devices shall have battery backup and be supplied by the door hardware provider.

4.2.26.4. Power supplies for electric trim, electric locks, and electric strikes shall be provided by the Access Control Contractor.

4.3. Windows:

4.3.1. All operating mechanisms shall be heavy-duty and institutional-grade.

4.3.2. Window units shall comply with ASTM E283, E331, and E547.

4.3.3. Owner shall retain a Testing Firm to perform tests on randomly chosen installed window units. Contractor shall be responsible for retesting units that have failed.

4.4. Glass and Glazing:

4.4.1. Glazing in new windows, doors, storefronts, etc. shall carry a ten (10) year manufacturer’s warranty.

4.5. Joint Sealants:

4.5.1. All Exterior sealants require the use of a sealant primer.

4.5.2. Multi-part pourable urethane Neutral Cure Silicone or Polyether sealant shall be used in the following:

4.5.2.1. Exterior and interior joints in horizontal concrete surfaces.

4.5.2.2. Between metal and concrete, mortar, stone or masonry.

4.5.3. One-Part mildew-resistant silicone shall be used at interior joints in vertical surfaces of toilet room, shower, and kitchen ceramic tile.
4.5.4. 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.

5. FINISHES

5.1. Wall Systems:

5.1.1. Use 5/8 inch Type X fire code drywall construction

5.1.2. Mold resistant drywall shall be used in intermittently wet areas (restrooms, wash rooms, custodial closets, etc.)

5.1.3. 20-gauge (0.0329 inch) minimum studs shall be used. Specify both gauge and thickness. Wood studs shall not be used.

5.1.4. Four (4) coats (Level IV) 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.

5.1.5. Demountable panel systems require Owner approval.

5.1.6. Wall Finishes:

5.1.6.1. Restroom tile shall be minimum height of 54 inches and extend above top of fixtures.

5.1.6.2. Chair rail height shall be determined by chair selection (when required).

5.2. Ceiling Systems:

5.2.1. Gypsum Board Ceilings:

5.2.1.1. Textured finishes shall not be used on drywall ceilings.

5.2.2. Acoustical Tile Ceilings:

5.2.2.1. 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.

5.2.2.2. Suspend ceiling grid directly from the building structure.

5.2.2.3. Ceiling tile basis of design shall be Armstrong Minaboard, fissured, 2 foot by 4 foot and/or 2 foot by 2 foot.

5.2.2.4. Reveal edge tiles may be used in selected areas with require Owner approval.

5.2.3. Concealed spline or tongue and groove ceiling systems shall not be used.

5.2.4. Means of access shall be maintained to the plenum space and above ceiling devices.

5.3. Paint Finishes:

5.3.1. Wall:
5.3.1.1. Wall finish shall be two (2) coats, plus primer, of latex eggshell or satin paint.

5.3.1.2. Flat paint shall not be used.

5.3.1.3. Semi-gloss paint shall be used in public areas on veneer plaster or concrete masonry units.

5.3.2. Ceiling finish shall be two (2) coats, plus primer, of latex flat paint.

5.3.3. Painted door, window, and miscellaneous trim finish shall be two (2) coats, plus primer, of latex or alkyd enamel semi-gloss paint.

5.3.4. Stained door, window, and miscellaneous wood trim finish shall be high sheen / gloss, oil based with a urethane topcoat.

5.3.5. Epoxy paints shall be 2-part systems.

5.4. Floor Finishes:

5.4.1. Entry Mats:

5.4.1.1. Basis of Design shall be linked tread, 3M Nomad floor mats.

5.4.2. Vinyl composition tile shall be a minimum 1/8 inch thick.

5.4.3. Slip resistant tile shall be used on slopes and inclines.

5.4.4. Epoxy resin floor color shall be integral to flooring material. Surface coloring shall not be used.

5.4.5. Ceramic tile grout shall be pigmented or natural gray. White or near white grout shall not be used. Joints shall be sealed with a silicone based product.

5.4.6. Ceramic tile base/cove shall be curved rather than a 90-degree angle.

5.4.7. Carpet and Base:

5.4.7.1. Submit carpet seaming diagram for Owner approval prior to ordering material.

5.4.7.2. Carpet:

5.4.7.2.1. Fiber: nylon type 6 or 6.6.

5.4.7.2.2. Construction: Tufted loop pile.

5.4.7.2.3. Color: Multi-color yarn system.

5.4.7.2.4. Carpet tile face weight: minimum 16 ounces.

5.4.7.2.5. Broadloom face weight: minimum 22 ounces.

5.4.7.3. Resilient base shall be 1/8 inch thick vinyl or rubber.

5.4.7.4. Base joints shall be at inside corners and no closer than 24 inches to an external corner.
5.4.7.5. Continuous, rolled base shall be used. *4 foot sections shall not be used.*

5.4.7.6. Wood Base shall be hardwood species only.

6. **FURNISHINGS**

6.1. **Window Treatments**

6.1.1. Basis of Design shall be MechoShade.

6.1.2. Exterior shades are not allowed.

7. **INTERIOR SIGNAGE**

7.1. **General**

7.1.1. Modular inserts shall be adhered with tamper-proof fastener system.

7.1.2. **Signage Installation**

7.1.2.1. Verify with Owner prior to specifying mounting systems which will permanently impact architectural finishes.

7.1.2.2. **Wall Mounted Signage**

7.1.2.2.1. Typical wall-mounted sign installation shall be double-sided foam tape and silicone adhesive.

7.1.2.2.2. Signs exceeding the adhesive strength of double-sided foam tape shall have additional threaded studs attached to wall surface.

7.1.2.2.3. Projecting flag identification shall be mechanically fastened to wall.

7.1.2.3. Signs mounted to glass shall have a backer panel of matching size on the second surface of the glass.

7.1.2.4. **Stone Mounted Signage**

7.1.2.4.1. Architectural lettering shall be securely mounted with vandal and tamper resistant method appropriate to wall surface.

7.1.2.4.2. Threaded studs, set in non-shrinking grout, shall be used wherever possible.

7.1.2.4.3. Signs and lettering mounted to limestone or similar natural stone surfaces shall not use silicone adhesive or double-sided tape.

7.1.2.5. **Ceiling Mounted Signage**

7.1.2.5.1. Signs hanging from ceiling or projecting from wall shall be mounted away from sprinklers and shall not obscure site lines to fire exit signage.

7.1.2.5.2. Bottom of sign shall be above door swing.
7.1.2.5.3. Sign shall be attached to structure, fastened to drywall, plaster, or suspended by cable. Cable shall be stainless steel and aircraft quality or equal.

7.1.2.5.4. Signs shall not be attached to suspended ceiling grid systems.

7.1.2.5.4.1. If structure is inaccessible, review alternatives with Owner.

7.1.2.5.4.2. Hole where cable passes through ceiling tile shall match dimension of suspension system.

7.2. Sign Types:

7.2.1. Refer to Section III for information.

8. SPECIALTIES

8.1. Visual Display and Bulletin Boards:

8.1.1. Refer to Section III for information.

8.2. Projection Screens:

8.2.1. Refer to Section III for information.

8.3. Restrooms and Restroom Accessories:

8.3.1. Restrooms:

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

8.3.2. Toilet Partitions:

8.3.2.1. Wall Hung Urinal Screens shall have integral wall-mounting flange or continuous wall-mounting bracket specified as a “Government Screen”.

8.3.2.2. Blocking shall be installed for all wall-mounted partitions.

8.3.2.3. Partitions shall have Trimco 3071-1 x 32D hook with through bolts and security Torx head screws.

(1) Ceiling-supported partitions shall have a flip-over latch for closure.

8.3.3. Restroom Accessories:

8.3.3.1. Owner shall provide one (1) triple-roll Renown toilet tissue dispenser per water closet. Contractor to mount dispenser above the ADA handrail (if present) on the wall adjacent to the latch side of the stall door (if present).

8.3.3.2. Toilet tissue dispenser locking mechanism shall not be blocked by ADA handrails.

8.3.3.3. Provide one (1) through-bolted double-hook inside of each stall door.
8.3.3.4. Owner shall provide Renown foam soap dispensers. **Contractor to wall mount soap dispenser above each lavatory.** Allow enough space to open and fill dispenser.

8.3.3.4.1. **Constructor to wall mount soap dispenser above each lavatory.**

8.3.3.4.1.8.3.3.4.2. **Allow enough space to open and fill dispenser.**

8.3.3.5. Hand Dryers:

8.3.3.5.1. **Constructor to provide one (1) Dyson Airblade electric hand dryer per two (2) lavatories, and a minimum of two (2) dryers for three (3) or more lavatories.**

8.3.3.5.2. Single unit installation height shall be 38 inches AFF to top of unit. For two (2) units, one (1) shall be at 34 inches AFF and the second shall be at 41 inches AFF.

8.3.3.6. Sharps Containers:

8.3.3.6.1. **Owner shall provide one (1) Sharps container for each restroom. Manufacturer shall be Bemis 3 quart translucent beige, number 125 020 with wall-safe bracket and key. Contractor shall mount in an unobstructed area, at 48 inches AFF to container inlet opening.**

8.3.3.6.2. **Constructor shall mount in an unobstructed area, at 48 inches AFF to container inlet opening.**

8.3.3.6.3. Container shall not be mounted above or within 12 inches of landfill or waste receptacles.

8.4. Lactation Rooms:

8.4.1. Soap dispenser and paper towel dispenser shall be wall-mounted next to the sink.

8.4.2. Minimum of three (3) single or two (2) double coat hooks shall be installed on wall.

8.4.3. Mount bulletin board and clock so visible from the seated position.

8.5. Recycling and Landfill (Trash) Receptacles:

8.5.1. Refer to Section III for information.

8.6. Vending Spaces:

8.6.1. Refer to Section III for information.

8.7. Custodial Work Spaces:

8.7.1. Custodial Work Control Center:

8.7.1.1. Light fixture(s) shall have safety guards.

8.7.1.2. Provide smooth floor transition from hall to room.
8.7.2. Supply Storage and Delivery Room:

8.7.2.1. The bottom shelf shall be 2 feet 6 inches AFF. Shelves shall be spaced 1 foot 8 inches apart, running the full length of long wall.

8.7.2.2. Light fixture(s) shall have safety guards.

8.7.2.3. Door shall have closer and armor plate.

8.7.2.4. Provide smooth floor transition from hall to room.

8.7.3. Equipment Storage Room:

8.7.3.1. Chemical dispensing unit shall be hard piped with cold water feed.

8.7.3.2. Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker. Install minimum 6 inches above the expected point of use.

8.7.3.3. Light fixture(s) shall have safety guards.

8.7.3.4. Door shall have closer and armor plate.

8.7.3.5. Provide smooth floor transition from hall to room.

8.7.4. Custodial Service Room:

8.7.4.1. Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker. Install minimum 60 inches AFF.

8.7.4.2. Light fixture(s) shall have safety guards.

8.7.4.3. Door shall have closer and armor plate.

8.7.4.4. Provide smooth floor transition from hall to room.

8.7.5. Heavy Equipment Room:

8.7.5.1. Light fixture(s) shall have safety guards.

8.7.5.2. Door shall have closer and armor plate.

8.7.5.3. Provide smooth floor transition from hall to room.

8.7.6. Light Bulb Storage Room:

8.7.6.1. Door shall have closer and armor plate.

8.7.6.2. Provide smooth floor transition from hall to room.

8.8. Maintenance Rooms:

8.8.1. Building Maintenance Work Control Center:
8.8.1.1. Light fixture(s) shall have safety guards.
8.8.1.2. Provide smooth floor transition from hall to room.

8.8.2. Building Maintenance Shop:
8.8.2.1. Light fixture(s) shall have safety guards.
8.8.2.2. Provide smooth floor transition from hall to room.

8.8.3. Building Maintenance Material / Equipment Storage Room:
8.8.3.1. Light fixture(s) shall have safety guards.
8.8.3.2. Door shall have closer and armor plate.
8.8.3.3. Provide smooth floor transition from hall to room.

8.8.4. All receptacles shall have a dedicated neutral and a dedicated ground.

8.9. Telecommunication Rooms (TR):
8.9.1. Walls shall extend to structure.
8.9.2. Walls and plywood shall be painted extra white, Sherwin Williams B24W02651, minimum two (2) coats.
8.9.3. Overhead structure to be painted Sherwin Williams B24W02651.
8.9.4. Floor finish shall be vinyl composition tile, Armstrong VCT51911 Classic White.
8.9.5. Secure Room door(s) with AMAG access control.
8.9.6. Provide cages on all fire suppression sprinklers.

8.10. Classrooms - General Assignment:
8.10.1. Refer to Section III for information.

8.11. Offices:
8.11.1. Refer to Section III for information.

2. Loading Dock Facilities
8.12. Animal Rooms:
8.11.2.8.12.1 Refer to Section III for information.

3. Animal Rooms
8.11.3.1.1. Refer to Section III for information.

9. CONVEYING SYSTEMS
9.1. General

9.1.1. Refer to Section III for information.

9.2. Elevators:

9.2.1. The Elevator control equipment shall be non-proprietary. Elevator control system shall be provided with all available diagnostic tool functions, either onboard or in a separate device.

9.2.2. Maintenance, adjustment and troubleshooting devices or systems shall be maintainable, repairable, and adjustable by any elevator repair company without the use of proprietary tools, degrading operation, or key shall be accepted.

9.2.3. Ramtel hands-free style. Manufacturer shall make spare parts available for purchase by the Owner’s Elevator Maintenance Constructor.

9.2.4. Manufacturer shall provide technical support to the Owner’s Elevator Maintenance Constructor for installation, adjustment, maintenance or troubleshooting assistance.

9.2.5. Telephone:

9.2.5.1. Provide shielded cabling for telephone model number R733M. Shielded wires for telephone shall be included in the compartment and cabling shall be connected to the car traveling cable.

9.2.5.2. GIA-TRONICS Telephone shall be provided by Owner and installed by Constructor. Constructor to contact Owner for rough-in template.

9.2.6. Elevator cars shall be provided with wall protection pads and installation hooks for these pads.

9.2.7. Contractor shall provide to the Owner the Manufacturer’s:

9.2.7.1. Spare Parts

9.2.7.2. Manuals

9.2.7.3. Safety and Software Upgrades

9.2.7.4. Electronic tools

9.2.7.5. Adjusting Information

9.2.7.6. Wiring Diagrams

9.2.7.7. Full List of Fault Codes with definitions
9.2.3.5-9.2.7.8. Product Data:

9.2.3.5.1-9.2.7.8.1. Signal and operating fixtures, operating panels and indicators.

9.2.3.5.2-9.2.7.8.2. Electrical characteristics and connection requirements.

9.2.3.5.3-9.2.7.8.3. Expected heat dissipation of elevator equipment in machine room.

9.2.4-9.2.8. Submittals and Shop Drawings. Provide the following Submittals:

9.2.4.1-9.2.8.1. Buffers and other components in hoistway.

9.2.4.2-9.2.8.2. Maximum rail bracket spacing.

9.2.4.3-9.2.8.3. Maximum loads imposed on guide rails requiring load transfer to building structure.

9.2.4.4-9.2.8.4. Loads on hoisting beams.

9.2.4.5-9.2.8.5. Clearances and travel of car.

9.2.4.6-9.2.8.6. Clear inside hoistway and pit dimensions.

9.2.4.7-9.2.8.7. Location and sizes of access doors, hoistway entrances and frames.

9.2.4.8-9.2.8.8. Rail attachment.

9.2.4.9-9.2.8.9. Cab design, dimensions and layout.

9.2.4.10-9.2.8.10. Hoistway door and frame details.

9.2.5-9.2.9. Operations and Maintenance Manuals shall include:

9.2.5.1-9.2.9.1. Wiring diagrams

9.2.5.2-9.2.9.2. Adjusting information

9.2.5.3-9.2.9.3. Fault code information

9.2.6-9.2.10. 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.

9.2.7-9.2.11. Maintenance and Repair Service:

9.2.7.1-9.2.11.1. 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.

9.2.7.2-9.2.11.2. Provide 24-hour callback service, including travel time and mileage, during this period at no charge to the Owner.
9.2.7.3. Service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator Contractor Constructor.

9.2.7.4. All parts and supplies shall be same as originally used in manufacture and installation.

9.2.7.5. Emergency Call-Back Response Time:

9.2.7.5.1. Maximum response time for emergency call-backs shall be limited to fifteen (15) minutes by telephone and sixty (60) minutes to arrive on site.

9.2.7.5.2. 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.

9.2.7.6. Elevator Contractor 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.

9.2.7.7. Coordinate removal of elevator from service with Owner.

9.2.8. Elevator shall have an electronic door screen reopening device.


9.2.14. Certificate frames shall be model CF34 Quality Elevator Products with a window dimension of 3-1/2” x 4-3/4”.

9.2.15. Controls shall be vandal proof.

9.2.16. Perform complete elevator performance check, with Owner present, prior to final State Elevator Inspection.

9.2.17. 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.


9.3. Lifts:

9.3.1. Refer to Section III for information.

9.4. Escalators:

9.4.1. Refer to Section III for information.
4. Escalators

1.1. Refer to Section III for information.

IV. STRUCTURAL

The following information is provided as a general guideline in establishing Structural Engineering project specific requirements.

1. GENERAL

1. All load criteria shall be in accordance with the latest edition of the applicable codes.

1.1. Refer to Section III.

2. FOUNDATIONS

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

3. CONCRETE

3.1. Mix Design and Materials:

3.1.1. Accessories touching the exposed surface of the concrete or in contact with soil shall be coated with plastic or epoxy to prevent rust.

3.2. Exposed Concrete:

3.2.1. 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.

3.3. Precast Concrete:

3.3.1. Fabricator shall submit design to the Design Professional for review.

3.3.2. Fabricator shall have a minimum of three (3) years of experience in the fabrication of similar precast units.

3.3.3. Erector shall have a minimum of two (2) years of experience erecting similar precast units.

3.3.4. Shop drawings shall be prepared by a Registered Professional Engineer licensed to practice in the State of Iowa.

3.4. Placement:

3.4.1. Joints:

3.4.1.1. Contraction joints shall be tooled during finishing or sawed within 18 hours of concrete placement.

3.4.1.2. Contraction joints shall have a minimum depth of ¼ of the pavement thickness and a minimum width of 1/8 inch.
3.4.1.3. Transverse contraction joints shall be provided at a maximum of 2 ½ times the pavement thickness for street pavements and 2 times for all other pavements.

3.4.1.4. Longitudinal joints shall have a maximum separation of 12 feet for streets and 9 feet for sidewalks.

3.4.1.5. Construction joints shall be located at expansion joint locations wherever possible. Construction joints at other locations shall be keyed.

3.4.1.6. Concrete flatwork shall be isolated from columns, existing walls, etc., by non-extruding expansion joint material.

3.5. Testing:

3.5.1. The Owner shall retain services of the testing firm. ContractorConstructor shall be responsible for scheduling tests.

3.5.2. ContractorConstructor shall notify the Owner a minimum of 48 hours prior to placement of concrete.

3.5.3. Testing Requirements:

3.5.3.1. Strength, air entrainment, temperature, and slump tests.

3.5.3.2. Strength tests shall require four (4) cylinders, three (3) broken and one (1) spare.

3.5.3.3. 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. Concrete may be tested more often, at the Owner’s discretion.

3.5.4. Test data from concrete cylinder breaks shall be evaluated using the current edition of American Concrete Institute 214.

3.5.5. Test results shall be sent directly to the ContractorConstructor, Design Professional, and the Owner.

4. MASONRY

4.1. General

4.1.1. Refer to Section III for information.

4.2. Brick and Block Masonry:

4.2.1. Refer to Section III for information.

4.3. Stone Masonry:

4.3.1. Coping stones shall be secured with stainless steel anchors and pins.

4.3.2. 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.
4.3.3. Head joints of coping stones shall be set with joint sealant in lieu of mortar or grout.

4.4. Accessories:

4.4.1. Shelf angles and other metal objects incorporated into masonry walls shall be hot dipped galvanized. Fasteners shall be stainless steel.

4.4.2. Flashing:

   4.4.2.1. Flashings shall extend ¼ inch beyond the face of wall.
   4.4.2.2. In-wall flashings shall be composite copper asphaltic felt.
   4.4.2.3. Through-wall flashings shall be stainless steel.
   4.4.2.4. Weeps shall be installed above each flashing.

4.4.3. Wall ties shall be hot dipped galvanized steel, equal to Hohmann & Barnard, Inc., DW10 Box Wall Tie.

4.4.4. 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

5.1. Structural Steel:

   5.1.1. Certified (AWS D1.1) welders shall be required on structural work.

5.2. Testing:

   5.2.1. The Owner shall retain services of the testing firm. Contractor Constructor shall be responsible for scheduling tests.

   5.2.2. Contractor Constructor shall notify the Owner a minimum of 48 hours prior to erection.

   5.2.3. Test results shall be sent directly to the Contractor Constructor, Design Professional, and the Owner.

5.3. Miscellaneous Metals:

   5.3.1. Guardrails and Handrails:

      5.3.1.1. Exterior guardrails and handrails shall be fully welded, hot dipped, galvanized steel pipe. Surfaces to be painted shall be prepared per ASTM D6386 Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products and Hardware Surfaces for Painting.

      5.3.1.2. Paint Railings black with high gloss enamel paint. Paint shall be listed for use over galvanized steel.

      5.3.1.3. Infill panels shall be vertical balusters.
5.3.1.4. Support posts shall be installed in sleeves cast into walk. Size sleeve 1 inch larger than post.

5.3.1.5. Fill sleeve with non-shrink non-metallic grout around support posts. Provide type NP1 caulk bead at support post penetration. Caulk to be installed minimum ½ inch depth into sleeve. Taper caulk to pitch water away from support post.

5.3.2. All exterior fasteners shall be stainless steel.

5.3.3. Mock up panel is required for all welded railings, grilles and similar architectural metal elements.

5.3.4. Exposed, exterior stainless steel elements shall be type 316.

6. WOOD AND PLASTICS

6.1. Rough Carpentry:

6.1.1. Chromated Copper Arsenate (CCA) treated lumber shall not be used.

6.2. Architectural Millwork and Cabinetry:

6.2.1. Millwork finish shall be free of lead bearing substances.

a. Durable solid surfacing materials shall be used for windowsills.

   (1), such as plastic laminate on solid wood or exterior grade plywood.

6.2.2. Substrate, shall be used for windowsills. Standard particleboard shall not be used.

6.2.3. Countertops:

6.2.3.1. Seams shall be kept to a minimum.

6.2.3.2. Plastic laminate countertops shall have a plywood substrate.

6.2.3.3. Sprayed-on glue application for plastic laminate shall not be used.

6.2.3.4. Countertops in wet areas shall not be constructed with substrate susceptible to moisture.

V. BUILDING MECHANICAL

The following information is provided as a general guideline in establishing Mechanical Engineering project specific requirements.

1. GENERAL

1.1. Hanger design, application, and installation shall comply with MSS SP-58 and SP-69 Standards.

1.2. Solder shall be lead free.

1.3. Testing:

   1.3.1. All piping shall be hydraulically tested. AirPneumatic testing is not acceptable due to safety concerns.
1.2.2.1.3.2. Unless specified below, 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.

1.2.3.1.3.3. Test all systems for a minimum of four (4) hours.

1.2.4.1.3.4. 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 of the specified minimum yield strength of the pipe.

1.2.5.1.3.5. Natural gas shall be tested at twice the working pressure or a minimum of 3 psig.

1.2.6.1.3.6. Sanitary sewer shall be tested at 10 feet of head pressure for minimum of four (4) hours.

1.3.1.4. Identification:

1.3.1.1.4.1. Labeling shall conform to ANSI A13.1.

1.3.2.1.4.2. Piping systems shall be labeled, color coded with the type of service and the direction of flow.

1.3.3.1.4.3. Lettering shall be placed at 20 foot intervals on straight runs of piping including risers and drops, adjacent to each valve and fitting, and at each side of penetrations of structure or enclosure.

1.3.4.1.4.4. Lettering shall be visible from the floor.

1.3.5.1.4.5. Labeling for refrigerant piping shall indicate refrigerant type.

1.3.6.1.4.6. For pipe ¾ inch and smaller, permanent phenolic tags shall be used.

1.3.7.1.4.7. Valves shall be tagged with an engraved brass or plastic tag describing type of service and area controlled by the valve.

1.3.7.1.1.4.7.1. Provide valve list for all valves located in the mechanical rooms.

1. Insulation

1.a. Exposed, insulated, exterior piping shall have an aluminum jacket installed. Jacket shall be weather-resistant, water-proof, smooth surfaced aluminum with a minimum thickness of 0.016 inch.

1.b. Exposed, insulated, interior piping in occupied areas within 6 feet of finished floor shall have a PVC jacket installed. Jacket shall be painted to match surrounding background.

1.c. Exposed, insulated interior piping in mechanical rooms is within 6 feet of the finished floor shall have an aluminum jacket installed.

1.4.1.5. Wall and Ceiling Access Doors;

1.4.1.5.1. Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.
Size to allow maintenance access all concealed valves and equipment.

2. FIRE PROTECTION AND SUPPRESSION

2.1. General

2.1.1. Fire protection systems shall be installed per NFPA IFC, IBC.

2.1.2. Materials and equipment shall be specifically approved, listed, and labeled for fire protection service by UL or FM Global.

   d. Sprinkler shop drawings shall include hydraulic calculations, pipe drawings all drains, isometric drawings, all sprinkler piping, and material/product cut sheets.

2.1.3. All installations shall follow FM Global Lockout-Tagout process and procedures. System control valves shall be clearly locked and labeled to protect downstream systems until accepted by the Owner.

2.2. Submittals and Shop Drawings Sprinkler submittal shall include hydraulic calculations, isometric drawings, sprinkler and drain piping, and material/product cut sheets.

2.2.3. Piping and Pumps:

   2.2.1. Piping:

      2.2.1.1. The fire department connection (FDC) shall be located as close as possible to a fire hydrant and the main Fire Alarm Control Panel. Locate horn/strobe directly above the FDC on the exterior of the building.

      2.2.1.2. Sprinkler 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.

      2.2.1.3. Minimum FM Global approved Schedule 40 steel sprinkler pipe shall be used for all water-based fire protection piping.

      2.2.1.4. Other piping

         2.2.1.4.1. Wet systems – Use schedule 40 black iron piping

         2.2.1.4.2. Dry systems and Preaction systems – Use schedule 40 galvanized sprinkler piping

         2.2.1.4.3. MRI/Magnet affected areas – Use copper piping with metal fusible link heads

         2.2.1.4.4. Piping before backflow preventer – Use cement lined ductile

   2.2.2. Pumps:

      2.2.2.1. Fire pump controller shall be wired directly from normal power and emergency power sources. Other disconnects, including molded cases, between controller and power source(s) shall not be allowed.
Fire pumps shall be horizontal split-case with electric motor.

Pump shall be sized to eliminate the need for pressure relief valves.

Accessories:

Valves:

Valves shall be located to allow access without requiring additional equipment.

Zone valves shall be located in a fire protected enclosure (stairwell) at a maximum 7 feet AFF.

Zone valve shall be located on the floor being served. Check valves and zone main drains shall accompany zone valve.

A pressure gauge shall be installed on the main supply of each sprinkler system, upstream from the main test valve, and in each zone.

Drains:

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.

Exterior discharge of water shall be away from building entrances or populated areas. This is particularly important at the location for testing the main drain of a system.

e. Sprinklers

Sprinkler:

Flexible sprinkler piping or heads shall not be allowed.

Sprinkler piping containing ethylene glycol shall be drained to a sanitary sewer.

Fire Extinguishers:

The Contractor shall provide and install all fire extinguishers.

Fire extinguishers shall be as follows:

Public areas and laboratories shall be Amarex B402 – 5 pound multi-purpose (ABC) dry chemical fire extinguisher.

Laboratories shall be Amarex 322 – 5 pound carbon dioxide (CO2) fire extinguisher.

Electrical rooms (where required) shall be Amarex 330 - 10 pound carbon dioxide (CO2) fire extinguisher.

Mechanical rooms and high hazard rooms shall be Amarex B456 – 10 pound multi-purpose (ABC) dry chemical fire extinguisher.

Fire Extinguisher Cabinets:
2.3.3.3.1.2.4.4.3.1. Cabinet shall be Larson 2409-R2 with full acrylic view. 24 inches high by 9 inches wide by 6 inches deep to hold a 5 or 10 pound ABC extinguisher or 5 pound CO2 extinguisher.

2.3.3.3.2.2.4.4.3.2. Extinguishers may be hung if renovation project in laboratories, electrical rooms, and mechanical rooms do not allow enough space for cabinet installation.

3. PLUMBING SYSTEMS

3.1. General

3.1.1. Refer to Section III for information.

3.2. Insulation

3.2.1. The following plumbing systems shall be insulated:

3.2.1.1. Domestic cold and hot water supply

3.2.1.2. Domestic hot water return or recirculating lines

3.2.1.3. Horizontal storm drain lines and roof drain sumps

3.2.1.4. Exposed waste lines

3.2.2. Refer to HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) Insulation requirements, Section IV D 3.

3.3. Instrumentation

3.3.1. General

3.3.1.1. Thermometers and gauges shall have dial faces between 2 inches and 5 inches in diameter. Thermometers installed more than 8 feet AFF shall have minimum dial face of 4 inches, installed to allow reading from floor level.

3.3.1.2. Thermometers shall be of the dry-well type and installed with thermal conductive material in the dry wells.

3.3.1.3. Thermometers and gauges shall be selected with expected operating conditions in the middle of the device’s range.

3.3.1.4. Thermometers and pressure gauges shall be accurate to 1 percent of full scale.

3.3.1.5. Gauges shall be installed with gauge cocks.

3.3.2. Provide pressure gauges immediately upstream and downstream of skid mounted, domestic booster pump assemblies.

3.4. Piping and Pumps

3.4.1. General
3.4.1.1. Dielectric unions shall not be allowed in piping systems. Use dielectric couplings or flanges to connect dissimilar piping materials.

3.4.2. Domestic Water:

3.4.2.1. Materials:

3.4.2.1.1. PVC piping shall not be used for domestic water systems.

3.4.2.1.2. Pipe and fittings shall be copper, Type L, hard or soft drawn for solder joint connections, ASTM B88.

3.4.2.1.3. Unions 2 ½ inches and larger shall have flange joints.

3.4.2.2. Valves:

3.4.2.2.1. Gate valves, 4 inches to 12 inches, shall be flanged, cast iron, 125 pound, solid wedge, bolted bonnet, OS&Y, Nibco F617-0 or equal. Gate valves 4 inches and smaller shall not be used. Gate valves shall not be used inside the building.

3.4.2.2.2. Check valves 2 inches and smaller shall be soldered, bronze, 125 pound, horizontal swing, Nibco S-413 or equal. Check valves 2 ½ inches to 8 inches shall be flanged, cast iron, 125 pound, bolted bonnet, horizontal swing, Nibco F-918 or equal.

3.4.2.2.3. Ball valves, 3 inches and smaller, shall be soldered, bronze 125 pound, full port, Nibco S-580 or equal.

3.4.2.2.4. Butterfly valves, 6 inches and larger, shall be gear operated.

3.4.2.2.5. Globe valves shall be maximum 2 inches.

3.4.2.2.6. Low point drain valves shall be equipped with a hose adaptor fitting.

3.4.2.2.7. Valve Handle Extensions:

3.4.2.2.7.1. Valves on piping systems with insulation thicknesses of 1 inch or greater shall have handle extensions.

3.4.2.2.8. Moving parts shall be a minimum of 1 inch beyond the face of the insulation to allow for operation without damaging the vapor barrier.

3.4.2.2.8.1. Insulation vapor barrier shall be sealed to the valve handle extension cover.

3.4.2.3. Strainers:

3.4.2.3.1. Strainers, 2 inches and smaller, shall be threaded, bronze, 250 pound, 20 mesh stainless steel screen, Watts Model 777 or equal. Strainers 2 ½ inches to 12 inches shall be flanged, cast iron, 125 pound, 0.045 inch perforated stainless steel screen, Hoffman Model 450 or equal.
3.4.2.3.2. Prior to project completion, Contractor shall remove strainer construction screens. Wire removed screen to suction piping near strainer. Only the Owner shall remove screens from project site.

### 3.4.3. Sanitary Waste and Vent:

3.4.3.1. 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.

3.4.3.2. Gate valves shall be installed upstream of strainer for backflow devices and shall be epoxy coated.

3.4.3.3. Cleanouts shall be located in the wall or on the floor, not above the ceilings.

3.4.3.4. Pipe and fittings may be cast iron, DWV copper, or DWV Schedule 40 PVC. Copper and PVC shall not be used below grade.

### 3.4.4. Storm Sewer Systems:

3.4.4.1. Pipe and fittings may be cast iron, or DWV schedule 40 PVC. Piping below building floor slabs to 5' outside the building wall shall be hubbed cast iron.

3.4.4.2. Provide cast iron cleanouts at grade with a concrete pad.

3.4.4.3. Foam core or cell core PVC not permitted.

### 3.4.5. Special Systems:

#### 3.4.5.1. Acid Waste:

3.4.5.1.1. Pipe and fittings may be either glass or CPVC. All materials must be rated and approved for acid waste use.

#### 3.4.5.2. Distilled and Deionized Water:

3.4.5.2.1. Pipe and fittings shall be Schedule 80 PVC or other plastic piping systems designed specifically for this type of service.

#### 3.4.5.3. Natural Gas:

3.4.5.3.1. Pipe and fittings shall be carbon steel, A53 Gr. B or A106 Gr. B, Schedule 40.

3.4.5.4. Valves 1 inch and smaller shall be ball valves, rated for the type of service.

#### 3.4.5.5. Compressed Air and Vacuum:

3.4.5.5.1. Pipe and fittings shall be Type L.

### 3.4.6. Pumps:

3.4.6.1. Recirculating pumps in hot water systems shall be constructed of non-ferrous material.
3.5. Equipment:

3.5.1. Water Heaters:

3.5.1.1. Refer to Section III for information.

3.5.2. Expansion Tanks:

3.5.2.1. Refer to HYDRONIC SYSTEM EXPANSION TANK DETAIL in Appendices.
3.5.2.2. All expansion tanks shall be installed with provisions for draining and venting.

3.5.3. Water Softeners:

3.5.3.1. All water softening equipment shall be installed with a test port immediately downstream from the softening equipment.
3.5.3.2. Provide Neptune meter immediately downstream of the Water Softener
3.5.3.3. Softeners shall have twin, alternating, fiberglass tanks.
3.5.3.4. Top of unit control panel shall not be mounted above 84 inches AFF.
3.5.3.5. Top of brine tank shall not be mounted above 60 inches AFF.
3.5.3.6. Allowable Manufacturers: Culligan, Marlo, Fleck

(a) Culligan
(b) Marlo
(c) Fleck

3.5.4. Backflow Preventers:

3.5.4.1. Refer to UTILITY DISTRIBUTION DUPLEX BACKFLOW PREVENTER STATION DETAIL in Appendices.
3.5.4.2. Domestic water backflow prevention devices shall be Watts 909. Provide Watts strainer. Provide epoxy coated device for units sized larger than 2 inches.
3.5.4.3. Provide individual isolation valve upstream of each strainer.
3.5.4.4. All backflow preventers shall be located and configured to allow ready accessibility for maintenance and testing. Minimum clearance is 24 inches in all directions.
3.5.4.5. Backflow preventers located more than 4 feet AFF shall have an access platform.
3.5.4.6. Pit installations of backflow preventers shall not be allowed.
3.5.4.7. Drainage from backflow preventers shall be air-gapped, gravity drain only, to a floor drain or floor.
3.5.4.8. Potable water systems shall have two (2) backflow preventers in parallel, each at 100 percent capacity.
3.5.4.9. Dedicated fire suppression water system shall have one (1) FM Global approved double-check assembly.


3.6. Fixtures:

3.6.1. General

3.6.1.1. Fixtures and related equipment shall be of commercial grade or better.

3.6.1.2. Fixtures (sinks, urinals, water closets, etc.) shall be white in color.

3.6.1.3. Fixture hardware (faucets, flush valves, etc.) shall be chrome color.

3.6.1.4. Strainers shall be specified for sinks. Pop-up drain stoppers shall not be used with the exception of residence halls.

3.6.1.5. Water closets shall have check hinges.

3.6.1.6. Automatic faucets shall be infrared, proximity sensor type. Basis of design for countertop lavatories shall be Rubbermaid Technical Concepts TC.

3.6.1.7. Water closets shall have an automatic flush valve, be wall-mounted, 500 pound minimum load with floor mounted heavy-duty rated carrier.

3.6.1.8. Lavatory faucets shall be hands free, automatic.

3.6.1.9. Spring return valves on faucets shall not be used.

3.6.1.10. Urinal flush valves shall be side mount, automatic. Flush valves shall have a manual override function. Approved manufacturers include Sloan, Zurn and Delaney.

3.6.1.11. Sensor valves shall be battery operated.

3.6.1.12. Showers shall have anti-scald mixing valves.

3.6.1.13. Note locations of electric water coolers and fixtures with automatic flush valves (battery), with courtesy flush button, on electrical and plumbing plans.


3.6.2. Water Coolers:

3.6.2.1. Water cooler shall be located a maximum of 36 inches from cooling unit.

3.6.2.2. Hydration Station (water cooler with bottle filler) basis of design shall be Elkay LZSTL8WSLK or Halsey Taylor HTHB-HAC8BLWF.

3.6.3. Hose Bibbs and Wall Hydrants:
3.6.3.1. Provide isolation valves on interior feed to deactivate outdoor hose bibbs during winter.

3.6.3.2. Exterior hose connections shall be recessed socket type.

3.6.4. Floor Drains:

3.6.4.1. 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.

3.6.5. Emergency Showers and Eyewash Stations:

3.6.5.1. For mechanical and custodial rooms only, the basis of design for eyewash stations and their associated mixing valves shall be Speakman SE-505 and Leonard TA-300, respectively. The eyewash station shall be installed as close as possible to the mop sink.

4. HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

4.1. General

4.1.1. All penetrations through firewalls, floor or roof decks shall have firestopping material installed at the penetrations and shall be shown on the drawings.

4.1.2. Install manual air vents at all high points in water systems.

4.1.3. Maintenance Access:

4.1.3.1. Coils, energy recovery equipment, wheels, heat exchangers, motors, etc shall be removable and replaceable without removing adjacent equipment, piping, ductwork, conduit, etc.

4.1.3.2. Coils within a unit shall be removable without requiring removal of any other coil in the same unit.

4.1.3.3. Piping shall be offset to allow for removal of coils without removal of piping header.

4.1.3.4. Locate hangers to allow removal of maintainable components without undue torque on remaining equipment, piping, ductwork, conduit, etc.

4.2. Piping:

4.1.3.4.2.1. General

4.1.3.4.2.1.1. Mechanical joint piping systems may be used in exposed areas and in other approved locations for chilled water, condenser water, and dual temperature/heating water with gaskets rated to 250 degrees F / 120 degrees C.

4.2.1.2. Provide minimum 3 inch spacing between fittings on insulated, mechanically coupled systems, such as Victaulic, to allow for insulation on fittings.

4.1.3.4.2.1.3. Triple-duty valves shall not be used.
4.1.3.3.4.2.1.4. **All** Building hydronic piping systems shall be labeled with tag containing the following information. Tag to be attached at chemical feed point/system:

- **4.1.3.3.1.4.2.1.4.1.** System water volume
- **4.1.3.3.2.4.2.1.4.2.** Chemical additive and ratio
- **4.1.3.3.3.4.2.1.4.3.** Date of system startup

4.2.1.5. **Dielectric unions shall not be allowed in piping systems. Use dielectric couplings or flanges to connect dissimilar piping materials.**

4.1.4.4.2.2. **Hot Water Piping:**

- **4.1.4.4.2.2.1.** Hose bibbs shall be installed for manual air vents at all high points of the hot water systems.
- **4.1.4.4.2.2.2.** Automatic air vents shall not be used.

4.2.2.3. **Refer to HOT WATER (GLYCOL) PREHEAT COIL PIPING DETAIL and HOT WATER PREHEAT COIL PIPING (2-WAY VALVE) DETAIL in Appendices.**

4.1.5.4.2.3. **Chilled Water Piping:**

- **4.1.5.1.4.2.3.1.** Provide thermometers and pressure gauges on both the inlet and discharge sides of any device connected to the chilled water system.
- **4.1.5.2.4.2.3.2.** Material:
  - **4.1.5.2.1.4.2.3.2.1.** PVC shall not be used for chilled water systems.
  - **4.1.5.2.2.4.2.3.2.2.** Welded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 40. Minimum pipe size shall be ¾ inch.
  - **4.1.5.2.3.4.2.3.2.3.** Copper systems shall use a minimum of Type L copper.
  - **4.1.5.2.4.4.2.3.2.4.** Any threaded black steel pipe shall be schedule 80.
- **4.1.5.3.4.2.3.3.** Valves:
  - **4.1.5.3.1.4.2.3.3.1.** Control valves, for pipe sizes 3 inches and smaller, shall be globe valves. For pipe sizes larger than 3 inches, control valves shall be butterfly valves.
  - **4.1.5.3.2.4.2.3.3.2.** Isolation valves, for pipe sizes 2 inches and smaller, shall be ball valves. For pipe sizes larger than 2 inches, isolation valves shall be butterfly valves.
  - **4.1.5.3.3.4.2.3.3.3.** Balancing valves 2 ½ inches and smaller shall be plug valves. For pipe sizes larger than 2 ½ inches, butterfly valves shall be used.
  - **4.1.5.3.4.4.2.3.3.4.** All sizes shall have external stem packing.
4.1.5.4.4.2.3.3.5. Butterfly valves shall be resilient seated with bronze or stainless steel discs and shall be bubble-tight. All butterfly valves shall be lug-type and gear operated.

4.2.3.6. Valve Handle Extensions:

4.2.3.6.1. Valves on piping systems with insulation thicknesses of 1 inch or greater shall have handle extensions.

4.2.3.6.2. Moving parts shall be a minimum of 1 inch beyond the face of the insulation to allow for operation without damaging the vapor barrier.

4.2.3.6.3. Insulation vapor barrier shall be sealed to the valve handle extension cover.

4.1.5.4.4.2.3.4. Mechanical Couplings and Valves:

4.1.5.4.1.4.2.3.4.1. Mechanical Couplings, 2 inch through 12 inch:

4.1.5.4.1.1.4.2.3.4.1. Manufactured in two (2) segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12.

4.1.5.4.1.2.4.2.3.4.1. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000.

4.1.5.4.1.3.4.2.3.4.1. Mechanical Coupling bolts shall be zinc-plated, heat-treated carbon steel track head.

4.1.5.4.2.4.2.3.4.2. Rigid Type:

4.1.5.4.2.1.4.2.3.4.2. 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.

4.1.5.4.3.4.2.3.4.3. Flexible Type:

4.1.5.4.3.1.4.2.3.4.3. Use in locations where vibration attenuation and stress relief are required.

4.1.5.4.3.2.4.2.3.4.3. Flexible couplings may be used in lieu of flexible connectors at equipment connections.

4.1.5.4.3.3.4.2.3.4.3. Three (3) couplings, for each connector, shall be placed in close proximity to the vibration source.

4.1.5.4.4.4.2.3.4.4. Flange Adapters:

4.1.5.4.4.1.4.2.3.4.4. Use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges.

4.1.5.4.4.2.4.2.3.4.4. Basis of design shall be Victaulic style 741.
For direct connection to ANSI Class 300 flanges, basis of design shall be Victaulic Style 743.

Butterfly Valves 2 inches (DN50) through 12 inches (DN300) shall be 300 psi CWP (2065 kPa) suitable for bi-directional and dead-end service at full rated pressure.

Insulation:

a. Insulation shall not have gaps.

General

4.3.1. Insulation systems shall be compliant with Midwest Insulation Constructors Association (MICA) National Commercial and Industrial Insulation Standards, latest edition.

4.3.2. Systems shall be clean and dry prior to installing insulation.

4.3.3. Insulation that indicates exposure to moisture, including piping or ductwork condensation, shall be removed and replaced. Wet insulation, or insulation that has been wet, shall not be accepted.

4.3.4. After testing and cleaning, colder than ambient systems shall not be put into operation until insulation and vapor barriers are complete.

4.3.5. Elastomeric piping insulation installed outdoors shall be jacketed or coated.

4.3.6. Joints shall be sealed using the Manufacturer’s approved adhesive.

Insulation Types

4.3.2.1. Piping insulation passing through partitions for Chilled Water, Chilled Potable Water, and systems operating below 60 degrees F shall be flexible closed-cell elastomeric or Styrofoam/Polyisocyanurate.

4.3.2.2. Heating Water, Domestic Water, Storm, and Sanitary piping insulation shall be fiberglass, flexible closed-cell elastomeric, or cellular glass.

4.3.2.3. Refrigerant piping insulation shall be flexible closed-cell elastomeric.

Piping Insulation:

4.3.3.1. Insulation and vapor barrier shall be continuous through hangers and interior and exterior wall and floor penetrations. Repair vapor barrier breaches on below ambient piping systems with ASJ tape or chilled water mastic.

4.3.3.2. 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.

4.3.3.3. Appurtenances and accessories shall be insulated to prevent condensation or burn hazards. Vapor barrier shall remain continuous across the assembly on below ambient piping systems.

4.3.3.4. Hanger inserts:
4.3.3.4.1. Provide rigid insulation inserts at hangers for Chilled Water systems.

4.3.3.4.2. Wood or plastic block hanger inserts shall not be used as permanent systems.

4.3.3.4.3. Provide rigid insulation inserts at hangers for Domestic Water and Heating Water systems pipe hangers sized properly to allow for continuous insulation sizes 2 inch and larger.

b. Insulation blankets

4.3.3.4.4. Custom fabricated, removable insulation blankets inserts shall be provided for equipment that operates above or below ambient conditions a minimum of 180 degrees and that needs regular maintenance such as extend a minimum of 2 inches beyond the hanger shield. Refer to MICA Plate 1-610

4.3.3.4.5. Inserts shall be Polyisocyanurate or calcium silicate.

4.3.3.5. Piping shields shall be installed at hangers and supports. Shields shall be mechanically secured to the piping by tape, bands, or other visible method.

4.3.3.6. Jackets

4.3.3.6.1. Exposed piping in interior occupiable or public spaces, including in mechanical spaces, shall be jacketed to 8 feet above finished floor.

4.3.3.6.1.1. Steam and steam valves, bonnets, condensate chests/tanks, and systems shall have metal jacketing. All other systems shall have PVC jacketing.

4.3.3.6.1.2. Jacketing is required on elastomeric insulation in mechanical spaces.

4.3.3.6.2. Metal jacketing may be used on below ambient piping systems outside of the building.

4.3.3.6.3. Metal jacketing

4.2.1.1.1.4.3.3.6.3.1. Metal jacketing on steam meters and steam condensate systems may be banded, riveted or screwed.

4.3.3.6.3.2. Metal jacketing on below ambient systems shall be banded, with all joints lapped and sealed with silicone. Screws and rivets shall not be used.

4.3.3.6.4. PVC Jacketing

4.3.3.6.4.1. Minimum jacketing thickness shall be 0.020 inches.

4.3.3.6.4.2. Self-adhered flexible cladding systems shall not be used.

4.3.4. Fittings, Appurtenances, and Accessories
4.3.4.1. All fitting, appurtenances, and accessories shall be insulated with a manufactured assembly, MICA plate assembly, or custom-fabricated blanket.

4.3.4.2. Insulation assemblies on fittings, appurtenances, and accessories that require regular maintenance and operating above 120 degrees F or below 55 degrees F shall be able to be removed and reapplied without damaging the assembly.

4.3.4.3. Fitting Assemblies

4.3.4.3.1. Provide mineral fiber or pre-molded inserts at fittings to prevent condensation at fittings. Refer to MICA Plate 2-500.

4.3.4.3.2. PVC fitting laps shall be mechanically fastened with stainless steel tacks, outward-clench staples, or ASJ tape.

4.3.4.3.3. Joints on PVC fittings on below-ambient systems shall be sealed with mastic or taped with PVC or ASJ tape to maintain vapor barrier.

4.3.4.4. Custom-Fabricated Insulation Blankets:

4.3.4.4.1. Custom-fabricated, removable insulation blankets shall be provided for equipment and appurtenances that operate in the following temperature ranges: fittings that require regular maintenance and for which manufactured systems are not available. Examples include bonnets, condensate chests, tanks, and steam meters.

(a) 35 to 55 degrees F
(b) 120 degrees F or higher
(c) Equipment and appurtenances to be insulated include, but are not limited to:
   i. Shut-off valves (including bonnets)
   ii. Strainers
   iii. Condensate chests / tanks
   iv. Steam and chilled water meters
   v. Heat exchangers
   vi. Pumps

4.3.4.4.2. The custom-fabricated insulation blankets shall be attached via Velcro straps and d-ring buckles. Installation and removal by wires is not acceptable.

4.3.5. Ductwork Insulation:

4.3.5.1. General

4.3.5.1.1. Ductwork insulation pins shall be securely fastened. Loose or unattached pins will not be accepted.

4.3.5.1.2. Rigid insulation inserts shall be installed at trapeze hangers.

4.3.5.1.2.1. Inserts shall be taped to the duct wrap and shall extend a minimum of 2 inches beyond the hanger.
4.3.5.1.2.2. Insulation and vapor barrier shall be continuous between the hanger and the ductwork.

4.3.5.1.2.3. Taping insulation or vapor barrier to the hanger will not be accepted.

4.3.5.2. Duct Wrap Flexible Insulation:

4.3.5.2.1. Joints shall be sealed with FSK or foil tape. Tape shall be securely adhered with the manufacturer’s recommended squeegee.

4.3.5.2.2. Duct wrap insulation longitudinal joints shall be mechanically fastened with outward-clenching staples.

4.3.5.2.3. Cupped head welded pins or stick pins shall be used on ductwork over 24 inches in either dimension. Pins shall be placed at 12 inches on center, maximum.

4.3.5.3. Duct Board Rigid Insulation shall be mechanically fastened to ductwork with pins.

4.3.6. Equipment Insulation:

4.3.6.1. Equipment insulation shall comply with MICA Plates 4-100 through 4-660.

4.3.6.2. Insulation on below ambient system equipment shall be installed without voids between the insulation and the equipment.

4.3.4.4. Air Distribution:

4.3.4.4.1. Ductwork

Maximum length of flexible ductwork shall be 36 inches.

4.3.4.4.2. Accessories: Access doors shall be located before and after all reheat coils.

4.4.3. Ductwork trapeze hangers shall be installed to allow rigid insulation inserts. Refer to ductwork insulation.

4.4.5. Equipment:

4.4.5.1. General

4.4.5.1.1. Provide major equipment with pressure, temperature, and flow indicators at time of installation to establish unit performance.

4.4.5.1.2. Provide equipment with bearings lubricated for life by the manufacturer. Where periodic lubrication is needed, specification shall require lubrication points to be readily accessible for lubrication. Remote lubrication systems shall be metal.

4.4.5.1.3. Provide access doors at all coils, filters, motors, belts etc.

(1) Coils within air handling units, chillers, and heat exchangers shall be capable of being pulled without obstruction of equipment, pipes, conduit, etc., or requiring
removal of any other coil in the same unit. Provide flanges or unions at the header piping to allow entire piping assembly to be removed. Locate hangers to allow removal without undue torque on remaining piping.

4.4.1.4.5.1.4. All coils within air handling units shall be drainable.

4.4.1.5.4.5.1.5. Mechanical equipment/systems shall be installed on a 43.5 inch minimum concrete housekeeping pad, with steel support framing, as required, to allow proper housekeeping, drainage, and full access. Sub floors beneath housekeeping pads shall be sealed to prevent leakage through cracks in pads.

4.4.1.6.4.5.1.6. Motors shall be premium-efficiency.

4.4.1.7.4.5.1.7. Motors shall not be designed to operate in the service factor.

4.4.1.8.4.5.1.8. 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.

4.4.1.9.4.5.1.9. Equipment shall have a hand/off/auto switch to allow manual override of the normal controls.

4.4.2.4.5.2. Refrigerant Systems:

4.4.2.1.4.5.2.1. Valves on refrigerant lines shall be full port. Provide isolation valves on each side of driers. Provide check valves on the discharge of compressors.

4.4.2.2.4.5.2.2. Pipe discharge from all relief valves to exterior of the building.

4.4.2.3.4.5.2.3. Insulate suction and hot gas bypass on refrigerant lines in all locations and discharge lines if exposed in occupied areas.

4.4.2.4.4.5.2.4. Piping and fittings shall be copper, except in an evaporative condenser, where steel piping is acceptable. Use long radius fittings.

4.4.2.5.4.5.2.5. Solder shall be 15 percent silver solder.

(2) For units over 5 tons, use 1 inch fiberglass insulation. For smaller units, use ¼ inch closed cell foam insulation, minimum.

(3) All insulation on exterior piping will be protected by an aluminum jacket.

4.4.2.6.4.5.2.6. Compressors:

4.4.2.6.1.4.5.2.6.1. Compressors shall have five (5) year manufacturer warranty.

4.4.2.6.2.4.5.2.6.2. Multiple units are preferred over larger single units.

4.4.2.6.3.4.5.2.6.3. All compressors shall be single speed.

4.4.2.6.4.4.5.2.6.4. All 3-phase units shall have adjustable voltage monitors for each phase, with manual reset.

4.4.2.6.5.4.5.2.6.5. Compressors shall have recycle timers and crankcase heaters.
4.4.2.6.6 Provide high and low pressure switches.

4.4.2.7 Solenoid valves shall have a manual lift stem.

4.4.2.8 Provide driers on all liquid lines with isolation valves on each side of the drier.

4.4.2.9 Coils shall have copper tubes and aluminum fins.

4.4.3 Pumps:

4.5.3.1 Refer to PUMP – END SUCTION DETAIL and PUMP – IN-LINE DETAIL in Appendices.

4.4.3.2 Install all pumps in easily accessible locations. Install isolation valves on each side of the pump.

4.4.3.3 Pumps shall have mechanical seals.

4.4.3.4 Base mounted, centrifugal pumps shall be installed with a pressure gauge manifold and a suction diffuser/strainer.

4.4.3.5 Pipe vibration isolators shall be stainless steel.

4.4.3.6 Pumps 7 ½ HP and greater shall have Chesterton mechanical split seals, or approved equal.

4.4.3.7 Bell and Gosset pumps shall be the standard of quality.

4.4.3.8 Horizontal in-line pumps shall have a maximum of 1 HP. Vertical in-line pumps shall have a maximum of 5-horsepower, be mounted within 4 feet AFF, and shall be protected by a strainer. In-line pumps are preferred to be close-coupled.

4.4.3.9 Operate Hydronic pumps continuously once chemical inhibitors are added to ensure system circulation.

4.4.3.10 Prior to project completion, Contractor shall remove strainer construction screens. Wire removed screen to suction piping near strainer. Only the Owner shall remove screens from project site.

4.5.4 Air Terminal Units:

4.5.4.1 Splices in the poly tubing shall have brass couplers. Plastic couplers or tees are not acceptable.

4.4.4 Air Handling Equipment:

4.4.4.1 Units shall have a magnahelic filter pressure differential indicator installed with a manifold and valves to isolate lines on each side of the across filter section.

4.4.4.2 Thermometers shall be installed to show temperatures of the mixed, discharge, outside, and return air.

4.4.4.3 Thermometers shall be bi-metal type with a minimum 4-inch dial face.

4.4.4.4 Oil and grease lines shall be extended to the exterior of the case.
4.4.4.2.4.5.5.2. Drain pans shall be stainless steel, externally insulated and bottom drained. Provisions for cleaning shall include either a removable pan or ease of access for cleaning in place.

4.4.4.3.4.5.5.3. Traps for drains shall be sized for the system served. Refer to AHU CONDENSATE DRAIN DRAW-THRU AND BLOW-THRU DETAIL in Appendices. Ensure adequate room for the size of trap required. Adjust the height of the housekeeping pad as required. A 6-5.5 inch minimum height housekeeping pad is preferred.

4.4.4.4.5.5.4. Coils:

4.4.4.4.1.4.5.5.4.1. Refer to CHILLED WATER COIL PIPING DETAIL in Appendices.

4.4.4.4.2.4.5.5.4.2. All coils shall have a minimum of 0.025 inch tube wall thickness and 5/8 inch O.D. minimum diameter.

(a) It is preferred hot water only coils have a maximum of 8 fins/inch. Dual temperature coils are preferred to have a maximum of 10 fins/inch.

4.4.4.4.3.4.5.5.4.3. Coils shall have copper coils, tubes and aluminum fins, and non-ferrous headers.

4.4.4.4.4.5.5.4.4. Coils shall be drainable.

4.4.4.4.5.4.5.5.4.5. Water coils shall be piped for counter flow.

4.4.4.4.6.4.5.5.4.6. Balancing valves shall be installed at the coil.

4.5.5.5. All dampers used in a fully closed position Preheat Coils:

4.5.5.5.1. Preheat coils shall be steam integral face and bypass. Coil shall be vertical for units above 10,000 CFM.

4.5.5.5.2. Minimum tube wall thickness shall be 0.035 inches.

4.5.5.5.3. Install flexible connectors between the coil and steam and condensate connections to allow for expansion and contraction.

4.5.5.5.4. Provide two steam traps at each coil.

4.5.5.5.5. Preheat coil shall fail open upon freeze stat alarm.

4.5.5.5.6. Condensate drain outlet to be minimum of 18 inches above AHU base rail.

4.5.5.5.7. Acceptable manufactures: LJ Wing, Aerofin

4.5.5.6. Dampers shall be low-leakage type. A standard of quality (3 cfm/sq ft @ 1” w.g.).

4.4.4.5.4.5.5.7. Owner-witnessed factory testing is Ruskin CD60 not required.

4.5.5.8. Fan Arrays – Multiple Fan Cells:
4.5.5.8.1. Utilize fan arrays for supply, return, and relief fans in Custom Air Handling Units sized above 10,000 CFM.

4.5.5.8.2. Lifting rail or hoist shall be provided if any component of the fan array weighs more than 100 pounds.

4.5.5.8.3. Air Handling Unit Configuration:

4.5.5.8.3.1. Return air units to be capable of turndown to 10 percent of maximum airflow.

4.5.5.8.3.2. 100 percent outside units to be capable of turndown to 50 percent of maximum airflow.

4.5.5.8.3.3. Fans shall be configured for N+1 redundancy.

4.5.5.8.4. Fan Cell Assemblies:

4.5.5.8.4.1. Fan cells shall be direct driven, AMCA Arrangement 4, plenum fans, duty Class II or III. Class I fans shall not be used.

4.5.5.8.4.2. Provide fans cells with backflow prevention device that reduces system effect when the fan is disabled. Size fan to account for the backdraft damper pressure drop.

4.5.5.8.5. Motor Controls and Monitoring:

4.5.5.8.5.1. Each cell shall have noninvasive, zero pressure drop flow pressure sensing taps installed in the fan inlet cone for airflow monitoring capability. Acceptable manufacturers: MAMAC, Setra

4.5.5.8.5.2. Each cell shall be monitored by a current sensor.

4.5.5.8.5.3. Each cell shall be individually wired to a motor controller containing motor overloads and a dedicated micro drive. Acceptable manufacturers: ABB, Yaskawa, Toshiba

4.5.5.8.5.4. Installation of controller(s) on the wall of the AHU is acceptable.

4.5.5.8.5.5. Individual fans shall be independently capable of indexing on and off and changing speed.

4.5.5.8.5.6. A fault in any one fan cell shall not affect the overall AHU air flow and pressure.

4.5.5.9. Air blenders shall be installed in all return air units.

4.5.5.10. For units 10,000 CFM and above:

4.5.5.10.1. Acceptable manufacturers: MarCraft, Haakon, Governair, ClimateCraft

4.5.5.11. Provide shaft grounding or ceramic bearings with shaft grounding rings at motors.
4.4.5.6. Humidifiers:

4.4.5.1. Refer to Section III for information.

4.4.6. Corrosion Coupon Rack:

4.4.6.1. Provide corrosion coupon rack on all closed loop systems. Coordinate location with Owner.

4.4.7. Chemical Pot Feeders:

4.4.7.1. Provide JL Wingert model 5HD

4.4.7.2. Top of feeder to be located no more than 36 inches AFF. Verify final location with Owner to verify safe chemical transfer.

4.4.7.3. Provide isolation valves at the inlet, outlet, and drain outlet. Locate valves immediately adjacent to feeder.

4.4.8. Bag Filters:

4.4.8.1. Provide size #1 or size #2 bag filter and housing, based on flow rate and system size. Coordinate final location with Owner.

4.5. Lab Systems:

4.5.1. Fume Hoods:

4.5.1.1. Mott Casework shall be the fume hood basis of design.

4.5.2. Refer to FUME HOOD INSTALLATION DETAIL in Appendices.

4.6. Steam Systems:

4.6.1. Drip legs are required for all steam risers. Drawings shall indicated drip leg locations. See END OF MAIN DRIp STATION PIPING (BUILDING) DETAIL in Appendices.

4.6.2. Piping, Pumps and Valves:

4.6.2.1. Pumps:

4.6.2.1.1. Condensate pumps shall be duplex electric pumps.

4.6.2.1.2. Install a pressure gauge on the system side of the condensate pump discharge check valve.

4.6.2.1.3. All condensate pumps shall be capable of handling high temperature condensate.

4.6.2.2. PRVs:
4.6.2.2.1.4.7.3.2.1. Install Isolation valves at all PRVs.

4.6.2.2.2.4.7.3.2. Install pressure gauges on both sides of the PRV.

4.6.2.2.3.4.7.3.2. All PRVs shall be located and configured to allow ready accessibility for maintenance. Provide a minimum clearance of 24 inches in all directions. No PRV shall be located more than 8 feet AFF.

4.6.2.2.4.4.7.3.2. PRVs in the distribution system shall not contain a bypass.

4.6.2.3.4.7.3.3. Medium and Low Pressure Steam - Above Grade:

4.6.2.3.1.4.7.3.3.1. Pipe and fittings:

4.6.2.3.1.1.4.7.3.3.1.1. Piping shall be seamless black steel.

4.6.2.3.1.1.1.4.7.3.3.1.1.1. For supply, piping shall be Schedule 40.

4.6.2.3.1.1.2.4.7.3.3.1.1.2. For condensate, piping shall be Schedule 80.

4.6.2.3.1.2.4.7.3.3.1. Fittings 2 inches and smaller shall be threaded cast iron or malleable iron. Fittings 2 ½ inches and larger shall be welded, with flanged connections to valves and equipment.

4.6.2.3.1.3.4.7.3.3.1.3. Valves 2 inches and smaller shall be 150 pound rising stem gate valves with a union on one (1) side. Valves 2 ½ inches and larger shall be OS & Y gate valves.

4.6.2.3.1.4.4.7.3.3.1.4. Globe valves shall be used only for throttling purposes. Globe valves shall be a minimum of 150 pound, and shall be rated for steam.

4.6.2.3.1.5.4.7.3.3.1.5. Traps shall be protected by a strainer upstream. Isolation valves shall be installed on each side of each trap with blowdown. Integral check valves shall not be used.

4.6.2.3.2.4.7.3.3.2. Strainers shall be Y-pattern, rated for steam, with stainless steel baskets. All strainers shall be installed with a blow down valve.

4.6.2.3.3.4.7.3.3.3. Safety relief valves shall have piping equal to or larger than tappings of the valve. Pipe discharge to exterior of the building.

4.6.2.3.4.4.7.3.3.4. Vent lines from pressure powered pumps or condensate pumps shall not be connected to a relief vent pipe.

(7) Install aluminum jacket on exposed piping in occupied areas within 6 feet AFF. PVC jacket shall not be used.

4.7.3.3.5. Steam traps sized from ½ inch through 1 inch shall have universal 2-bolt connectors. Acceptable manufacturers: Spirax Sarco, Armstrong, Watson McDaniel.
4.6.3.4.7.4. Equipment:

4.7.4.1. Heat Exchangers:

4.7.4.1.1. Refer to Section III for information.

4.6.3.4.7.4.2. Air vent/vacuum breakers shall be installed on steam equipment as required.

4.7.5. Refer to HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) Insulation requirements, Section IV D 3.

4.7.4.8. Snowmelt Systems:

4.7.1.1.1.1. Refer to Section III for information.

4.8.1. Refer to SNOWMELT SCHEMATIC DETAIL in Appendices.

5. INSTRUMENTATION

5.1. Meters:

5.1.1. Domestic Water Utility Meters:

5.1.1.1. Refer to UTILITY DISTRIBUTION DOMESTIC WATER METER DETAIL in Appendices for meter specification and connection details.

5.1.2. Chilled Water Utility Meters:

5.1.2.1. 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.

5.1.3. Hot Water Utility Meters:

5.1.3.1. Refer to UTILITY DISTRIBUTION HOT WATER METER DETAIL in Appendices for meter specification and connection details.

5.1.3.5.1.4. Control and Signal Cabling:

5.1.3.5.1.4.1. Separate raceways and junction boxes to metering and controlling devices shall be installed for each voltage class, including separating AC from DC.

5.1.3.5.1.4.2. 480 VAC conductors are to be installed at least 12 inches away from any lower voltage signal cabling raceways. Conductor shall not be installed in shared junction boxes that include signal wiring.

6. CONTROLS

6.1. General

6.1.1. Contractor/Constructor shall furnish and install all equipment, accessories, wiring, piping, and instrumentation required for a complete and functional system. Provide all hardware and
software, including all relays, sensors, power supplies, etc. required to perform the sequences intended.

6.1.2. Manufacturers shall be Johnson Controls or Schneider Continuum Controls.

6.1.3. All components shall have been thoroughly tested and proven in actual use.

6.1.3.1. The DDC system shall possess a modular architecture, permitting future expansion through additional DDC panels, sensors, actuators and/or operator terminals.

6.1.3.2. The DDC system shall monitor and control the equipment with respect to the indicated Sequences of Operation and Points List. Provide sufficient number of input/output units as determined by specific applications.

6.1.3.3. Existing DDC system shall be extended to meet the requirements, as indicated by the Drawings and Specifications associated with this project.

6.1.4. BACnet Integration:

6.1.4.1. All BACnet devices shall be BACnet Testing Lab certified.

6.1.4.2. Conduct on-site device testing using the BACnet Manufacturers Association / BACnet Testing Laboratories (BMA/BTL) Virtual Test Shell 3.5.0 (VTS) program.

6.1.4.3. BACnet instance numbers shall be coordinated with the Owner. Assigned numbers shall be physically entered by the equipment manufacturer at the BACnet device.

6.1.5. Installing Contractor shall specialize in systems and products and have a minimum of five (5) years documented experience.

6.1.6. The control system shall be installed by experienced control electricians and fitters regularly engaged in control installations. 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. Installers shall:

6.1.6.1. Verify that all field controllers are properly addressed and communicating with the master controller.

6.1.6.2. Jumper configurations.

6.1.6.3. Be onsite to make corrections during point-to-point controls verification.

6.1.6.4. Coordinate with Owner to determine device and sensor locations.

6.1.7. Warranty:

6.1.7.1. All actuators shall have a minimum two (2) year manufacturer’s warranty.

6.2. Scopes of Work:

6.2.1. Coordinate with UI Controls for projects using third party controls subcontractors.

6.2.2. The following responsibilities shall apply when UI Controls is providing project programming:
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<tr>
<th>ACTIVITY</th>
<th>RESPONSIBLE PARTY</th>
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<td>Provide Control Components per Plans &amp; Specifications</td>
<td>CONTROL OR OWNER</td>
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<td>Submittals</td>
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<td>Device/ System Installation</td>
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<td>Communication Bus Verification</td>
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<td>Determine Sensor Locations</td>
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<td>Build/ Install Graphics</td>
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<td>Record Drawings</td>
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### 6.2.3. DDC Contractor shall additionally:

6.2.3.1. Verify space requirements to insure proper service clearances.

6.2.3.2. Provide all required information, material and direction to the designated Contractor as required for device and accessory installation.

6.2.3.3. Address controllers

6.2.3.4. Configure jumpers

### 6.2.4. HVAC Contractor shall:

6.2.4.1. Install automatic valves, separable wells, flow switches, airflow monitoring stations, etc., supplied by the DDC Contractor.

6.2.4.2. Install all automatic control dampers.

6.2.4.3. Assemble multiple section dampers with required inter connecting linkages and extend required number of shafts through duct for external mounting of damper motors.
6.2.4.4. Coordinate installation of variable air terminal units with control Contractor Constructor.

6.2.4.5. Install duct mounted reheat coils.

6.2.5. Electrical Contractor Constructor shall:

6.2.5.1. Provide all power wiring (120 volt or greater) to motors, electric dampers, smoke detectors, and DDC panels.

6.2.5.2. Assign and identify electrical circuits to control Contractor Constructor for dedicated controller wiring.

6.2.6. Controls Electrical Contractor Constructor shall:

6.2.6.1. 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.

6.3. User Interface:

6.3.1. Graphics:

6.3.1.1. 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.

6.3.1.2. System Selection/Penetration: Support user access to all system schematics and floor plans with a graphical penetration scheme, menu selection, or text-based commands.

6.3.1.3. Dynamic Data Displays: Show dynamic temperature values, humidity values, flow values, and status indication in their actual respective locations. Values shall automatically update to represent current conditions without operator intervention.

6.3.1.4. Windowing: 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.

6.3.1.5. Provide graphics screen with building floor plan showing actual locations of master controllers, system control panels, and Variable Frequency Drives. Plans shall include routing of control communication bus and pneumatic piping.

6.3.1.6. Graphics Development Package: Provide graphic generation software to allow the user to add, modify, or delete system graphic displays.

6.3.1.6.1. DDC Contractor Constructor shall provide libraries of pre-engineered screens and symbols depicting:

6.3.1.6.1.1. Standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.)
6.3.1.6.2. The graphic development packages shall allow user to perform the following:

6.3.1.6.2.1. Define symbols.
6.3.1.6.2.2. Position and size symbols.
6.3.1.6.2.3. Define background screens.
6.3.1.6.2.4. Define connecting lines and curves.
6.3.1.6.2.5. Locate, orient and size descriptive text.
6.3.1.6.2.6. Define and display color for all elements.
6.3.1.6.2.7. Establish correlation between symbols or text and associated system points or other displays.

6.3.1.6.3. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon:

6.3.1.6.3.1. Building function
6.3.1.6.3.2. Mechanical system
6.3.1.6.3.3. Building layout
6.3.1.6.3.4. Any other logical grouping of the facility

6.3.1.6.4. User shall be able to build graphic displays that include point data from multiple DDC panels, including MCP, sub panels, LCUs, or VAV terminal unit control.

6.3.1.7. Control Contractor Constructor shall coordinate with Control Engineering for campus graphic standard.

6.3.2. Local Interface

6.3.2.1. Controllers shall support the connection of a portable interface device such as a laptop computer or vendor specific hand-held device. Via this local interface, an operator shall:

6.3.2.1.1. Adjust application parameters.
6.3.2.1.2. Execute manual control of input and output points.
6.3.2.1.3. View dynamic data.
6.3.3.1. Route alarms directly from primary application nodes to specific workstations and servers.

6.3.3.2. The alarm management portion of the master controller software shall, at the minimum, provide the following functions:

6.3.3.2.1. Log date and time of alarm occurrence.

6.3.3.2.2. Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.

6.3.3.2.3. Allow user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

6.3.3.2.4. Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

6.3.3.2.5. Provide the ability to direct alarms to an e-mail address or phone text message.

6.3.3.2.6. Any attribute of any object in the system may be designated to report an alarm.

6.3.3.2.7. The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

6.3.3.3. Provide BAS alarm point for all flood protection valves.

6.3.4. Reports:

6.3.4.1. Reports shall be capable of being directed to each of the following:

6.3.4.1.1. User interface displays

6.3.4.1.2. Printers

6.3.4.1.3. Archives

6.3.4.2. The system shall provide the following reports:

6.3.4.2.1. All points in the BAS.

6.3.4.2.2. All points in each BAS application.

6.3.4.2.3. All points in a specific area network.

6.3.4.2.4. All points in a user-defined group of points.

6.3.4.2.5. All points currently in alarm in BAS application.

6.3.4.2.6. All points locked out in a BAS application.
6.3.4.2.7. All BAS schedules.
6.3.4.2.8. All user defined and adjustable variables, schedules, interlocks, etc.
6.3.4.2.9. BAS diagnostic and system status reports.

6.3.5. Schedules

6.3.5.1. The system shall provide multiple input forms for automatic BAS time-of-day scheduling and operations override. The following spreadsheet types shall be accommodated:

6.3.5.1.1. Weekly schedules.
6.3.5.1.2. Temporary override schedules.
6.3.5.1.3. Holiday schedules.
6.3.5.1.4. Monthly schedules.

6.3.5.2. Schedules shall be provided for each system or sub-system.

6.3.5.2.1. Each schedule shall include all user commanded points residing within the system.
6.3.5.2.2. 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.
6.3.5.2.3. Scheduling and rescheduling of points shall be accomplished via the system schedule spreadsheets.

6.3.5.3. Monthly calendars for a twelve (12) month period shall be provided to allow for scheduling of holidays and special days in advance.

6.3.6. Historical Trending and Data Collection

6.3.6.1. Trend and store point history data for all BAS points and values as selected by the user.
6.3.6.2. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.
6.3.6.3. Provide the capability to perform the following statistical functions on the historical database:

6.3.6.3.1. Average
6.3.6.3.2. Arithmetic mean
6.3.6.3.3. Maximum/minimum values
6.3.6.3.4. Range – difference between minimum and maximum values
6.3.6.3.5. Standard deviation
6.3.6.3.6. Sum of all values

6.3.6.3.7. Variance

6.3.6.4. Coordinate with Controls Engineering on trend specifics as they apply to data collection for the Energy Control Center.

6.4. Sensors and Equipment:

6.4.1. Nomenclature:

6.4.1.1. Label all system control points and devices.

6.4.1.2. Control point identifiers, descriptions and object names shall be per the Owner’s equipment nomenclature standard.

6.4.1.3. The Owner’s nomenclature standard shall apply to third-party BACnet controllers.

6.4.2. Sensors and equipment shall be of the electronic-type suitable for their intended purpose.

6.4.3. Inputs and Outputs:

6.4.3.1. The DDC System shall be capable of receiving the following input signals:

6.4.3.1.1. Analog Inputs (AI) shall monitor temperature, humidity, voltages, or any type of input signal from a 4 to 20 mA or 0 to 10 volt DC as selected by software.

6.4.3.1.2. Digital Inputs (DI) shall accept dry contact closures.

6.4.3.1.3. Pulse accumulators shall have the same characteristics as the DI except that, through software, the number of total pulses shall be counted. The pulse accumulator shall accept up to 10 pulses per second.

6.4.3.2. The DDC System shall be capable of providing the following output signals:

6.4.3.2.1. Digital Outputs (DO) shall provide dry contact closures for momentary and maintained programmable operation of field devices. Closures will have a duration of 0.1 seconds to continuous.

6.4.3.2.2. Analog Output (AO) shall provide variable outputs of 4 to 20 mA, 0 to 10 volt DC, or 0 to 20 volt DC, as selected by the software. Pulse Width Modulation (PWM) outputs are prohibited.

6.4.4. Accuracy shall be consistent with that specified below and as required to maintain end-to-end system accuracy.

6.4.4.1. Temperature sensors shall be thermistor or RTD-type.

6.4.4.2. Averaging sensors used as control points shall follow manufacturer recommended sensor coverage. Averaging sensors for monitoring only purposes, such as cooling coil temperature, face/bypass temperature, or return air temperature, may use a single averaging sensor.
6.4.4.3. Energy recovering units shall have averaging temperature sensors at the inlets and outlets at the wheels.

6.4.4.4. Humidity sensors shall be electronic with no moving or other parts requiring periodic service. Accuracy will be +3 percent of reading.

6.4.4.5. Control relays shall be rated for the application with form c contacts with position indicator.

6.4.4.6. Duct Static Pressure Probes: Duct static pressure control point or monitor point shall use the following probe in conjunction with an appropriately sized pressure transducer. Probe shall be mounted as per manufacture’s recommendations.

6.4.4.6.1. Static Pressure Tip, ¼ inch Barb (Kele Part Number: A-302-K)

6.4.4.6.2. Mounting Flange for A-302-K (Kele Part Number: A-345-K)

6.4.4.7. Air flow status sensors for all supply, return, exhaust and relief applications shall be differential pressure type.

6.4.4.7.1. Fan arrays (fan wall technology) shall be coordinated through control engineering.

6.4.4.7.2. Where Fan Wall Technology is utilized, an adjustable differential pressure switch shall be installed across the fan wall.

6.4.4.7.3. An additional current transducer at each motor shall be installed for alarming purposes.

6.4.4.8. Hydronic flow status sensors shall be differential pressure type and suitable for intended application. No paddle switches. Provide external bleed ports in an H frame configuration. Refer to CHILLED WATER DIFFERENTIAL PRESSURE TRANSDUCER DETAIL in Appendices.

6.4.4.9. Water Temperature Sensors shall be installed in separate immersion wells.

6.4.4.10. 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.

6.4.4.11. Current transducers shall be industrial type with separate zero and span adjustments.

6.4.5. Terminal Air Box (TAB) Controllers:

6.4.5.1. 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.

6.4.5.2. Each TAB controller shall be capable of controlling the following configurations of variable air volume types:

6.4.5.2.1. Single Duct, cooling only.

6.4.5.2.2. Single Duct with Reheat.
6.4.5.2.3. Double Duct.

6.4.5.2.4. Fan-Powered, Parallel or Series Flow.

6.4.5.2.5. Remote Heating.

6.4.5.3. 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.

6.4.5.4. 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.

6.4.5.5. Valve actuators shall be proportional control 0 to 10 volt DC. No spring return actuators with zone control devices.

6.4.6. Low Temperature Safety: Low-limit switches shall have low point sensitive elements (not averaging type) installed to cover the entire duct/coil area. These switches shall be 2-position manual reset type, wired to shut down the supply fan and send an alarm at the DDC system.

6.4.7. Chilled Water System Differential Pressure Control: When the design utilizes “Flow Control Industries Delta P Valves”, the manufacturer’s recommended control strategy shall be applied. Refer to the “Flow Control Industries Delta P Valve System Design Manual” for proper application.

6.4.8. Building pressurization:

6.4.8.1. Volume tracking shall be used for these applications.

6.4.8.2. Building pressure shall be a monitored point only.

6.4.9. Building steam pressure shall be monitored on the secondary side of all pressure reducing valves.

6.4.10. Humidity Control:

6.4.10.1. Units that have humidity control require the following:

6.4.10.1.1. Zone humidity

6.4.10.1.2. Return air humidity

6.4.10.1.3. Discharge air humidity

6.4.10.2. Discharge high humidity limit switch shall be wired back as feedback to the DDC controls and hard wired to the humidity valve.

6.4.11. Air Handler Heating and Cooling Water Coils: Per control valve, provide supply and return temperature sensors on coil header piping.

6.4.12. Air Handler and Exhaust Fans Safety Static Pressure Sensors:
6.4.12.1. Provide low static sensor on inlet side of all supply, return and exhaust fans. Mount sensor on unit.

6.4.12.2. Provide high static sensor on discharge side of supply fans before fire smoke dampers. Mount sensor on unit.

6.4.13. Automatic Control Valves:

6.4.13.1. Provide factory fabricated electronic control valves of type, body material, and pressure class required for application.

6.4.13.2. Provide valve size in accordance with specified maximum pressure drop across control valve.

6.4.13.3. Equip control valves with heavy-duty electronic actuators, with proper shutoff ratings.

6.4.13.4. 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 percent of inlet pressure for low-pressure systems.

6.4.13.5. Valve Trim and Stems shall have bronze trim with stainless steel stem

6.4.13.6. Packing shall be spring-loaded Teflon, self-adjusting.

6.4.14. Dampers:

6.4.14.1. Automatic dampers shall be single or multiple blade and furnished by the DDC subcontractor.

6.4.14.2. Dampers shall be installed by the HVAC subcontractor under the supervision of the DDC subcontractor.

6.4.14.3. Damper frames shall be constructed of 13-gauge galvanized sheet metal and shall have flanges for duct mounting.

6.4.14.4. Damper blades shall not exceed 6 inches in width. All blades shall be of corrugated type construction, fabricated from two (2) sheets of 22-gauge galvanized sheet steel, spot-welded together. Blades shall be oil impregnated sintered metal.

6.4.14.5. Replaceable butyl rubber seals shall be provided with the damper. Seals shall be installed along the top, bottom, and sides of the frame and long each blade edge. Seals shall provide a tight closing, low leakage damper.

6.4.14.6. Dampers to be installed in fume hood exhaust ducts shall be of all stainless steel construction with high quality bearings for service in a corrosive environment.

6.4.14.7. Damper shaft shall be exposed and mechanically marked (indicating damper position) for enabling easy access for maintenance, repair and future replacement.

6.4.14.8. Damper leakage shall be rated for a class 1A or better. Refer to AMCA 500-D-98.

6.4.15. Damper and Valve Motors:
6.4.15.1. Size each motor to operate dampers or valves with sufficient reserve power to provide smooth modulating action.

6.4.15.2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator.

6.4.15.3. Mechanical end switches to deactivate the actuator at the end of rotation are not acceptable.

6.4.15.4. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator. Non-mechanical forms of fail-safe operation are not acceptable.

6.4.15.5. Proportional actuators shall accept a 0 to 10 volt DC. All actuators shall provide a 0 to 10 volt DC position feedback signal.

6.4.15.6. 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. Actuators operating on 120-volt AC power shall not require more than 10 VA.

6.4.15.7. Non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

6.4.15.8. 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.

6.4.15.9. Actuators shall be sized for proper speed of response at the velocity and pressure conditions to which the control damper is subject.

6.4.15.10. Shall produce sufficient torque to close off against the maximum system pressures encountered.

6.4.15.11. Dampers installed in fume hood exhaust ducts shall be of stainless steel construction with high quality bearings, etc. for service in a corrosive environment.

6.4.15.12. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator’s rated torque. Manufacturer shall be ISO9001 certified.

6.4.15.13. Approved manufacturers include Johnson Controls and Belimo.

6.4.16. Combination Air Flow and Temperature Measurement Station (AFMS):

6.4.16.1. General

6.4.16.1.1. CSC shall provide thermal dispersion-type, combination airflow and air temperature measurement devices where indicated on the drawings and/or control sequences.

6.4.16.1.2. 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.
6.4.16.1.3. Airflow and temperature measuring devices shall be UL Listed as an entire assembly. Devices in UL labeled enclosures are not equivalent and shall not be used without a UL Listing for Standard 873.

6.4.16.1.4. Design and installation shall use duct-mounted devices in filtered airstreams and adequate access shall be provided for maintenance.

6.4.16.1.5. Fan inlet sensors shall not be substituted for duct or plenum sensor probes.

   6.4.16.1.5.1. Fan inlet sensors may be used with Owner approval where conditions make duct/plenum installation impractical. are acceptable require written approval from Owner

   6.4.16.1.5.2. Where fan inlet mounting are accepted, mounting styles shall be indicated on the plans as either “face-mounting” or “throat-mounting.” Face mounting shall have no mechanical fastening in the throat or on the surface of the inlet cone and shall be used on all performance-sensitive plenum-type or plug fans.

6.4.16.1.6. The device selected shall be capable of reading accurately throughout the full, intended range of airflow.

6.4.16.2. Basis of Design shall be EBTRON, Inc. Gold Series

6.4.16.3. Transmitter:

   6.4.16.3.1. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature.

   6.4.16.3.2. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units.

   6.4.16.3.3. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.

   6.4.16.3.4. All integrated circuitry shall be industrial grade temperature rated.

6.4.17. Air Flow Monitoring Stations:

   6.4.17.1. Device shall be capable of reading accurately throughout the full, intended range of airflow.

   6.4.17.2. Basis of design shall be Air Monitor Corporation, VOLU-probe or VOLU-probe/FI.

6.4.18. Miscellaneous Devices:

   6.4.18.1. Provide all the necessary switches, relays, transformers, etc. to make a complete and operable system.

   6.4.18.2. Locate devices in local interface panel, unless otherwise specified.

   6.4.18.3. All buildings shall have a building static pressure sensor which has been field verified with Owner.
6.5. Installation:

6.5.1. Install all equipment in accordance with equipment manufacturer's published instructions. Furnish printed copies of these instructions to the Owner prior to installation.

6.5.2. Identification:

6.5.2.1. All equipment, including valves, dampers, etc., shall be identified by a unique equipment number and the equipment tagged after installation.

6.5.3. DDC Panels:

6.5.3.1. Neatly train wiring inside Panduit wire management system.

6.5.3.2. Mount relays and devices on din rail.

6.5.3.3. Control wiring cable sheath shall be stripped backed no more than 6 inches from control terminations.

6.5.3.4. Label electrical circuit number inside DDC panel door.

6.5.4. Wiring:

6.5.4.1. Wiring, including low voltage wiring, shall comply with the requirements of the Electrical Sections of the specifications. Wiring methods shall be in accordance with the requirements of applicable codes.

6.5.4.2. Install control wiring in conduit when exposed within the space, mechanical rooms, exterior locations, etc. Low voltage control cable installed per the NEC within a concealed location.

6.5.4.3. 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.

6.5.4.4. Wiring from remote equipment shall be to terminal blocks. The terminal blocks shall be permanently marked for identification. Wire nut connections are not allowed in control panel wiring.

6.5.4.5. Label each field wire at each end. All relays and transformers in panels shall be labeled.

6.5.4.6. Splices shall not be made in shielded wiring except where specifically required. Splices shall be made on terminal blocks in approved junction boxes. Outlet boxes shall not be used for splices. Comply with labeling requirements above.

6.5.4.7. 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.

6.5.4.8. Powering for DDC control devices shall originate from dedicated control power circuits. DDC Contractor will identify on submittal riser diagram the devices power by each circuit.

6.6. Air Flow Matrix:
VI. ELECTRICAL

The following information is provided as a general guideline in establishing Electrical Engineering project specific requirements.

2.1. GENERAL

2.1.1. General

2.2. Identification:

2.2.1. All switching, protective devices and metering on main distribution panels shall be identified with labels.

2.2.2. Equipment labels shall be adhesive-backed vinyl or plastic with ½ inch letters.

2.2.3. 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.

2.2.3.1. Provide label on the inside of the panel door in public spaces. See Arc Flash requirements, below, for additional information.

2.2.3.2. Provide label on the outside of equipment in Mechanical, Electrical and non-public spaces.

2.2.4. Label inside cover of all safety switches with fuse size, type, current limiting ability and devices controlled.

2.2.5. Label all receptacles on the cover plate with self-adhesive labels. Label shall indicate panel name and circuit number.

2.2.6. All light fixtures shall be labeled with the panel number and circuit number from which they are fed. Place label out of public view. Coordinate label location with the Owner.

2.2.7. All junction box covers shall be labeled with the panel number and circuit numbers contained in the junction box.

2.2.7.1. Exposed boxes in finished areas shall be labeled on inside of cover.

2.2.7.2. Exposed boxes in unfinished areas shall be labeled on outside of cover.

2.2.7.3. Concealed boxes above accessible ceilings shall be labeled on outside of cover.

2.2.3. Arc Flash:
2.3.1.3.1. **Contractor** The contract documents shall provide specific Constructor requirements for gathering as-installed equipment and feeder field data to Design Professional for use in completing the Record Designer in Arc Flash Assessment calculations.

2.3.2.1.3.2. **Equipment Labeling:**

2.3.2.1.3.2.1. All new and modified equipment, as identified in NFPA 70E, 2015 Edition, shall be labeled. Label shall include, at a minimum, the information identified in NFPA 70E.

2.3.2.1.3.2.2. Apply labels to the face of the equipment enclosure so that they will be visible without opening a door, panel, or enclosure plate.

2.3.2.1.3.2.3. Arc flash labels shall be a permanently attached, non-aging material with waterproof, abrasion resistant lettering.

2.4.1.4. **Grounding:**

2.4.1.4.1. All grounding electrodes shall be tested to the recorded resistance value specified by the Design Professional. Provide two (2) copies of testing reports to the Owner.

3.2. **MEDIUM-VOLTAGE (601 VOLTS – 69k VOLTS) ELECTRICAL DISTRIBUTION**

3.2.1. Medium voltage switchgear, transformers, metering, and cabling by Owner.

3.2.2. **Raceways:** Contractor shall furnish a min. 1 inch rigid metal raceway from primary building electric meters to the utility network cabinet. Refer to **UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL in Appendices.**

4.3. **LOW-VOLTAGE ELECTRICAL DISTRIBUTION**

4.3.1. **Equipment:**

4.3.1.1. **Design:**

4.3.1.1.1. Provide nominal 43.5 inch high housekeeping pads for floor mounted equipment. Pads shall extend 4 inches beyond the equipment.

4.3.1.2.1. Exterior and interior surfaces of electrical equipment enclosures shall be wiped or cleaned with a vacuum immediately prior to final acceptance.

4.3.1.3.1. Scratches on painted surfaces shall be touched up with equipment manufacturer’s standard paint of matching color.

4.3.1.4.1. Provide five (5) spare ¾ inch conduit stubs from flush panels into suspended ceiling space or other accessible space.

4.3.1.5.1. Provide each panel with a clear, plastic covered, typed circuit schedule. The schedule shall identify circuits by room number and location in room using final room numbers provided by the Owner.

4.3.1.6.1. Provide branch circuit electrical panels in General Education Buildings with Best 5E Series ¾-inch Utility Cylinder. Key to MK EB and EB1.
4.1.2.3.1.2. Transient Voltage Surge Suppression:

4.1.2.1.3.1.2.1. Refer to Section III for information.

4.1.3.3.1.3. Switchboards:

4.1.3.1.3.1.3.1. Covers to consist of full-length hinge, door within a door.

4.1.3.2.3.1.3.2. Approved manufacturers include Square D, General Electric and Cutler-Hammer.

4.1.4.3.1.4. Panelboards:

4.1.4.1.3.1.4.1. Circuit breakers on branch circuit panelboards shall be bolt-on type.

4.1.4.2.3.1.4.2. Approved manufacturers include Square D I-Line, GE Spectra Series, and Cutler-Hammer.

4.1.5.3.1.5. Motor Control Center:

4.1.5.1.3.1.5.1. Approved manufacturers include Square D, General Electric and Cutler-Hammer.

4.1.6.3.1.6. Breakers, Fuses and Safety Switches:

4.1.6.1.3.1.6.1. Each project shall supply one (1) set of three (3) spare fuses for each type and size fuse installed.

4.1.6.2.3.1.6.2. Provide spare fuse storage cabinet of metal construction. Cabinet shall be labeled and mounted as directed by Owner.

4.1.6.3.3.1.6.3. Safety switches shall be heavy duty.

4.1.6.4.3.1.6.4. Safety switches in mechanical rooms shall have minimum NEMA 3R enclosures.

4.1.6.5.3.1.6.5. All safety switches shall have a grounding bar.

4.1.6.6.3.1.6.6. Approved manufacturers include Square D, General Electric and Cutler-Hammer.

4.1.7.3.1.7. Variable Frequency Drive:

4.1.7.1.3.1.7.1. Manufacturer shall provide harmonic analysis of the supplied VFD. Total harmonics are shall not to exceed 3 percent.

4.1.7.2. Provide factory installed MSTP interface card in each VFD.

4.1.7.2.3.1.7.3. Provide startup services by a Factory-Certified Service Representative.

4.1.7.3.1.7.4. Minimum Provide a minimum of 4 hours of Owner training time shall be four (4) hours.

4.1.7.4.3.1.7.5. Approved manufacturers include: ABB, Allen-Bradley, Toshiba and Schneider Electric.
4.1.7.5-3.1.7.6. Refer to VARIABLE Frequency DRIVE MOUNTING DETAILS in Appendices.

4.2.3.2. Devices:

4.2.1.3.2.1. Receptacles and switches shall be heavy-duty, minimum specification grade, minimum 20 amp rating.

4.2.2.3.2.2. Receptacles and switches shall be side and back wiring type. All wire connections shall be screw clamp or wire nut type.

4.2.3.3.2.3. Install switches at 48 inches AFF. Install receptacles at 18 inches AFF.

4.2.4.3.2.4. Install 120 volt receptacles with the ground up.

4.2.5.3.2.5. Approved Manufacturers include:

4.2.5.1.3.2.5.1. Switches shall be Hubbell, Leviton 1221, or Pass and Seymour

4.2.5.2.3.2.5.2. Receptacles shall be Hubbell 5362, Leviton 5362A, or Pass and Seymour.

4.2.5.3.3.2.5.3. Isolated Ground Duplex Receptacles shall be Hubbell, Leviton, or Pass and Seymour IG5362.

4.2.5.4.3.2.5.4. Plugmold shall be Wiremold V24GB306.

4.2.5.5.3.2.5.5. Plugmold Pigtail shall be Pass and Seymour S266-X 12/3 type SJOW cord.

4.3.3.3. Raceways, Boxes, and Supports:

4.3.1.3.3.1. Raceway and Boxes:

4.3.1.1.3.3.1.1. For Branch Circuits, the minimum conduit size shall be ¾ inch. The minimum size for flexible metal conduit shall be ½ inch.

4.3.1.2.3.3.1.2. Conduit shall be supported from the building structure. Attachment to other pipes, conduits, ductwork, etc. shall not be allowed.

4.3.1.3.3.1.3. At the points where conduit penetrates concrete that is in contact with soil, that conduit shall be Schedule-80 PVC bedded in sand. If the PVC is a bend of greater than 45-degrees, the bend shall be completely encased in concrete.

4.3.1.4.3.3.1.4. All metallic fittings shall be compression-type rated for ground connection.

4.3.1.5.3.3.1.5. All fittings shall be galvanized steel or malleable iron.

4.3.1.6.3.3.1.6. EMT shall not be used outdoors, in wet locations, in floor crawl spaces, or within 5 feet of finished grade.

4.3.1.7.3.3.1.7. The use of flexible metal conduit shall be limited to recessed lighting fixtures. Maximum length shall be 6 feet.

4.3.1.8.3.3.1.8. Liquid-Tight flexible metal conduit shall be used to connect rotating, vibrating or moveable equipment.
4.3.1.9.3.3.1.9. Empty conduits shall have nylon pull cords installed with temporary caps or plugs.

4.3.1.10.3.3.1.10. Non-Metallic Conduit or Boxes:

4.3.1.10.1.3.3.1.10.1. Shall be used only in wet locations.

4.3.1.10.2.3.3.1.10.2. May be used for underground electric circuits less than 600 volts which are:

4.3.1.10.2.1.3.3.1.10.2.1. Under paved areas and areas scheduled to be paved.

4.3.1.10.2.2.3.3.1.10.2.2. Next to permanent buildings, under formal planting beds and in extremely high areas that would be difficult to excavate due to regular heavy use.

4.3.1.10.3.3.3.1.10.3. Shall be Schedule-40 minimum weight and to be designed for electric application with all connections solvent-welded. Conduit 2 inches and smaller shall be a minimum of Schedule 80.

4.3.1.10.4.3.3.1.10.4. Schedule 80 PVC conduit shall be utilized anywhere non-metallic conduit emerges from concrete or where conduit may receive physical abuse.

4.3.1.11.3.3.1.11. Maintain a 6 inch minimum from top of ceiling tile support grid to any raceway.

4.3.1.12.3.3.1.12. Raceways, boxes and their supports shall be compatible with the atmosphere of the area in which they are installed.

4.3.2.3.3.2. Hangers and Supports:

4.3.2.1.3.3.2.1. Lead, fiber, wood and powder actuated anchors are prohibited.

4.3.2.2.3.3.2.2. Bolted conduit clamps are prohibited below 8 feet AFF in public areas.

4.4.3.4. Wire and Cable:

4.4.1.3.4.1. Number 10 AWG shall be used when length of wire serving floor maintenance receptacles exceeds 100 feet.

4.4.2.3.4.2. Provide dedicated neutral and ground for each isolated ground device.

4.4.3.3.4.3. The minimum wire size for lighting and power branch circuits is #12 AWG.

4.4.4.3.4.4. The minimum wire size for Class 1 control circuits is #14 AWG.

4.4.5.3.4.5. Any conductors installed in flexible conduit at terminal connections of rotating, vibrating or moveable equipment shall be of stranded wire.

4.4.6.3.4.6. 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
Green | Ground | Green

4.5.3.5. Metering and Switchgear:

4.5.1.3.5.1. Metering:

4.5.1.3.5.1.1. Additional electric kilowatt-hour meters may be needed to properly account for other customer electric power usage.

4.5.1.2.3.5.1.2. Place a disconnect means ahead of meter.

3.5.1.3. Meter sockets/boxes for these self-contained meter sites shall be provided by UI Meters and Controls and shall be installed and wired by the contractor.

3.5.1.3.1. All cabling shall be clearly labeled.

4.5.1.2.1.3.5.1.3.2. Meters shall be provided and installed by UI Meters and Controls.

3.5.1.3.3. CTs and PTs shall be provided by owner and installed by Contractor. CT and PT wiring to meters shall be by the Owner.

3.5.1.4. Metering Raceways: contractor

4.5.1.2.2.3.5.1.4.1. Contractor shall provide a 1 inch min. raceway from utilities network cabinet to socket based electrical meters.

3.5.1.4.2. Rigid metal if outside, EMT acceptable if inside. If there are

4.5.1.2.3.3.5.1.4.3. For multiple electric meters in one location, contractor shall provide and install a 12 inch by 12 inch by 4 inch junction box (with backplane) centrally located near electric meters.

4.5.1.2.4.3.5.1.4.4. Provide raceways to each meter from junction box and from junction box to utility network cabinet.

4.5.1.2.5.3.5.1.4.5. Refer to UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL in Appendices.

4.5.1.3.3.5.1.5. Wire and Cable for Metering: UI Meters and Controls will provide, pull and terminate all cabling.
4.5.2.3.5.2. Switchgear:

4.5.2.1.3.5.2.1. Secondary utility disconnect switchgear shall be furnished and installed by owner.

5.4. BACKUP POWER SYSTEMS

5.4.1. Backup Power:

5.1.4.1.1. Packaged Generator Assemblies:

5.1.4.1.1.1. Provide startup services and training for Owner’s personnel by a Factory-Certified Service Representative.

5.1.4.1.1.2. Submit a completed manufacturer’s start-up checklist.

5.1.4.1.1.3. All fuel piping from the outside of the building for day tank filling and venting shall be hard piped.

5.1.4.1.1.4. A high liquid level device shall be provided for day tank overflow protection.

5.1.4.1.1.5. Manufacturer shall have a service center within a 100 mile radius of The University of Iowa.

5.1.4.1.1.6. The engine’s New Source Performance Standard (NSPS) compliance certificate shall be submitted to the Owner.

5.1.4.1.1.7. If diesel generator is allowed by Owner, 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 percent by volume.

5.1.2.4.1.2. Battery Equipment:

5.1.2.4.1.2.1. Batteries on racks or in cabinets shall be accessible for maintenance. Provide 24 inches minimum vertical access above batteries.

5.2.4.2. Load Shedding Generation:

5.2.4.2.1. Refer to Section III for information.

5.3.4.3. Environmental and Code Compliance:

5.3.4.3.1. Refer to Section III for information.

4.3.1. Refer to Section III for information.

5.4.4. Monitoring and Data Transmission:

5.4.4.1. Refer to Section III for information.

5.5.4.5. Transfer Switches:

4.5.1. Refer to Section III for information.
6.5. LIGHTING

6.1-5.1. General

6.1.1.5.1.1. Refer to Section III for information.

5.2. Submittals and Shop Drawings:

5.2.1. Submit dimensioned drawings of lighting fixtures.

5.2.2. Submit a separate sheet for each light fixture, lamp, and ballast, assembled in order of luminaire "type" designation. Clearly indicate fixture type, manufacturer, model number, and accessories for each item.

5.2.3. Submit a “Lamp and Ballast Schedule” noting fixture type, lamp designation, lamp manufacturer, and local supplier for each fixture.

5.2.4. LED fixture submittals shall include photometric reports per IES LM-79 guidelines.

5.2.4.1. 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.

5.2.4.2. Provide manufacturer of origin for the LED chipset included in the fixture.

6.2-5.3. Interior Lighting:

6.2.1.5.3.1. Design:

6.2.1.1.5.3.1.1. Refer to Section III for information.

6.2.2.5.3.2. Classroom Design:

6.2.2.1.5.3.2.1. Refer to Section III for information.

6.2.3.5.3.3. Daylighting:

6.2.3.1.5.3.3.1. Refer to Section III for information.

6.2.4.5.3.4. Ballasts:

6.2.4.1.5.3.4.1. All ballast cases shall be bonded to the equipment grounding conductor.

6.2.4.2.5.3.4.2. Ballasts shall be serviceable while the fixture is in its normally installed position and shall not be mounted to removable reflectors or wire-way covers unless so specified.

6.2.4.3.5.3.4.3. Utilize parallel-wired ballasts where possible so that if one (1) lamp fails remaining lamps stay on.

6.2.4.4.5.3.4.4. All ballasts shall have a sound rating “A” and total THD of 10 percent or less.
6.2.4.5.3.4.5. Remote-mounted ballasts shall be located in an accessible, cool, dry location with adequate ventilation. Label each ballast to correspond to its specific fixture and location. Manufacturer’s published limitations for remote distances shall not be exceeded.

6.2.4.6.3.4.6. Select lighting fixtures with tool-less access to ballasts for ease of maintenance.

6.2.4.7.3.4.7. In existing buildings, all compact fluorescent ballasts shall be provided with integral end-of-life sensor so that ballast does not provide continuous voltage to a lamp once the lamp has reached its end-of-life.

6.2.4.8.3.4.8. Utilize parallel-wired ballasts where possible so that if one (1) lamp fails the remaining lamps stay on.

6.2.4.9.3.4.9. Clearly label all specialty ballasts (dimming, stepped dim, high or low ballast factors, etc.) to prevent incorrect replacements.

6.2.4.10.3.4.10. Coordinate with Environmental Health and Safety for disposal of existing ballasts.

6.2.5.3.5. Lamps:

6.2.5.1.3.5.1. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent lamps intended to be dimmed as per manufacturer recommendations.

6.2.5.2.3.5.2. Coordinate with Environmental Health and Safety for disposal of existing lamps.

6.2.6.3.5.6. Lighting Fixtures (luminaries):

6.2.6.1.3.6.1. Provide all lighting fixtures with a specific means for grounding their metallic wire-ways and housings to an equipment grounding conductor.

6.2.6.2.3.6.2. 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. Edges of pre-finished sheet metal shall be finished in a similar corrosion-resistant manner to match the adjacent surface(s).

6.2.6.3.3.6.3. Fixture finish shall be free of stains or evidence of rusting, blistering or flaking.

6.2.7.3.7. LED Lamps and Fixtures:

6.2.8.1.3.7.1. LED fixture submittals shall include photometric reports per IES LM-79 guidelines.

6.2.8.1.1.3.7.1.1. 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.

6.2.8.2.1.3.7.1. Provide manufacturer of origin for the LED chipset included in the fixture.

6.2.8.3.3.7.1. All LED fixtures shall have a maximum Correlated Color Temperature variance of +/- 100 degrees K. Products installed in field with greater variance shall be replaced at no cost to Owner.
6.2.8.4.5.3.7.2. All LED fixtures, modules, or arrays, per type, shall be provided with the same date code of manufacture.

6.2.8.5.3.7.3. Submit driver data and dimmer compatibility list as provided by the manufacturer. Contractor shall furnish and install only dimmers listed as compatible with the specified LED lighting fixture.

6.2.8.5.3.7.4. Contractor 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.

6.2.8.5.3.7.5. LED fixtures shall be provided with a driver and light source as a modular system.

6.2.8.5.3.7.6. All LED drivers shall carry a minimum life expectancy of 50,000 hours.

6.2.8.5.3.7.7. 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. Active cooling systems involving fans or other maintainable mechanical parts are prohibited.

6.2.9.5.3.8. Emergency Lighting and Exit Signs:

6.2.9.1.5.3.8.1. Emergency lighting and exit sign units shall not be mounted higher than 10 feet AFF.

6.2.9.2.5.3.8.2. Center exit signs on building elements, such as corridors and doorways.

6.2.9.3.5.3.8.3. Exit Signs:

6.2.9.3.1.5.3.8.3.1. 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.

6.2.9.3.2.5.3.8.3.2. Lamps shall be red LED, mounted in center of letters on red color-stable plastic or fiberglass.

6.2.9.3.3.5.3.8.3.3. LED shall be rated minimum twenty-five (25) year life.

6.2.9.3.1.5.3.8.3.1. LED exit light fixtures without diffuser panels shall be maximum of 3.5 watts for single-faced and 7 watts for double-faced.

6.2.9.3.2.5.3.8.3.2. LED exit light fixtures with diffuser panels shall use 1 watt maximum per fixture for single-or double-faced.

6.2.9.3.4.5.3.8.3.4. Fixtures shall be wired for universal 120 to 277-volt.

6.2.9.3.5.5.3.8.3.5. EXIT signs shall comply with UL 924 and EPA Energy Star Specifications at the end of five (5) years of continual use.

6.2.9.3.6.5.3.8.3.6. 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. Letter illumination shall appear when viewed in a typical installation.

6.2.9.3.7.5.3.8.3.7. There shall be no radioactive material used in the fixtures.

6.2.9.4.5.3.8.4. Emergency Fixtures:

6.2.9.4.1.5.3.8.4.1. System shall consist of an automatic power failure device and fully automatic solid-state charger in a self-contained power pack.

6.2.9.4.2.5.3.8.4.2. Charger shall be trickle, float, constant-current or constant-potential type, or a combination of these.

6.2.9.4.3.5.3.8.4.3. Battery shall operate unattended and require no maintenance, including no additional water, for a minimum of five (5) years.

6.2.9.5.5.3.8.5. Exit signs and emergency lighting equipment shall include self-testing module to perform the following functions:

6.2.9.5.1.5.3.8.5.1. 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.

6.2.9.5.2.5.3.8.5.2. Self-test feature shall automatically run a one (1) minute test once a month and an alternating 30 or 60-minute test once every six (6) months.

6.2.9.5.3.5.3.8.5.3. Multi-color LED on-board indicators shall provide visible fault detection and charging status.

6.2.9.5.4.5.3.8.5.4. Manual test switch to simulate a discharge test cycle.

6.2.9.5.5.5.3.8.5.5. Module shall have low voltage battery disconnect and brown-out protection circuit.

6.2.10.5.3.9. Fixture Installation:

6.2.10.1.5.3.9.1. Luminaires located in suspended ceilings shall be connected with a maximum 6 foot length of flexible metal conduit.

6.2.10.2.5.3.9.2. Use number 12 AWG (min) light fixture whips.

6.2.10.3.5.3.9.3. Luminaires shall be fitted with swivels or otherwise adjusted so they hang plumb and true.

6.2.10.4.5.3.9.4. Fixtures in finished spaces shall not be chain hung.

6.2.10.5.5.3.9.5. Housing, trim, and lens frame shall be true, straight and parallel to each adjacent fixtures and features.

6.2.10.6.5.3.9.6. Fixtures shall not be supported by ceiling acoustical panels.

6.2.10.7.5.3.9.7. 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.

6.2.10.8.5.3.9.8. 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.

6.2.10.9.5.3.9.9. Round fixtures or fixtures smaller than the ceiling grid shall have at least two (2) 3/4 inch (19 mm) metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.

6.2.11.5.3.10. Quality Control:

6.2.11.1.5.3.10.1. Foot candle measurements shall be taken after lamps have been in service for one-hundred (100) hours.

6.2.11.1.1.5.3.10.1.1. Obtain measurements during periods of darkness at a sufficient number of locations to demonstrate that the design criteria have been met.

6.2.11.1.2.5.3.10.1.2. Results shall be submitted to Owner.

6.2.11.2.5.3.10.2. Where ballast noise is audible above the ambient noise, use sound level meter (capable of measuring as low as 35 dB) to test ballast. Replace all ballasts outside of specified range.

6.2.11.3.5.3.10.3. Test all emergency fixtures and exit signs under power failure conditions.

6.2.11.4.5.3.10.4. Lighting Designer shall observe and direct Contractor in the field for final aiming of each adjustable fixture.

6.2.11.4.1.5.3.10.4.1. Aiming shall occur after sunset, at a time designated by the Owner.

6.2.11.4.2.5.3.10.4.2. All materials and labor necessary for the final aiming and adjusting shall be included in the Contractor's base bid.

6.2.11.5.5.3.10.5. Include provisions for pre-construction meeting between manufacturer's representatives, Lighting Designer, Contractor and Owner to verify required devices, placement, intended operation, and wiring scenarios.

6.2.11.6.5.3.10.6. Contractor shall verify that installation of controls is complete and correct per manufacturer provided drawings and specifications. Demonstrate fully operational system to the Owner prior to scheduling training.

6.2.11.7.5.3.10.7. The Owner reserves the right to videotape each training session for use in future training programs.

6.2.11.8.5.3.10.8. Training shall include:

6.2.11.8.1.5.3.10.8.1. A combination of classroom and field venues (all typical room types).
6.2.11.8.2-5.3.10.8.2. Complete overview of the entire system identifying specific features and operating descriptions.

6.2.11.8.3-5.3.10.8.3. Provide specific instructions on how to turn lights on, off, dim lights, etc. allowing for hands-on participation.

6.2.11.8.3.1-5.3.10.8.3.1. Review of each device that is part of the lighting system, including specific luminaires. Review shall include device purpose, how it is used, how the user interfaces with the device, etc. The Contractor Constructor shall bring minimum one (1) of each component to the training event so participants can “touch and hold” each device.

6.2.11.8.4-5.3.10.8.4. If the system includes daylight-harvesting functionality, provide a complete description of how the daylight-harvesting system works.

6.2.11.8.5-5.3.10.8.5. Provide detailed instructions and demonstrations on how to adjust, calibrate, program, troubleshoot, repair, and replace each sensor and major system component.

6.2.11.8.6-5.3.10.8.6. Provide detailed instructions and demonstrations on how to repair and troubleshoot individual luminaires.

6.2.11.8.7-5.3.10.8.7. For computerized systems, provide detailed system login, programming, reporting, and troubleshooting instructions.

6.3.4. Interior Lighting Controls:

6.3.1.5.4.1. Design:

(1) Provide Sequence of Operation for manufacturer each lighting control strategy and Commissioning Agent use condition in verifying building operates as intended and designed.

5.4.1.1. Include provisions for post-occupancy retesting or verification by the Documents.

6.3.1.1.5.4.1.2. Manufacturer retest controls within one (1) year after occupancy to ensure that all control systems are still operating as intended.

6.3.1.2.5.4.1.3. Where dual-level or multi-level switching is provided, switches shall control the same lamp sets at each fixture.

6.3.1.3.5.4.1.4. Project specific control layouts shall be included in the Manufacturer’s submittals. Include Manufacturer’s layout demonstrating proper indicating coverage areas and sensor types for the application.

6.3.1.4.5.4.1.5. The control system shall be complete for all Sequences of Operation, and include all hardware, software, hand-held devices, panels, cables, etc. as required to test, troubleshoot, program, and operate the system.

6.3.1.5.5.4.1.6. Provide complete programming and source code to Owner.
### 6.3.1.6-5.4.1.7
Ceiling sensors shall be located minimum of 4 feet from supply air diffuser to avoid false activation.

### 5.4.1.8
Control cabling shall be labeled at both ends.

### 6.3.1.7-5.4.1.9 Control Scenarios:

<table>
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<tr>
<th>SPACE TYPE</th>
<th>CONTROL TYPE</th>
<th>DURATION</th>
<th>Allow HVAC Integration</th>
<th>NOTES</th>
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<tr>
<td>Classroom</td>
<td>Vacancy Sensor</td>
<td>15 minutes</td>
<td>Yes</td>
<td>Teacher over-ride off, test mode on (1 hr.), dimming</td>
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<td>Restroom</td>
<td>Occupancy Sensor</td>
<td>15 minutes</td>
<td>No</td>
<td>No manual over-ride.</td>
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<td>Office</td>
<td>Vacancy Sensor</td>
<td>15 minutes</td>
<td>Yes</td>
<td>Manual on. Potential for dual-level</td>
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<tr>
<td>Mechanical Room</td>
<td>Manual</td>
<td>N/A</td>
<td>No</td>
<td>Manual on/off only in mechanical areas</td>
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<tr>
<td>Conference</td>
<td>Vacancy Sensor and Dimming</td>
<td>15 minutes</td>
<td>Yes</td>
<td>Multi-zone, preset control. Possible a/v interface.</td>
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<td>Open Office, Auditoria, Corridor,</td>
<td>Occupancy Sensor or Central</td>
<td>15 minutes</td>
<td>Yes</td>
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<td>Common Areas</td>
<td>System</td>
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<td>Storage</td>
<td>Vacancy Sensor</td>
<td>15 minutes</td>
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<td>Laboratory</td>
<td>Occupancy Sensor</td>
<td>15 minutes</td>
<td>Yes</td>
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<tr>
<td>Telecommunication Room</td>
<td>Manual</td>
<td>N/A</td>
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### 6.4-5.5 Exterior Lighting:

#### 6.4.1.5.5.1
Wiring for exterior light fixtures shall be installed in Schedule 40 PVC conduit, 2 inch minimum. Minimum burial depth shall be 24 inches.

#### 6.4.2.5.5.2
Temporary lighting around the perimeter of the project shall be provided during major construction projects which have displaced exterior lighting.
6.4.3.5.3. Circuiting shall be 208V, 3 phase, 4 wire plus ground with 120V fixtures being installed in a phase "a", "b", "c" alternating fashion. Provide fusing in base of pole, Ferraz Shawmut FEB-11-11 600V, 30A or equal.

6.4.4.5.4. Provide in-grade pull boxes (hand-holes) sized and located as required by NEC. Pull-boxes shall be a minimum of 12 inches by 12 inches, Quazite concrete service box #PC1212BA12 with lid #PC1212CA00. Lid to read "U OF I ELECTRIC".

5.5.4.1. Pull-boxes shall be a minimum of 12 inches by 12 inches.

6.4.4.1.5.5.4.2. Quazite concrete service box #PC1212BA12 with lid #PC1212CA00.

6.4.4.2.5.5.4.3. Lid to read "U OF I ELECTRIC".

6.4.5.5.5. Exterior Lighting Fixtures:

6.4.5.1.5.5.5.1. Lighting bollards and luminaires in sidewalks, roadways and retaining walls are prohibited.

6.4.5.2.5.5.5.2. All light sources shall be LED. Color temperature shall be 4000 degrees K +/- 300 degrees.

6.4.6.5.5.6. All Main Campus walkways, parking lots and outdoor gathering areas shall utilize University Standard Light Fixtures. Refer fixture type definitions below. Use the following fixtures:

6.4.6.1.5.5.6.1. Type S1:

6.4.6.1.1.5.5.6.1.1. Description: Single LED type 3 cobra head mounted on a 27 ½ foot concrete pole with 6 foot mast arm.

6.4.6.1.2.5.5.6.1.2. Luminaire: Lumark LD-RL-T3-B06-E-BZ-LCF, multi-volt, bronze color

6.4.6.1.3.5.5.6.1.3. Distribution: Type 3

6.4.6.1.4.5.5.6.1.4. Color Temperature: 4000K

6.4.6.1.5.5.6.1.5. Power Input: 146W

6.4.6.1.6.5.5.6.1.6. Lumen Output: 12302 lumens

6.4.6.1.7.5.5.6.1.7. Pole: Stresscrete P275-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 9-1/4 inches

6.4.6.1.8.5.5.6.1.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, 2-coats JB acrylic.

6.4.6.1.9.5.5.6.1.9. Mast Arm: KA186-H-1 ARM CH BRNZE-TXT

6.4.6.1.10.5.5.6.1.10. Mounting: Anchor bolts, concrete base

6.4.6.1.11.5.5.6.1.11. Application: Parking lots.
6.4.6.2.5.5.6.2. Type S2:

6.4.6.2.1.5.5.6.2.1. Description: Double LED type 3 cobra head mounted on a 27 ½ foot concrete pole with 6 foot double mast arms.

6.4.6.2.2.5.5.6.2.2. Luminaire: Two Lumark LD-RL-T3-B06-E-BZ -LCF, multi-volt, bronze color

6.4.6.2.3.5.5.6.2.3. Distribution: Type 3

6.4.6.2.4.5.5.6.2.4. Color Temperature: 4000K

6.4.6.2.5.5.6.2.5. Power Input: 146Wx2

6.4.6.2.6.5.5.6.2.6. Lumen Output: 12302x2 lumens

6.4.6.2.7.5.5.6.2.7. Pole: Stresscrete P275-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 9-1/4 inches

6.4.6.2.8.5.5.6.2.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

6.4.6.2.9.5.5.6.2.9. Mast Arm: KA186-H-2 ARM CH BRNZE-TXT, double mast arm.

6.4.6.2.10.5.5.6.2.10. Mounting: Anchor bolts, concrete base

6.4.6.2.11.5.5.6.2.11. Application: Parking lots.

6.4.6.3.5.5.6.3. Type S3:

6.4.6.3.1.5.5.6.3.1. Description: Single LED type 3 cobra head mounted on a 34 foot direct buried concrete pole with 6 foot mast arm.

6.4.6.3.2.5.5.6.3.2. Luminaire: Lumark LD-RL-T3-B06-E-BZ -LCF, multi-volt, bronze color

6.4.6.3.3.5.5.6.3.3. Distribution: Type 3

6.4.6.3.4.5.5.6.3.4. Color Temperature: 4000K

6.4.6.3.5.5.6.3.5. Power Input: 146W

6.4.6.3.6.5.5.6.3.6. Lumen Output: 12302 lumens

6.4.6.3.7.5.5.6.3.7. Pole: Stresscrete E340-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 10 1/2 inches

6.4.6.3.8.5.5.6.3.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

6.4.6.3.9.5.5.6.3.9. Mast Arm: KA186-H-1 ARM CH BRNZE-TXT

6.4.6.3.10.5.5.6.3.10. Mounting: Direct burial
SECTION IV – OUTLINE SPECIFICATIONS AND DETAILS

6.4.6.3.11-5.5.6.3.11. Application: Parking lots.

6.4.6.4-5.5.6.4. Type S4:

6.4.6.4.1-5.5.6.4.1. Description: Double LED type 3 cobra head mounted on a 34 foot direct buried concrete pole with 6 foot double mast arm.

6.4.6.4.2-5.5.6.4.2. Luminaire: Two Lumark LD-RL-T3-B06-E-BZ -LCF, multi-volt, bronze color

6.4.6.4.3-5.5.6.4.3. Distribution: Type 3

6.4.6.4.4-5.5.6.4.4. Color Temperature: 4000K

6.4.6.4.5-5.5.6.4.5. Power Input: 142Wx2

6.4.6.4.6-5.5.6.4.6. Lumen Output: 12302x2 lumens

6.4.6.4.7-5.5.6.4.7. Pole: Stresscrete E340-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 10 ½ inches

6.4.6.4.8-5.5.6.4.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

6.4.6.4.9-5.5.6.4.9. Mast Arm: KA186-H-2 ARM CH BRNZE-TXT

6.4.6.4.10-5.5.6.4.10. Mounting: Direct burial

6.4.6.4.11-5.5.6.4.11. Application: Parking lots.

6.4.6.5-5.5.6.5. Type S5:

6.4.6.5.1-5.5.6.5.1. Description: LED pedestrian type 3 shoebox mounted on a 19 foot direct buried concrete pole with custom adapter, net pole height 14 feet.

6.4.6.5.2-5.5.6.5.2. Luminaire: Lumark LD-RV-T3-B03-E-BZ -LCF, multi-volt, bronze color

6.4.6.5.3-5.5.6.5.3. Distribution: Type 3

6.4.6.5.4-5.5.6.5.4. Color Temperature: 4000K

6.4.6.5.5-5.5.6.5.5. Power Input: 73W

6.4.6.5.6-5.5.6.5.6. Lumen Output: 6680 lumens

6.4.6.5.7-5.5.6.5.7. Pole: Stresscrete E190-APH-G-S90-C/W-HEX RING, hexagonal, Pole Top: 4 inches, Pole Butt: 7.61 inches.

6.4.6.5.8-5.5.6.5.8. Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.

6.4.6.5.9-5.5.6.5.9. Adapter: Custom hex fitter adapter
6.4.6.5.10. Mounting: Direct burial

6.4.6.6.5.11. Application: Pedestrian walkways

**Type S6:**

6.4.6.6.1. Description: LED pedestrian ornamental Queen Anne style luminaire on a decorative 10 foot cast-iron pole

6.4.6.6.2. Luminaire: Spring City Electrical Mfg. William & Mary #ALMWML-LE080/EV1/X2-40-CN5-PPBP-FGV-CU. Benjamin Moore Bronzetone #163-60. Refer to Drawing #S102572.

6.4.6.6.3. Distribution: Type 5

6.4.6.6.4. Color Temperature: 4000K

6.4.6.6.5. Power Input: 80W

6.4.6.6.6. Lumen Output: x lumens

6.4.6.6.7. Pole:

6.4.6.6.7.1. Spring City Electrical Mfg. Edgewater #IPSEDG-18-10.00-TN7.00/.075-323/1NW-CU, 10 feet,

6.4.6.6.7.2. Light center: 10 feet - 8 11/16 inches, 18 inch Octagonal Base, 1 piece heavy wall cast iron per ASTM 11A 48-83 class 30, provide grounding stud, 4 each 3/4 inch by 24 inch by 3 inch hook (fully galvanized with 1 galvanized nut and 1 galvanized washer per bolt), access door located in base with tamper proof hex socket screws. Refer to Drawing #S102572.

6.4.6.6.7.3. Pole Finish: Prime paint Sherwin Williams 2-part recoatable epoxy primer (B67H5-Part G and B67V5-Part H) final coat to be Sherwin Williams Semi-Gloss Black or Benjamin Moore Bronzetone depending on location (Black for Pentacrest and Cleary Walkway, Bronzetone elsewhere)

6.4.6.6.8. Adapter: Tenon 7 inch diameter by 3/4 inch high.

6.4.6.6.9. Mounting: Anchor bolts, concrete base

6.4.6.6.10. Application: Pentacrest, T. Anne Cleary Walkway

**Type S7:**

6.4.6.7.1. Description: LED round pole-top luminaire on a 19 foot direct buried concrete pole with custom adapter, net pole height 14 feet.

6.4.6.7.2. Luminaire: Kim CCS-21P3-120L4K120-DB-P, bronze color

6.4.6.7.3. Distribution: Type 3
Color Temperature: 4200K
Power Input: 126W
Lumen Output: 10297 lumens
Pole: Stresscrete E190-APH-G-S90-C/W-HEX RING, hexagonal
Pole Finish: S90 Saluki Bronze B196-6-30-LS, polished finish, two (2) coats JB acrylic.
Adapter: Custom hex fitter adapter
Mounting: Direct burial
Application: Gathering areas

5.5.7. Oakdale Campus walkways, parking lots and outdoor gathering areas shall use the following fixtures.

5.5.7.1. Walkway Lighting:

5.5.7.1.1. Luminaire: Cooper LDRV T3-B03-E-LCF-BK, LED, Black

5.5.7.1.2. Pole: Stresscrete E190-APH-G-E11, hex ring, black

5.5.7.2. Parking Lot Lighting:

5.5.7.2.1. Luminaire: Cooper LDRL-T3-B06-E-BK-LCF (Cobra Head), LED, Black

5.5.7.2.2. Pole: Stresscrete E340-APH-G-Ell with KA186-A-H-1-TXT-BLK arms

5.5.7.3. Street Lighting:

5.5.7.3.1. Luminaire: Cooper LDRL-T3-B06-E-BK-LCF (Cobra Head), LED, Black

5.5.7.3.2. Pole: Stresscrete E340-APH-G-Ell with KA186-A-H-1-TXT-BLK arms

6.5.6. Exterior Lighting Controls:

6.5.6.1. Exterior lighting not attached to the building shall be controlled by Utilities & Energy Management via lighting contactor. Exterior lighting shall not be controlled by the building's energy management system.

6.5.6.1.1. Contactor shall be 208 volt, 3 phase, 4 wire, 60 amp (minimum), with hand-off-auto.

6.5.6.1.2. Control voltage shall be 120 volt.

6.5.6.1.3. Exterior lighting shall be metered separately from building power.

6.5.6.1.4. Contactor shall be mounted downstream of site lighting electrical meter.
7.6 COMMUNICATIONS

7.1.6.1 General

7.1.6.1.1 Use removable fire-stopping pillows for cable tray penetrations.

7.1.6.1.2 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.

7.1.6.1.3 Utility Network: Refer to UTILITY DISTRIBUTION UTILITY NETWORK CABINET DETAIL in Appendices for utility network cabinet and pathways. UI Meters and Controls will provide, pull, and terminate all utility network cable.

7.2.6.2 Telecommunication Pathways:

6.2.1 Refer to TELECOMMUNICATION CABLE OUTLET DETAIL in Appendices.

7.2.6.2.2 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 90.

7.2.6.2.3 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.

7.2.6.2.4 Pull boxes shall be placed directly after a bend or sized accordingly if the pull box is located at the bend.

7.2.6.2.5 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. Conduit and raceway for wall phones shall be sized to receive one (1) cable.

7.2.6.2.6 Secondary pathways shall be minimum 1 inch conduit from work area outlet box to within 24 inch of nearest cable tray of work area outlet. Secondary alternative solutions shall be coordinated with Owner prior to design or installation.

7.2.6.2.7 Rough-in box at secondary pathway destination shall be Randle Industries, Inc. 5 Square Telecommunications box, part number T-55017.

7.2.5.6.2.6 Fire Rated Pathways shall be:

7.2.5.6.2.6.1 Specified Technologies Inc. EZ-Path Fire Rated Pathways or approved equal.

7.2.5.6.2.6.2 Coordinate with Owner size of EZ-Path.

7.2.5.6.2.6.3 Utilize five (5) ganged pathway bracket in all telecommunications rooms. Part number EZP544W. Provide five (5) EXD44S Pathways at each bracket.

7.2.5.6.2.6.4 Utilized for all interior Telecommunication Room primary cable pathways.

7.2.5.6.2.6.5 Utilized for all interior fire-rated communication primary cable pathways.
<table>
<thead>
<tr>
<th>PATHWAY TRADE SIZE</th>
<th>SIAMESE CAT 5E 40% FILL CABLES DESIGN</th>
<th>CATEGORY CAT 6A 40% FILL CABLES DESIGN</th>
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</thead>
<tbody>
<tr>
<td>2 inch caddy clip</td>
<td>35</td>
<td>24</td>
</tr>
<tr>
<td>1 inch EMT conduit</td>
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<td>5</td>
</tr>
<tr>
<td>1 1/4 inch EMT conduit</td>
<td>214</td>
<td>8</td>
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<tr>
<td>2 inch EMT conduit</td>
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<td>19</td>
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<tr>
<td>2 1/2 inch EMT conduit</td>
<td>2255</td>
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<tr>
<td>3 inch EMT conduit</td>
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<tr>
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<td>45110</td>
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</tr>
<tr>
<td>4 inch EMT conduit</td>
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<td>83</td>
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<td>EZD44</td>
<td>45126</td>
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<td>4000 Wiremold</td>
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<td>29</td>
</tr>
<tr>
<td>6000 Wiremold</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>6 inch by 6 inch Wireway</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PATHWAY TRADE SIZE</th>
<th>SIAMESE CAT 5E 40% FILL CABLES DESIGN</th>
<th>CATEGORY CAT 6A 40% FILL CABLES DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 inches wide, 3 inches / 4 inches rung</td>
<td></td>
<td>73/97</td>
</tr>
<tr>
<td>height cable tray center spline top rung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Refer to inches wide, 3 Refer to inches / 4 inches rung</td>
<td>110/146</td>
<td></td>
</tr>
<tr>
<td>height cable tray center spline top rung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 inches wide, 3 inches / 4 inches rung</td>
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<tr>
<td>height cable tray center spline top rung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 inches wide, 3 inches / 4 inches rung</td>
<td>220/293</td>
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<tr>
<td>height cable tray center spline top rung</td>
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<td></td>
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</table>
7.3.6.3. Grounding and Bonding:

7.3.1.6.3.1. Telecommunication Main Ground Busbar (TMGB):

- Shall be Chatsworth Products Inc. ¼ inch by 4 inch by 20 inch, part number 40153-020

7.3.2.6.3.2. Telecommunication Grounding Busbar (TGB) or approved equal:

- Shall be Chatsworth Products Inc. ¼ inch by 4 inch by 12 inch, part number 40153-012

7.3.3.6.3.3. Telecommunication Horizontal Rack Busbar:

- Chatsworth Products Inc. 3/16 inch by ¾ inch, part number 10610-019

7.3.4.6.3.4. Bonding Conductors shall be insulated copper.

7.3.5.6.3.5. Flat, braided, aluminum ground straps shall be utilized for bonding sections of aluminum cable tray.

7.3.6.6.3.6. Bonding Conductor size shall be determined by NEC.

7.3.7.6.3.7. Interconnecting Bonding Conductor (IC):

- Shall be insulated, copper, number 3/0 AWG referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications.

7.3.8.6.3.8. Telecommunication Bonding Backbone (TBB):

- Shall be insulated, copper, number 3/0 AWG.

7.3.9.6.3.9. Equipment Bonding Conductor (EK):

- Shall be green colored insulation, copper, number 6 AWG.

7.3.10.6.3.10. Bonding Conductor Terminations:

7.3.10.1.6.3.10.1. Two-hole compression lugs shall be Thomas and Betts, two-hole lugs long barrel-type, catalogue number 54816BE, high-conductivity wrought copper, electro tin plated, or approved equal, installed at TMGB or TGB location.

7.3.10.2.6.3.10.2. One-hole compression lugs shall be Thomas and Betts, long-barrel one-hole lugs, catalogue number 54905BE, high-conductivity wrought copper, electro tin plated, or approved equal, installed at out ends from TMGB or TGB.

7.4.6.4. Data and Voice Horizontal Infrastructure:
**6.4.1** Horizontal Station Cable:

- **Base cabling design** shall be one (1) of the following:
  1. TE Connectivity TrueNet Category 5E (C5eT) Plenum, Siamese cable. Manufacturer’s Commscope Systimax GigaSPEED CAT 6, part number TN5ETPX2-WT01-A.
  2. TE Connectivity TrueNet Category 5E Plenum cable, manufacturer’s part number TN5ESP-BLII.

**7.4.1.1.6.4.1.1.** Construction shall be 24700210032, 23 AWG copper, FEP Teflon insulated twisted 4-pair solid copper conductors, Siamese type (two [2] 4-pair groups), twisted pairs, FEP polyolefin flame retardant insulated, unshielded, ripcord, with Natural colored, plenum rated, jacket, TIA/EIA category 5E, communications cable ANSI/ITIA-56-C.2 Category 6. Cabling shall be white.

- **Alternate cabling, CAT 5E or 6A, shall be as directed by the Owner.**

**7.4.2** Install all cables through primary and secondary pathways. Installation methods and techniques shall satisfy current ANSI/EIA/TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces.

**7.4.3** Support all cable such that they will not be damaged by normal building use.

**7.4.4** Communications may share support superstructures with multiple utilities. Design superstructures to support the entire connected load.

**7.4.5** Provide metallic conduit sleeves and nylon bushings for all floor and wall penetrations.

**7.4.6** Horizontal cabling shall be continuous from the work area communication outlet to the distribution frame.

**7.4.7** Cables shall not be installed or routed in any manner that violates the manufacturer’s specifications.

**7.4.8** The following minimum bend radius and pulling tension shall be applied, unless the manufacturer’s requirements are more stringent:

- **7.4.8.1** The minimum bend radius for 5E Siamese-type cable is 4.2 inches for cable oriented flat around corners, and 2.1 inches for cable oriented on edge around corners.

- **7.4.8.2** Maximum pulling tension is 50 pounds.

**7.4.9** 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.

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**7.5.6.5** Fiber Optic and Copper Backbone and Riser Cable:

**7.5.1.6.5.1** Premise Fiber Optic Cable Risers:
7.5.1.1.6.5.1.1. Fiber Risers:

7.5.1.1.6.5.1.1.1. Optical fiber riser cable must be Corning FREEDM Loose Tube Gel-Free Riser Cable. Strand count will be specified per project.

7.5.1.1.6.5.1.1.1. Single mode application use OS2 SM

7.5.1.1.6.5.1.1.2. All fiber shall be installed as a home-run. No mid-span splices are allowed.

7.5.1.1.6.5.1.1.3. Provide a service loop of 10 feet (minimum) at both ends of the cable.

7.5.1.2.6.5.1.2. Accepted Single Mode OS2 Connector Installation:

7.5.1.2.1.6.5.1.2.1. Corning CCH Pigtail Cassette CCH-CS12-59-POORE.

7.5.1.2.2.6.5.1.2.2. Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-59-POORE cassette loaded with SC connectors.

7.5.1.3.6.5.1.3. Accepted Single Mode Connectors for Non-Building Riser Fibers:

7.5.1.3.1.6.5.1.3.1. Corning UniCam SC High-Performance Connectors.

7.5.1.4.6.5.1.4. Accepted Fiber Housings are:

7.5.1.4.1.6.5.1.4.1. Corning Closet Connector Housing CCH:

7.5.1.4.1.6.5.1.4.1.1. The CCH is a one (1) piece enclosure.

7.5.1.4.2.6.5.1.4.2. Clearfield xPAK:

7.5.1.4.2.6.5.1.4.2.1. The xPAK Part Number 6PAK-SC fiber demarcation housing for fire panels and other similar applications.

7.5.1.4.3.6.5.1.4.3. Accepted Closet Connector Housing CCH Panels:

7.5.1.4.3.6.5.1.4.3.1. CCH-CP12-59

7.5.1.5.6.5.1.5. Closet Connector Housing Panel Polarity Orientation

7.5.1.5.1.6.5.1.5.1. Specific orientation of the adapters is necessary to maintain the correct polarity of the transmitting and receiving signals throughout the campus. Polarity is achieved by physical key slot orientation of adapters in the fiber distribution enclosures.
7.6.6.6. Outdoor Plant Fiber Optic Cable:

7.6.1.6.6.1. Single-mode fiber shall have a core diameter of 8.3 microns and cladding diameter of 125 microns. Maximum attenuation shall be:

7.6.1.1.6.6.1. 0.44 dB/Km @ 1310 nm

7.6.1.2.6.6.1. 0.35 dB/Km @ 1550 nm

7.6.1.3.6.6.1.3. Zero-dispersion wave length of 1310 nm + or - 10 nm

7.6.2.6.6.2. Loose Tube Fiber Cable:

7.6.2.1.6.6.2.1. Provide Corning ALTOS Loose-tube, gel-free cable, 24 F, Single mode (OS2), part number 024EU4-T4101D20.

7.6.2.2.6.6.2.2. Suitable for underground (in conduit) and aerial installation.

7.6.2.3.6.6.2.3. Cable sheath rated and marked OFNR for riser applications per NEC.

7.6.2.4.6.6.2.4. 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.

7.6.2.5.6.6.2.5. Six (6) or twelve (12) fibers per buffer tube.

7.6.2.6.6.6.2.6. Use standard color codes on sub-buffers per current EIA/TIA 598.

7.7.6.7. Copper:

7.7.1.6.7.1. Copper riser cable shall be specified per project by Owner.
7.7.2.6.7.2. Type CMR, 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.

7.7.3.6.7.3. Copper riser will be rated for the environment in which installed.

7.7.4.6.7.4. Accepted copper splice connecting hardware shall be 3M or AT&T.

7.7.5.6.7.5. Splice connecting hardware shall be 25 pair modular connectors specifically designed for straight splicing applications.

7.7.6.6.7.6. Splice modules shall be designed to accommodate splicing of 22 - 26 AWG solid copper conductors having Polyvinyl Chloride (PVC) or Polyethylene (PE) insulation.

7.7.7.6.7.7. 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.

7.7.8.6.7.8. Accepted copper splice closures shall be 3M. Coordinate size with Owner.

7.8.6.8. CATV Distribution and Horizontal Infrastructure:

7.8.1.6.8.1. Horizontal drop cable shall be plenum-rated 75Ω Series 6. Horizontal drop lengths shall not exceed 295 feet over Series 6 (refer to note below under Cable Type).

7.8.2.6.8.2. Horizontal cabling between Telecommunications Rooms and outlet/drop locations shall be made as individual home runs. Intermediate splices or couplings are not allowed.

7.8.3.6.8.3. 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.

7.8.4.6.8.4. Label all horizontal drops with outlet location and run length.

7.8.5.6.8.5. Distribution feeds less than 500 feet shall be plenum rated, 75Ω Series 11.

7.8.6.6.8.6. 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.

7.8.7.6.8.7. All F-Connectors and will be hand tightened and then torqued to 20 pounds/inch.

7.8.8.6.8.8. The Contractor shall ensure that the CATV System meets or exceeds the following system design criteria at any and all CATV System drops:

7.8.8.1.6.8.8.1. Minimal Signal level range at required.

7.8.8.2.6.8.8.2. Analog marker channels 2, 78 and 120 will be 6dBmV+/- 4 dBmV.

7.8.8.3.6.8.8.3. Carrier to noise ratio shall be 43 dB (minimum).

7.8.8.4.6.8.8.4. Humidity shall be 1 percent.

7.8.9.6.8.9. Cable Type:
7.8.9.1  Horizontal Non-Plenum <=295 feet Series 6 – Commscope 5727 Belden – Snap-n-Seal SNS1P6 (Compression Connector).

7.8.9.2  Horizontal Plenum <=295 feet Series 6 – Commscope 2276V WHRL Belden – Snap-n-Seal SNS6PLA.

7.8.9.3  Closet Risers <=500 feet – Non-Plenum – Series 11 Belden 1617A Belden Snap-n-Seal SNS11AS.

7.8.9.4  Closet Risers <=500 feet Plenum – Series 11 Commscope 2285V WHRL Plenum compression Connector – Corning / Gilbert GAF-UR-11PL.

7.8.9.5  Risers between closets exceeding 500 feet to be semi-flex .500 (Times Fiber part number T10500J/GRS500AFMDU03 F/M) or fiber optic cable. Coordinate with Owner.

6.9  Audio Visual (A/V) Systems:

6.9.1  General

6.9.1.1  Equipment shall be installed with the latest firmware and software.

6.9.1.2  Analog output signals shall be scaled to the native resolution of the display.

6.9.1.3  Constructor shall use industry Audio Visual Best Practices as outlined by Infocomm.

6.9.1.4  Equipment shall be ventilated to assure that equipment operates at or below manufacturer recommendations.

6.9.1.5  Provide system training for Operations Staff and Departmental Users.

6.9.2  Submittals and Shop Drawings:

6.9.2.1  Submittals shall include equipment data, floor plan locations, and equipment riser diagram(s) showing equipment connections.

6.9.2.2  Submit as-built drawings, including equipment locations and cable routing prior to Final Completion.

6.9.2.3  Source code, including all GUI's shall be submitted to the Owner prior to Final Completion.

6.9.2.4  Provide EASE (Enhanced Acoustics Simulator for Engineers), or equivalent acoustic model for spaces with occupancy at or above 150 people.

6.9.3  Pathways and Cables:

6.9.3.1  Pathways shall be specific for AV, no sharing with other cables (ex. network cables).

6.9.3.2  Cables shall be either in conduit or J-hooks.

6.9.3.3  Cables must meet or exceed the manufacture requirements of the connected equipment.

6.9.3.4  Cable splicing is not acceptable. Cabling shall be homerun.
6.9.3.5. Cabling shall be labeled with both function and location. Numbering is not acceptable.

6.9.3.6. Hook and loop (Velcro) fasteners shall be used for cable management. Tie wraps or zip ties are not acceptable.

6.9.4. Control Equipment:

6.9.4.1. Touch Panels: Extron TLP Pro 1020 (use Extron PoE injector)

6.9.4.2. Keypads: Extron MLC Plus 200 (use Extron PoE injector)

6.9.4.3. Processors: Extron IPCP Pro 350 or 550

6.9.5. Switching and Distribution:

6.9.5.1. Matrix Switchers: Extron DTP CrossPoint 84 IPCP MA 70, DTP CrossPoint 108 4K, XTP II CrossPoint

6.9.5.2. Scalers and Processors: Extron IN1608 MA 70

6.9.5.3. Media Distribution: Extron DTP and XTP Transmitters and Receivers

6.9.6. Audio Equipment:

6.9.6.1. Amplifiers: Extron digital amps

6.9.6.2. Speakers: JBL Pro

6.9.6.3. DSP: Biamp Tesira

6.9.6.4. Ceiling Microphones: Audix M3

6.9.6.5. Wireless Microphones: Audio Technica ATW-3000 series

6.9.6.6. Desktop Microphones: Audio Technica or Shure

6.9.6.7. Speakerphone: Konftel 55W

6.9.6.8. Systems shall incorporate a custom made 1U rack panel from Liberty AV Solutions – WebBox 3 (UNIOWA-WQ441606 or UNIOWA-WQ455657 if there is not a power outlet available on front) both XLR connectors are mic level.

6.9.7. Video (Visual) Equipment:

6.9.7.1. Projectors: Panasonic

6.9.7.2. Displays: Samsung, Sharp (commercial grade)

6.9.7.3. Cameras (PTZ): Lumens, Sony, Vaddio

6.9.7.4. Cameras (USB): AMX, Sony, Vaddio

6.9.7.5. Screens: Da-Lite (recessed where possible)
6.9.7.6. Blu-ray Players: Sony, Oppo

6.9.7.7. Document Cameras: Wolfvision VZ-8Light4

6.9.8. Miscellaneous Equipment:

6.9.8.1. AV Bridge: Vaddio - AV Bridge Conference, Extron - MediaPort 200

6.9.8.2. Video Conferencing Codec: Zoom, Panapto

6.9.8.3. Racks and Rack Accessories: Middle Atlantic

6.9.8.4. Mounts: Chief, Peerless

8.7. ELECTRONIC SAFETY AND SECURITY

8.1.1.7.1 Electronic Access Control and Security (AMAG):

8.1.1.7.1.1 Electronic Access:

7.1.1.1. Submittals and Shop Drawings: Constructor submittals shall include product data, system block diagram(s), door details, controller schedule, door schedule, and camera schedule. Schedules shall reference room numbers, door numbers, and equipment numbers, as applicable.

8.1.1.7.1.2 The access control supplier and integrator shall be Security Equipment Inc.

8.1.1.7.1.3 Vendor identification information is permitted only on access control system panels.

8.1.1.7.1.4 All component hardware shall be 24 volt.

8.1.1.7.1.5 Equipment and components shall be located to allow access for maintenance and inspection.

8.1.1.7.1.6 UL or WH fire-rated doors or frames shall not be modified as to void the label or fire-rating.

8.1.1.7.1.7 Unless otherwise noted, the following electrical components are to be furnished and installed by the access control supplier.

8.1.1.7.1.8 AMAG System:

8.1.1.7.1.8.1 Access control and monitoring systems shall be networked with the existing AMAG Symmetry Enterprise for Central Station managed by Facilities Management.

8.1.1.7.1.8.2 Server(s), central station software, back-up systems, proximity cards, badging station, and printer shall be provided by the Owner.

8.1.1.8.7.1.9 AMAG Panel:

8.1.1.8.7.1.9.1 Panels shall AMAG M2150.
8.1.1.9.7.1.10. **Power Supplies:**

8.1.1.9.1.7.1.10.1. Power supplies for electric latch retraction panic devices shall have battery backup, provided and installed by the Hardware Supplier.

8.1.1.9.2.7.1.10.2. Maintenance access to power supply shall not interfere with door operation.

8.1.1.9.3.7.1.10.3. Power supplies other than for electric latch retraction panic devices shall be Securitron BPSM-24-10 with 7 amp-hour battery backup. Provided and installed by Access Control Contractor.

8.1.1.10.7.1.11. **Emergency Locking Push-Button Switches:**

8.1.1.10.1.7.1.11.1. Safety Technology International, series 2000 and custom labeled 'PUSH TO LOCK DOOR'.

8.1.1.11.7.1.12. **Door Position Switch and Latch Bolt Monitoring:**

8.1.1.11.1.7.1.12.1. Door position switches for wood doors shall be 3/8 inch diameter recessed, similar to GRI model 2020-12.

8.1.1.11.2.7.1.12.2. Door position switches for steel doors shall be 1 inch diameter recessed, similar to GRI model number 184-12.

8.1.1.11.3.7.1.12.3. Latch bolt monitor to be provided with door hardware.

8.1.1.11.4.7.1.12.4. 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. A general door alarm is not acceptable.

8.1.1.12.7.1.13. **Card Readers:**

8.1.1.12.1.7.1.13.1. Card readers shall be HID RP40 proximity type wall-mount or HID RP15 micro-proximity frame-mount.

8.1.1.12.1.1.7.1.13.1.1. Color shall be charcoal gray or black.

8.1.1.12.1.2.7.1.13.1.2. Mounting height shall be 36 inches AFF to centerline.

8.1.1.12.1.3.7.1.13.1.3. Wiegand Interface Modules shall be provided.
8.1.1.12.2-7.1.1.13.2. 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.

8.1.1.13.7.1.1.4. Biometric Reader:

8.1.1.13.1.7.1.1.4.1. Hand geometry readers shall be Schlage Recognition Systems HKCR Handkey with enrollment stations as necessary.

8.1.1.14.7.1.1.5. Request to Exit Motion Detectors:

8.1.1.14.1.7.1.1.15.1. When integral hardware request to exit switches are not possible, motion detectors similar to Bosch DS160 series shall be utilized.

(3) Keyswitch
7.1.1.16. Keyswitch to Stairwell Fire Reentry Card Reader:

7.1.1.16.1. Card reader shall simultaneously unlock required reentry exit stairwell doors, installed and transmit an alarm to University Key and Access Services. Key and Access Services will remotely relock doors.

7.1.1.16.2. Install next to fire panel or in fire command room, shall be Securitron MKA as directed by the Owner and Authority Having Jurisdiction.

7.1.1.16.3. Provide signage to indicate “Fire Department Emergency Access Only”. Mount directly adjacent to card reader adjacent to fire panel.


8.1.1.14.2.7.1.1.16.5. Provide monitor relay in Electronic Access Control and Security system to provide door secure status.

8.1.1.15.7.1.1.17. Cabling and Pathways:

8.1.1.15.1.7.1.1.17.1. Card reader cabling shall be yellow jacket, plenum-rated, continuously labeled ‘Access Control Cable’, similar to CSC model number 112115.

8.1.1.15.2.7.1.1.17.2. Biometric reader cabling shall include all of the following

8.1.1.15.2.1.7.1.1.17.2.1. Yellow jacket, plenum-rated, continuously labeled ‘Access Control Cable’, similar to CSC model number 112115.

8.1.1.15.2.2.7.1.1.17.2.2. Yellow jacket, plenum-rated, continuously labeled ‘Access Control Cable’, similar to Lake Cable P222EPST-04CO

8.1.1.15.2.3.7.1.1.17.2.3. Yellow jacket, plenum-rated, continuously labeled ‘Access Control Cable’, similar to Lake Cable P182CS-04CO
8.1.1.15.3.7.1.1.17.3. Monitored opening cabling shall be yellow jacket, plenum-rated, continuously labeled ‘Access Control Cable’, similar to CSC model number 110200.

8.1.1.15.4.7.1.1.17.4. Pull strings shall be provided in all cabling pathways.

8.1.1.15.5.7.1.1.17.5. Cabling in occupied spaces shall be in conduit. Exposed conduit in occupied spaces shall be painted to match adjacent surfaces.

8.1.1.15.6.7.1.1.17.6. Conduit shall be minimum ¾ inch with pull boxes every 50 feet minimum.

8.1.1.15.7.7.1.1.17.7. Maximum conduit fill shall be 40 percent.

8.1.1.15.8.7.1.1.17.8. Communication cable shall be supported by ITS cable trays, when available. Design Professional shall determine the impact on cable tray and conduit capacity during the Design Development stage of the project and shall review with Owner.

8.1.1.15.9.7.1.1.17.9. When cable trays are not available or have inadequate capacity, J-hooks (spaced at a maximum of 4 feet) or conduit shall be used.

8.1.1.15.10.7.1.1.17.10. ITS closets shall have access control when used as a cabling pass-thru.

8.1.1.15.11.7.1.1.17.11. Wire and cable from the node to all devices at each door shall be continuous, without splices.

8.1.1.16.7.1.1.18. Elevators:

8.1.1.16.1.7.1.1.18.1. Elevator nodes shall be located in the elevator equipment room.

8.1.1.17.7.1.1.19. System startup:

8.1.1.17.1.7.1.1.19.1. Contractor shall conduct a 100 percent device check-out prior to Owner’s demonstration and training. Documentation to be submitted to Owner.

8.1.1.18.7.1.1.20. Record drawings shall be provided to the Owner prior to Owner’s demonstration and training.

8.2.7.2. Video Surveillance Systems:

8.2.1.1.1.1.1. Refer to Section III for information.

7.2.1. Refer to Section III for information.

8.3.7.3. Security Alarm/Intrusion Alarm Systems:

8.3.1.7.3.1. Refer to Section III for information.

8.4.7.4. Fire Alarm and Detection Systems:
8.4.1.7.4.1. General

8.4.1.7.4.1.1. Finished back boxes shall be provided by equipment supplier for any surface-mounted pull stations or signaling devices.

8.4.1.7.4.1.2. All detection devices shall be placed in easily accessible locations. Smoke, heat, audio visual devices, etc. shall be mounted on solid surfaces.

8.4.1.7.4.1.3. Contractor Constructor shall assume responsibility and control of the building fire alarm system when the project affects 10 percent or more of the existing fire detection and notification devices.

8.4.1.7.4.1.4. The Contractor Constructor shall coordinate with Department of Public Safety if off-site reporting is required.

8.4.1.7.4.1.5. The Contractor Constructor shall follow the Fire Safety acceptance testing procedures noted in the Fire Alarm and Detection Specification.

8.4.1.7.4.1.6. The building shall be 100 percent tested with Fire Safety prior to project completion.

8.4.2.7.4.2. Fire Alarm Control Panels (FACP):

8.4.2.7.4.2.1. Coordinate FACP location with local authority having jurisdiction and Owner.

8.4.2.7.4.2.2. All new FACP shall be Simplex 4100ES. University Housing projects shall use Notifier 3030. No other substitutions shall be allowed.

8.4.2.7.4.2.3. 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.

8.4.2.7.4.2.4. Panel door locks shall be front mounted.

8.4.2.7.4.2.5. Fire alarm panel shall be an intelligent analog system with voice.

8.4.2.7.4.2.6. Top of FACP shall be 6 feet AFF and shall have minimum 2 feet clearance on each side.

8.4.2.7.4.2.7. When multiple FACPs are required, set panels 6 inches apart while maintaining 2 feet clearance on each side.

8.4.2.7.4.2.8. Provide Owner all hardware devices and software for off-line programming, complete with manuals and software files.

8.4.2.7.4.2.9. Provide locking breaker on 120 volt AC power source and label “Fire Alarm”. Permanently paint breaker red.

8.4.2.7.4.2.10. Fire alarm control panel power shall be supplied dedicated circuit(s).

8.4.2.7.4.2.11. Single pole, 120/277V switches shall be installed within the fire alarm control panel to disconnect all AC and battery power.
8.4.2.12. A duplex receptacle, on a circuit separate from the fire alarm panel, shall be installed under the main fire alarm control panel.

8.4.2.13. 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.

8.4.2.14. Coordinate location with Sprinkler System Fire Department Connection.

8.4.3.7.4.3. Releasing Panels:

8.4.3.1.7.4.3.1. Releasing panel shall be Simplex 4100ES.

8.4.3.2.7.4.3.2. Separate Simplex 4100ES releasing panel is required for releasing other than sprinkler systems, such as Novec 1230.

8.4.4.7.4.4. Initiation Devices:

8.4.4.1.7.4.4.1. Pull Stations:

8.4.4.1.1.7.4.4.1.1. Pull stations shall be Simplex 4099-9001.

8.4.4.2.7.4.4.2. Smoke Detectors:

8.4.4.2.1.7.4.4.2.1. Smoke detectors shall not be located within 3 feet of an air vent.

8.4.4.3.7.4.4.3. Duct Detectors:

8.4.4.3.1.7.4.4.3.1. Provide a labeled test switch with LED. This test switch shall be installed for each duct smoke detector. This switch shall be installed at a mounting height of 48 to 72 inches AFF.

8.4.5.7.4.5. Annunciation Devices:

8.4.5.1.7.4.5.1. General

8.4.5.1.1.7.4.5.1.1. Contractor shall not mount a separate visual device and separate speaker side-by-side.

8.4.5.2.7.4.5.2. Strobe Devices:

8.4.5.2.1.7.4.5.2.1. 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.

8.4.5.3.7.4.5.3. Fire Department Connection Horn Strobe:

8.4.5.3.1.7.4.5.3.1. Provide Potter Sash 24 number 10000755 Sprinkler / Siren Strobe

8.4.5.3.2.7.4.5.3.2. Locate directly above the fire department sprinkler connection on the exterior of the building.

8.4.6.7.4.6. Other Devices:
7.4.6.1. Refer to Section III for information.

8.4.7.1.1.1. Refer to Section III for information.

8.4.8.7.4.7. Raceways, Boxes and Cables:

8.4.8.7.4.7.1. Conventional wiring shall be solid, THHN.

8.4.8.7.4.7.2. Insulate all grounding shields with 3M number 130C rubber tape.

8.4.8.7.4.7.3. Junction and pull boxes shall be a minimum size of 4 11/16 inches square by 2 1/8 inches deep.

8.4.8.7.4.7.4. Fire alarm and detection conduits shall be red.

8.4.8.7.4.7.5. Line voltage (120 volt AC) shall be run in separate conduit.

8.4.8.7.4.7.6. Spare conductors shall not be allowed in conduit or junction boxes.

8.4.8.7.4.7.7. Surface wireway is prohibited.

8.4.8.7.4.7.8. Box extensions shall not be permitted on new construction.

8.4.8.7.4.7.9. Splicing shall not be allowed in device mounting boxes.

8.4.8.7.4.7.10. Wiring size and color shall be per the Owner’s specifications.

7.5. Area of Refuge Phone:

7.5.1. Provide cabling for area of refuge telephone if required by Code.

7.5.2. GIA-TRONICS Telephone shall be provided by Owner and installed by Constructor. Constructor to contact Owner for rough-in template.

8.5.7.6. Automatic External Defibrillator (AED):

8.5.7.6.1. AED shall be Philips HeartStart Onsite model HS-1 with Onsite Semi-Rigid Standard Carry Case and Philips Fast Response Kit.

8.5.7.6.2. Cabinet shall be either:

8.5.7.6.2.1. JL Industries 1400 Series, Recessed, Semi-Recessed or Surface Mounted. Cabinet shall be equipped with JL Commander Alarm feature.

8.5.7.6.2.2. Modern Metal Products 180 Series, Recessed, Semi-Recessed or Surface Mounted. Cabinet shall be equipped with MMP alarm feature.

END OF SECTION IV – OUTLINE SPECIFICATIONS AND DETAILS
AHU CONDENSATE DRAIN DRAW-THRU AND BLOW THRU DETAIL

DRAIN PAN TRAP DETAIL FOR DRAW-THRU UNIT

H' DIMENSION TO BE MINIMUM OF 1\(\frac{1}{2}\)" PLUS TOTAL STATIC PRESSURE

DRAIN PAN TRAP DETAIL FOR BLOW-THRU UNIT

H' DIMENSION TO BE MINIMUM OF 1\(\frac{1}{2}\)" PLUS TOTAL STATIC PRESSURE
## BUILDING FIRE ALARM SYSTEM DETAILS

**SIMPLEX 4100 U**

- Adler Journalism and Mass Communication Building
- Art Building West
- Beckwith Boat House
- Boyd Law Building
- Cambus Maintenance Facility
- Campus Recreation and Wellness Center
- Carver-Hawkeye Arena
- Chemistry Building
- Chilled Water Plant 2 (West)
- 111 Church St
- 700 S. Clinton St.
- College of Public Health Building
- Communications Center
- Dental Science Building (West Wing)
- Eckstein Medical Research Building
- Engineering Research Facility
- English Philosophy Building
- Gilmore Hall
- Hancher, Voxman, Clapp
- Hardin Library for Health Sciences
- Pappajohn Biomedical Discovery Building
- Hydraulics Wave Basin Facility
- Iowa Memorial Union
- Jefferson Building
- Jessup Hall
- Kinnick Stadium
- Library (Main)
- Lindquist Center South
- Lindquist Center North
- Maclean Hall
- Madison Street Services Building
- Medical Laboratories
- Music West - Interim Building
- Nursing Building
- Information Technology Facility
- Oakdale Environmental Management Facility
- Oakdale Power Plant
- Multi Tenant Facility (POD A-B)
## BUILDING FIRE ALARM SYSTEM DETAILS

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<td>STUIT HALL</td>
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<td>PHILLIPS HALL</td>
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<td>POMERANTZ CENTER</td>
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<td>POWER PLANT</td>
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<td>RECREATION BUILDING</td>
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<td>RIVERSIDE RECITAL HALL (ST. THOMAS MOORE)</td>
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<td>STUDIO-ARTS</td>
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<td>MEDICAL RESEARCH CENTER</td>
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<td>NORTH CAMPUS PARKING AND CHILLED WATER FACILITY</td>
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<tr>
<td>OAKDALE STUDIO A</td>
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<td>SUBSTATION U</td>
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<td>SUBSTATION L</td>
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<td>BECKER COMMUNICATION STUDIES BUILDING</td>
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<td>CALVIN HALL</td>
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<td>HOSPITAL PARKING RAMP 1</td>
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<td>MOSSMAN BUSINESS SERVICES BUILDING</td>
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<td>NEWTON ROAD RAMP</td>
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<td>OAKDALE WASTE STORAGE FACILITY (AT OAKDALE ENVIRONMENTAL MANAGEMENT FACILITY)</td>
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<tr>
<td>INSTITUTE FOR RURAL AND ENVIRONMENTAL HEALTH</td>
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<td>LAUNDRY</td>
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### BUILDING FIRE ALARM SYSTEM DETAILS

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| MULTI TENANT FACILITY (POD C)  
MULTI TENANT FACILITY (POD D)  
MULTI TENANT FACILITY (POD E)  
2556 CROSSPARK ROAD  
2660 CROSSPARK ROAD  
PHYSIOLOGY RESEARCH LABORATORY  
TECHNOLOGY INNOVATION CENTER  
109 RIVER STREET  
SHAMBAUGH HOUSE  
SOUTH QUAD  
WATER PLANT |  

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BLANK HONORS CENTER  
KARRO ATHLETIC HALL OF FAME  
MACBRIDE HALL  
MEDICAL RESEARCH FACILITY  
HAWKEYE TENNIS AND RECREATION COMPLEX  
TROWBRIDGE HALL  
WENDELL JOHNSON SPEECH AND HEARING CENTER |  

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| SCIENCES LIBRARY  
BIOLOGY BUILDING EAST  
BIOLOGY BUILDING (OLD)  
BOWEN SCIENCE BUILDING  
CARVER BIOMEDICAL RESEARCH BUILDING  
DENTAL SCIENCE BUILDING  
FIELD HOUSE  
HYDRAULICS LABORATORY  
IOWA ADVANCED TECHNOLOGY LABORATORIES  
MEDICAL EDUCATION BUILDING |  

# BUILDING FIRE ALARM SYSTEM DETAILS

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<td>NORTH HALL</td>
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<td>PHARMACY BUILDING</td>
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<td>SCHAEFFER HALL</td>
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<td>SEAMANS CENTER</td>
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<td>WESTLAWN</td>
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<th>EDWARDS EST-3</th>
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<tr>
<td>COLLEGE OF MEDICINE ADMINISTRATION BUILDING</td>
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<tr>
<td>ECKSTEIN MEDICAL RESEARCH BUILDING</td>
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<tr>
<td>MEDICAL EDUCATION RESEARCH FACILITY</td>
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</table>
1. Install piping and unions to allow for ease of coil removal.
2. 2-way control valve.
3. Pipe multirow coils for counter flow through coil.
4. Calibrated balance valves to be sized to provide final balance at mid-range of valve with a head loss of five feet.
5. Balance valves must be oriented so that test ports are on the side or top of the device with a minimum of four inches clearance to access port ends.
6. Temperature sensor to report to BAS
REFERENCE NOTE:

1. INSTALL PIPING AND UNIONS TO ALLOW FOR COIL REMOVAL.
2. BRANCH LINES TO BE OFF SIDE OR TOP OF SUPPLY/RETURN MAINS.
3. PIPE MULTIROW COILS FOR COUNTER FLOW THROUGH COIL.
4. CALIBRATED BALANCE VALVES SHALL BE SIZED IN ACCORDANCE WITH THE MANUFACTURE’S RECOMMENDATIONS PROVIDING ACCURATE MEASUREMENT OF THE FLOW DESIGNED FOR THE COIL. (TYP) BALANCE VALVES SHALL BE ORIENTED SO THAT TEST PORTS ARE ON THE SIDE OR TOP OF THE DEVICE WITH A MINIMUM OF FOUR INCHES CLEARANCE TO ACCESS PORT ENDS. (TYP)
5. TEMPERATURE SENSOR TO REPORT TO THE BAS.

CHILLED WATER COIL (CC) PIPING

2015  N.T.S.  CW-CC-2
CHILLED WATER DIFFERENTIAL PRESSURE TRANSDUCER DETAILS
(Across Chilled Water Delta P Value) Detail

- Ball Valve (Typ)
- Pete’s Plug (Typ)
- Delta P Valve
- Flow

- DPT
  - Must be installed horizontal to valve network

- P-1
- P-2
- P-3

(P-1, 2, 3 Pete’s Plug)
DIFFERENTIAL PRESSURE TRANSUDER
(Across Supply and Return Mains) Detail

BALL VALVE (TYP)

PETE'S PLUG (TYP)

SUPPLY MAIN

MUST BE INSTALL HORIZONTAL TO VALVE NETWORK

DPT

UNION (TYP)

RETURN MAIN
DUCT SYSTEM DETAIL

Detail - Differential Pressure Transducer
(Across Supply and Return Mains)

2015  N.T.S.  DIF-PRES-TRAN-SUP-RET
DETAIL - DIFFERENTIAL PRESSURE TRANSDUCER
(ACROSS CHILLED WATER DELTA P VALVE)
END OF MAIN DRIP STATION PIPING (BUILDING) DETAIL

- LAST BRANCH TAKE OFF
- MAIN STEAM SUPPLY LINE
- CONDENSATE RETURN LINE
- CHECK VALVE
- 1/2" TEST STATION ASSEMBLY
- UNION (TYP.)
- STEAM TRAP
- EXCENTRIC REDUCER
- STRAINER ASSEMBLY
- GATE VALVE (TYP.)
- DRIP LEG ASSEMBLY
- 1/2" BLOW DOWN
END OF MAIN DRIP STATION PIPING (BUILDING)

2015 N.T.S. M-D-76-DRIP STATION
ENERGY IMPACT STATEMENT

Building Energy Summary:

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<tr>
<td>Project Affected Gross Area (GSF)</td>
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<tr>
<td>Annual Total Building Energy Use (MMBtu/year)</td>
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<tr>
<td>Annual Total Building Energy Use per GSF (Btu/year/GSF)</td>
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Energy Statistics:

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<tr>
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<td>Misc. Equipment (kWh)</td>
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<tr>
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<tr>
<td>Summer Peak Load (lbs/hr)</td>
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</tr>
<tr>
<td>Winter Peak Load (lbs/hr)</td>
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<tr>
<td>Annual Consumption (MMBtu/yr)</td>
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</tr>
<tr>
<td>Heating (MMBtu/yr)</td>
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<td>Humidification (MMBtu/yr)</td>
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<td>Process (MMBtu/yr)</td>
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<td>Winter Peak Load (lbs/hr)</td>
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<td>Winter Peak Load (tons/hr)</td>
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<tr>
<td>Annual Consumption (MMBtu/hr)</td>
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<td>Domestic Cold Water</td>
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<td>Peak Demand (GPM)</td>
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<tr>
<td>Peak Sanitary Demand (GPM)</td>
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<td>Annual Consumption (Mil gal/yr)</td>
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<tr>
<td>Sanitary Sewer (Mil gal/yr)</td>
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<td>Cooling Tower Evap. (Mil gal/yr)</td>
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<td>Cooling Tower Blowdown (Mil gal/yr)</td>
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<td>Domestic Hot Water</td>
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<td>Annual Consumption (Mil gal/yr)</td>
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<tr>
<td>Peak Demand (Therms/hr)</td>
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<tr>
<td>Annual Consumption (Therms/yr)</td>
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<tr>
<td>Storm Drainage System</td>
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<tr>
<td>Design Storm Peak Volume (GPM)</td>
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</table>
FUME HOOD INSTALLATION DETAIL

WELDED STAINLESS STEEL EXHAUST DUCT

1/2" CW(L)

FUME HOOD CONTROL DAMPER

AFMS

1/2" GAS, AIR, VAC AS REQUIRED W/ISOLATION VALVES.

PIPING TO BE IN END CAVITY OF FUME HOOD.

AIR FLOW CONTROLLER/MONITOR WITH LOCAL ALARM (BY DDC CONTRACTOR)

CUP SINK

VAC

CW

ACID WASTE 1 1/2"

AW LINE

NOTES: 1. TYPICAL FUMEHOOD INSTALLATION INDICATED, REFER TO PLANS AND FUME HOOD SUPPLIER SHOP DRAWINGS FOR SPECIFIC REQUIREMENTS.

2. LAB UTILITY FIXTURES FURNISHED AND PRE PIPED BY FUMEHOOD SUPPLIER; ACID WASTE AND VENT PIPING BY CONTRACTOR.

3. CONTRACTOR IS RESPONSIBLE FOR ALL FINAL CONNECTIONS AND INDICATED VALVING.

4. PIPE VACUUM BREAKER ON OUTLET SIDE OF CW VALVE, ROUTE PIPING IN THE SIDE WALL OF FUMEHOOD; MOUNT VACUUM BREAKER ON EXTERIOR OF FUME HOOD ON THE SIDE OF FRONT CORNER POST IN AN ACCESSIBLE LOCATION, BELOW CEILING.

5. CONFIRM LOCATION OF UTILITY CONNECTION SHOWN ON PLANS WITH ARCHITECTURAL AND APPROVED CASework SHOP DRAWINGS.

NOTES TO DESIGNER:

1. WHEN ONE SIDE OF HOOD IS AGAINST A WALL OR OBSTRUCTION LOCATE ALL LAB UTILITY FIXTURES AND CONTROLS ON THE OPEN SIDE.

2. PROVIDE A MINIMUM AIRFLOW OF 40 CFM PER LINEAR FOOT OF HOOD WIDTH (NFPA 45), COORDINATE WITH FUME HOOD MANUFACTURER AND FUME HOOD CONTROL REQUIREMENTS.
All steam valves shall utilize a 1/3–2/3 control valve arrangement and be capable of operating at building peak and minimum heating loads. If a 1/3–2/3 valve arrangement is not capable of meeting this performance range, a 3–valve arrangement shall be utilized.
1. Install piping and unions to allow for coil removal.
2. Branch lines to be off bottom of supply/return mains.
3. Pipe multi-row coils for counter-flow through coil.
4. Calibrated balance valves to be sized to provide final balance at mid-range of valve with a head loss of 5 feet.
5. Balance valves must be oriented so that test ports are on the side or top of the device with a minimum of four inches clearance to access port ends.
NOTES:

1. INSTALL PIPING AND UNIONS TO ALLOW FOR COIL REMOVAL.

2. BRANCH LINES TO BE OFF SIDE OR TOP OF SUPPLY/RETURN MAINS.

3. PIPE MULTIROW COILS FOR COUNTER FLOW THROUGH COIL.

4. CALIBRATED BALANCE VALVES SHALL BE SIZED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS PROVIDING ACCURATE MEASUREMENT OF THE FLOW DESIGNED FOR THE COIL. (TYP) BALANCE VALVES SHALL BE ORIENTED SO THAT TEST PORTS ARE ON THE SIDE OR TOP OF THE DEVICE WITH A MINIMUM OF FOUR INCHES CLEARANCE TO ACCESS PORT ENDS. (TYP)

5. UNITS 3,000 CFM AND ABOVE MUST USE A 1/3 - 2/3 VALVE ARRANGEMENT.

---

HOT WATER (GLYCOL) PREHEAT COIL PIPING

2015  N.T.S  HW-PHC

APPENDICES  300
HOT WATER PREHEAT/REHEAT COIL PIPING (2-WAY VALVE) DETAIL

1. Install piping and unions to allow for coil removal.
2. Branch lines to be off bottom of supply/return mains.
3. Pipe multirow coils for counter flow through coil.
4. Balance valves to be sized to provide final balance at mid-range of valve with a head loss of 5 feet.
5. Balance valves must be oriented so that test ports are on the side or top of the device with a minimum of four inches clearance to access port ends.
NOTES:
1. INSTALL PIPING AND UNIONS TO ALLOW FOR COIL REMOVAL.
2. BRANCH LINES TO BE OFF SIDE OR TOP OF SUPPLY/RETURN MAINS.
3. PIPE MULTIROW COILS FOR COUNTER FLOW THROUGH COIL.
4. CALIBRATED BALANCE VALVES SHALL BE SIZED IN ACCORDANCE WITH THE MANUFACTURER'S
   RECOMMENDATIONS PROVIDING ACCURATE MEASUREMENT OF THE FLOW DESIGNED FOR THE COIL (TYP).
   BALANCE VALVES SHALL BE ORIENTED SO THAT TEST PORTS
   ARE ON THE SIDE OR TOP OF THE DEVICE WITH A MINIMUM
   OF FOUR INCHES CLEARANCE TO ACCESS PORT ENDS. (TYP)

HOT WATER REHEAT COIL PIPING (2 - WAY VALVE)

2015
N.T.S
HW-RHC-1
CALCULATING EXPANSION TANK CHARGE PRESSURE:
Riser Height is the distance in feet from the bottom of the expansion tank to the highest point of the system piping above it.

\[
\text{Riser Height in ft.} + 5\;\text{psi} = \text{Expansion tank bladder charge pressure} - \frac{2.31}{2.31}
\]

Minimum charge pressure for all systems shall be at least 12 psi.

Expansion tank bladder charge pressure must be set with the expansion tank drained of all fluids and vented to atmosphere.

The expansion tank charge pressure shall also be the pressure set for the automatic fill valve on the system.
VALVE MUST BE LOCATED SO IT CAN BE ACCESSIBLE WITHOUT THE AID OF A LADDER.

CALCULATING EXPANSION TANK CHARGE PRESSURE:

• RISER HEIGHT = DISTANCE IN FEET FROM THE BOTTOM OF THE EXPANSION TANK TO THE HIGHEST POINT OF SYSTEM PIPING ABOVE IT.

\[
\left( \frac{\text{RISER HEIGHT IN FEET}}{2.31} \right) + 5 \text{ psi} = \text{EXPANSION TANK BLADDER CHARGE PRESSURE}
\]

• MINIMUM CHARGE PRESSURE FOR ALL SYSTEMS SHALL BE AT LEAST 12 PSI.

• EXPANSION TANK BLADDER CHARGE PRESSURE MUST BE SET WITH THE EXPANSION TANK DRAINED OF ALL FLUIDS AND VENTED TO ATMOSPHERE.

• THE EXPANSION TANK CHARGE PRESSURE WILL ALSO BE THE PRESSURE SET FOR THE AUTOMATIC FILL VALVE ON THE SYSTEM.

HYDRONIC SYSTEM EXPANSION TANK DETAIL

2015 NTS HYD–EXPAN–TANK
INTERIOR SIGNAGE DETAILS

FIGURE 1 – SIGN LOCATION PLAN
# INTERIOR SIGNAGE DETAILS

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<th>Sign Type</th>
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<th>Notes</th>
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**FIGURE 2 – SIGN SCHEDULE**
INTERIOR SIGNAGE DETAILS

EXHIBIT 1 – SIGN TYPE DIRECTORY

EXHIBIT 2 – SIGN TYPE ELEVATOR DIRECTORY
INTERIOR SIGNAGE DETAILS

EXHIBIT 3 – SIGN TYPE DEPARTMENT DIRECTORY

Biomedical Research Group
David Smith, Professor
Robert Jones, Research Assistant, W304
Susan Miller, Research Assistant, W315
David Smith, Professor, W304

single changeable insert

modular inserts

EXHIBIT 4 – SIGN TYPE DEPARTMENT DIRECTORY
INTERIOR SIGNAGE DETAILS

EXHIBIT 5 – SIGN TYPE OVERHEAD DIRECTIONAL

EXHIBIT 6 – SIGN TYPE WALL MOUNT DIRECTIONAL
INTERIOR SIGNAGE DETAILS

EXHIBIT 7 – SIGN TYPE WALL MOUNT DIRECTIONAL

EXHIBIT 8 – SIGN TYPE WALL MOUNT DIRECTIONAL
INTERIOR SIGNAGE DETAILS

EXHIBIT 9 – SIGN TYPE PROJECTING FLAG IDENTIFICATION

EXHIBIT 10 – SIGN TYPE DEPARTMENT IDENTIFICATION PLAQUE

Offices of Iowa Institute for Biomedical Imaging
INTERIOR SIGNAGE DETAILS

EXHIBIT 11 – SIGN TYPE ROOM NUMBER

EXHIBIT 12 – SIGN TYPE ROOM IDENTIFICATION
EXHIBIT 13 – SIGN TYPE CONFERENCE ROOM IDENTIFICATION
EXHIBIT 14 – SIGN TYPE OFFICE IDENTIFICATION
INTERIOR SIGNAGE DETAILS

EXHIBIT 15 – SIGN TYPE OPEN OFFICE WORK STATION IDENTIFICATION

EXHIBIT 16 – SIGN TYPE SYMBOL IDENTIFICATION
INTERIOR SIGNAGE DETAILS

W229

UNISEX

tactile copy
Grade II braille
printed symbol

Grade II braille

EXHIBIT 16A – SIGN TYPE MULTIPLE SYMBOL IDENTIFICATION
INTERIOR SIGNAGE DETAILS

EXHIBIT 17 – SIGN TYPE LARGE SYMBOL IDENTIFICATION

EXHIBIT 18 – SIGN TYPE ENTRANCE NUMBER PLAQUE
INTERIOR SIGNAGE DETAILS

EXHIBIT 19 – SIGN TYPE LOADING DOCK ENTRANCE NUMBER PLAQUE

EXHIBIT 20 – SIGN TYPE CODE SPECIFIED INFORMATION
LANDSCAPING PLANTING DETAIL: CONIFEROUS TREE

1. Plant tree in planting hole. Backfill hole with scoop soil from trunk base.
2. Place tree on unexcavated or undisturbed soil.
3. Water to completely soak into soil before planting.
4. Partially backfill root ball and water in tree. Allow tree to settle.
5. Finish backfilling.
6. Pressure so that root ball does not shift.
7. Trim soil around root ball base flush with foot line.

Additional Notes:
- Tree remains should be extended 6" beyond the tree migration line.
- Remove all packaging and labels after landscape.
- Set tree plumb using horizontal to warrant.
- Tree trunk should be visible at the top of the planted show that the trunk plane is visible. Each tree must be at least 2' higher than grade. Each grade must be 2' X root ball diameter.
LANDSCAPING PLANTING DETAIL: DECIDUOUS TREE

1. Scoop out a planting hole 6-8 times the diameter of the rootball.
2. Set the rootball 1-2 feet above final grade.
3. Place a 2-inch layer of organic mulch around the trunk base.
4. Water the tree daily for the first year.
5. Prune the tree as necessary to maintain a healthy shape.

SET TREE PLUMB AND MELTIC舉辦 THROUGHOUT WARTUNITY.
ARCHITECT APPROVAL AND LABELS ARE REQUIRED AFTER LANDSCAPE.

APPENDICES
LANDSCAPING PLANTING DETAIL: ROOT BALL INSTALLATION

1. Carefully cut and remove bottom of wire cage before placing in planting hole.
2. Completely remove remaining wire cage, twine, burlap, and all packaging before placing planting soil.
3. Partially backfill planting hole to stabilize tree.
**LANDSCAPING PLANTING DETAIL: TREE STAKING**

**NOTES:**

1. Steel posts to be notched or drilled.
2. Regardless of ground slope.
3. Tree staking is required for all deciduous trees.
4. Tree staking is required for all evergreen trees.
5. Use 2 stakes.
6. Plant wire, canvas or 40 mil polypropylene.
7. Attach with 10 ga. wire.
8. Thick and 1½ wide straps.
9. Remove within 1 year.

**STEEL POSTS**
- Width: 6 in.
- Height: 9 ft.
- Width of base: 6 in.
- Height of base: 9 ft.

**STAKING ORGANIZATION CHART**

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<th>Height (ft)</th>
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<tr>
<td>Material</td>
<td>Post</td>
<td>Panel</td>
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<tr>
<td>Width (in)</td>
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<td>6</td>
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<tr>
<td>Color</td>
<td>Brown</td>
<td>Green</td>
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**PLANT VIEW**

- Place stakes 6 ft beyond tree's drip line.

**ELEVATION CHART**

- Steel post, see chart.
LANDSCAPING POST AND CHAIN FENCE DETAILS

**Single Chain**

NOTE: POST HEIGHT & CHAIN SAG TEMPLATES TO BE USED

**Double Chain**
## LANDSCAPING PROHIBITED PLANT LIST

### Trees:

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Botanical Name</th>
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<tbody>
<tr>
<td>‘Autumn Blaze’ Maple</td>
<td>Acer hybrid</td>
<td>Norway Maple</td>
<td>Acer platanoides</td>
</tr>
<tr>
<td>Tree of Heaven</td>
<td>Ailanthus altissima</td>
<td>Cockspur Hawthorn</td>
<td>Crataegus crusgalli</td>
</tr>
<tr>
<td>Russian Olive</td>
<td>Elaeagnus angustifolia</td>
<td>Autumn Olive</td>
<td>Elaeagnus umbellatta</td>
</tr>
<tr>
<td>All Ash species</td>
<td>Fraxinus sp.</td>
<td>Austrian Pine</td>
<td>Pinus nigra</td>
</tr>
<tr>
<td>Corktree species (female)</td>
<td>Phellodendron sp.</td>
<td>Ginkgo (female cultivars)</td>
<td>Ginkgo biloba</td>
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<tr>
<td>Scotch Pine</td>
<td>Pinus sylvestris</td>
<td>White Poplar</td>
<td>Populus alba</td>
</tr>
<tr>
<td>Poplar Hybrids</td>
<td>Populus sp.</td>
<td>Purpleleaf Sandcherry</td>
<td>Prunus x cistena</td>
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<tr>
<td>Schubert Cherry</td>
<td>Prunus padus</td>
<td>Black Locust</td>
<td>Robinia pseudoacacia</td>
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<tr>
<td>Buckthorn (non-native species)</td>
<td>Rhamnus sp.</td>
<td>Willow (non-native species)</td>
<td>Salix sp.</td>
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<tr>
<td>Siberian Elm</td>
<td>Ulmus pumila</td>
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### Shrubs:

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<th>Botanical Name</th>
<th>Common Name</th>
<th>Botanical Name</th>
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</thead>
<tbody>
<tr>
<td>Barberry</td>
<td>Berberis sp.</td>
<td>Burning Bush</td>
<td>Euonymus alatus</td>
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<tr>
<td>Honeysuckle (non-native species)</td>
<td>Lonicera sp.</td>
<td>European Cranberry Viburnum</td>
<td>Viburnum opulus</td>
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<tr>
<td>Privet species</td>
<td>Ligustrum sp.</td>
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### Vines:

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<th>Botanical Name</th>
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</thead>
<tbody>
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<td>Porcelainberry</td>
<td>Amelopsis brevipeduculata</td>
<td>Oriental Bittersweet</td>
<td>Celastrus orbiculatus</td>
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<tr>
<td>Crownvetch</td>
<td>Coronilla varia</td>
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<td>Lythrum salicaria</td>
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<tr>
<td>Common Name</td>
<td>Botanical Name</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>White Fir</td>
<td>Picea glauca</td>
</tr>
<tr>
<td>Norway Spruce</td>
<td>Picea abies 'Fastigate Compacta'</td>
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<tr>
<td>Black Hills Spruce</td>
<td>Picea abies 'Fastigate Compacta'</td>
</tr>
<tr>
<td>Serbian Spruce</td>
<td>Pinus nigra</td>
</tr>
<tr>
<td>Blue Spruce</td>
<td>Pinus nigra</td>
</tr>
<tr>
<td>Japanese Dwarf White Pine</td>
<td>Pinus parviflora</td>
</tr>
<tr>
<td>Western White Pine</td>
<td>Picea abies 'Fastigate Compacta'</td>
</tr>
<tr>
<td>White Cypresse</td>
<td>Thuja occidentalis</td>
</tr>
<tr>
<td>Shawnee Brave Cypress</td>
<td>Chamaecyparis thyoides</td>
</tr>
<tr>
<td>Botanical Name</td>
<td>Common Name</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Acer buergeranum</td>
<td>Trident Maple</td>
</tr>
<tr>
<td>Acer griseum</td>
<td>Paperbark Maple</td>
</tr>
<tr>
<td>Acer shirasawan × gracilis 'Robin'</td>
<td>Skeeter's Broom</td>
</tr>
<tr>
<td>Acer palmatum cultivars</td>
<td>Japanese Maple</td>
</tr>
<tr>
<td>Acer rubrum cultivars</td>
<td>Red Maple (other than Autumn Blaze)</td>
</tr>
<tr>
<td>Acer tridentum</td>
<td>Three-flower Maple</td>
</tr>
<tr>
<td>Amelanchier × grandiflora 'Autumn Brilliance'</td>
<td>Autumn Brilliance Serviceberry</td>
</tr>
<tr>
<td>Asimina triloba</td>
<td>Common Paw Paw</td>
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<tr>
<td>Carpinus caroliniana</td>
<td>American Hornbeam</td>
</tr>
<tr>
<td>Celtis occidentalis</td>
<td>Hackberry</td>
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<tr>
<td>Ceris canadensis</td>
<td>Eastern Redbud (single stem)</td>
</tr>
<tr>
<td>Cinnamomum pinatifolium</td>
<td>Red Cinnamomum</td>
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<tr>
<td>Corylus colurna</td>
<td>Turkish Filbert</td>
</tr>
<tr>
<td>Eucommia ulmoides</td>
<td>Hardy Rubber Tree</td>
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<tr>
<td>Fagus grandifolia</td>
<td>American Beech</td>
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<tr>
<td>Fagus sylvatica</td>
<td>European Beech</td>
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<tr>
<td>Fagus sylvatica 'Riversi'</td>
<td>River Purple Beech</td>
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<td>Ginkgo biloba 'Autumn Gold'</td>
<td>Autumn Gold Ginkgo</td>
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<tr>
<td>Ginkgo biloba 'Princeton Sentry'</td>
<td>Princeton Sentry Ginkgo</td>
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<tr>
<td>Gleditsia triacanthos var. Inermis 'Skycole'</td>
<td>Skyline Honeylocust</td>
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<tr>
<td>Glycineus dioicus</td>
<td>Kentucky Coffee Tree male cultivars only</td>
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<tr>
<td>Heptacodium miconoides</td>
<td>Seven Son Flower</td>
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<tr>
<td>Koelreuteria paniculata</td>
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<tr>
<td>Liquidambar styradiflua</td>
<td>American Sweetgum</td>
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<tr>
<td>Liquidambar styradiflua 'Slender Silhouette'</td>
<td>Slender Silhouette Sweetgum</td>
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<tr>
<td>Maackia amurensis</td>
<td>Amur Maackia</td>
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<tr>
<td>Magnolia acuminata</td>
<td>Cucumber Magnolia</td>
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<td>Phellodendron amurense 'Macho'</td>
<td>Macho Cork Tree</td>
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<tr>
<td>Prunus maackii</td>
<td>Amur Choke Cherry</td>
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<tr>
<td>Prunus sargentii</td>
<td>Sargent Cherry</td>
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<tr>
<td>Quercus bicolor</td>
<td>Swamp White Oak</td>
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<tr>
<td>Quercus cocinea</td>
<td>Scarlet Oak</td>
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<tr>
<td>Quercus imbricaria</td>
<td>Shingle Oak</td>
</tr>
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<td>Quercus macrocarpa</td>
<td>Bur Oak</td>
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<tr>
<td>Quercus mublenbergi</td>
<td>Chinkapin Oak</td>
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<tr>
<td>Syringa reticulata cultivars</td>
<td>Japanese Tree Lilac</td>
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<tr>
<td>Ulmus americana 'New Horizon'</td>
<td>New Horizon Elm + disease resistant elms</td>
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<tr>
<td>Ulmus americana 'Princeton'</td>
<td>Princeton Elm</td>
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<tr>
<td>Ulmus parvifolia 'Frontier'</td>
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## Landscaping Recommended Plant List: Shrub and Perennial

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Height Width</th>
<th>Light Requirement</th>
<th>Soil</th>
<th>Growth</th>
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<td><strong>Common</strong></td>
<td><strong>Name</strong></td>
<td><strong>Height Width</strong></td>
<td><strong>Light Requirement</strong></td>
<td><strong>Soil</strong></td>
<td><strong>Growth</strong></td>
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<td>False spirea</td>
<td>Potentilla fruticosa</td>
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<td>Full Sun/Full Shade</td>
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<td>Fast</td>
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<tr>
<td>Tickseed 'Moonbeam' 'Zagreb'</td>
<td>Coreopsis verticillata</td>
<td>12-18&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Wild Geranium</td>
<td>Dianthus</td>
<td>6-12&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Fast</td>
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<td>Geranium</td>
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<td>Average</td>
<td>Fast</td>
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<tr>
<td>Hosta varieties</td>
<td>Hosta</td>
<td>18-24&quot;</td>
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<td>Average</td>
<td>Slow</td>
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<td>Russian Sage</td>
<td>Perovskia atriplicifolia</td>
<td>24-48&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Fast</td>
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<td>Selwyn upright varieties</td>
<td>Salvia</td>
<td>18-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Sambucus nigra 'Black Lace'</td>
<td>Sambucus nigra</td>
<td>6-12'</td>
<td>Part Sun</td>
<td>Average</td>
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### Shrub and Perennial Varieties

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Botanical Name</th>
<th>Height Width</th>
<th>Light Requirement</th>
<th>Soil</th>
<th>Growth</th>
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<td>Acacia variegata</td>
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<td>2-8'</td>
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<td>Average</td>
<td>Slow</td>
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<tr>
<td>Ailanthus altissima 'Cheesem'</td>
<td>Ailanthus altissima</td>
<td>3-5'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>A. 'Regent'</td>
<td>A. 'Regent'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
<td></td>
</tr>
<tr>
<td>A. 'Green Mountain'</td>
<td>A. 'Green Mountain'</td>
<td>1.5-2'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Amelanchier canadensis</td>
<td>Amelanchier canadensis</td>
<td>2-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Amelanchier</td>
<td>Amelanchier</td>
<td>1-2'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Berberis thunbergii 'Regent'</td>
<td>Berberis thunbergii 'Regent'</td>
<td>8-10'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<td>Buxus 'Green Mountain'</td>
<td>Buxus 'Green Mountain'</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Conus alba varieties</td>
<td>Conus alba</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Cryptomeria japonica 'Klawock'</td>
<td>Cryptomeria japonica</td>
<td>2-3'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Deutzia gracilis 'Nikko'</td>
<td>Deutzia gracilis 'Nikko'</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Fothergilla x intermedia</td>
<td>Fothergilla x intermedia</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Fuchsia 'Blue Shadow' 'Mt. Ayr'</td>
<td>Fuchsia 'Blue Shadow' 'Mt. Ayr'</td>
<td>1-3'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Witch Alde</td>
<td>Witch Alde</td>
<td>1-3'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Vitex agnus-castus 'Moraine'</td>
<td>Vitex agnus-castus 'Moraine'</td>
<td>6-8'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Hydrangea paniculata 'Quercifolia' varities</td>
<td>Hydrangea paniculata 'Quercifolia' varities</td>
<td>2-3'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Juniperus scopulorum 'Skyline'</td>
<td>Juniperus scopulorum 'Skyline'</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Kolkwitzia amabilis 'Dream Catcher'</td>
<td>Kolkwitzia amabilis 'Dream Catcher'</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Microbiota decussata</td>
<td>Microbiota decussata</td>
<td>3-4'</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Pinus mugo</td>
<td>Pinus mugo</td>
<td>18-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Pinus strobus 'Nana'</td>
<td>Pinus strobus 'Nana'</td>
<td>12-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Rosa 'Flower Carpet Varities'</td>
<td>Rosa 'Flower Carpet Varities'</td>
<td>12-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Syringa × persica var. 'Miss Kim'</td>
<td>Syringa × persica var. 'Miss Kim'</td>
<td>12-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
</tr>
<tr>
<td>Taubus alpina 'Montgold'</td>
<td>Taubus alpina 'Montgold'</td>
<td>12-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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<tr>
<td>Viburnum varities</td>
<td>Viburnum varities</td>
<td>12-24&quot;</td>
<td>Full Sun</td>
<td>Average</td>
<td>Slow</td>
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</tbody>
</table>

### Additional Varieties

- **Height Width:** 15'-20'
- **Light Requirement:** Full Sun
- **Soil:** Average
- **Growth:** Slow and Fast
<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Height</th>
<th>Width</th>
<th>Light Requirements</th>
<th>Salt</th>
<th>Soil</th>
<th>Growth</th>
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<tbody>
<tr>
<td>Cerastium tomentosum</td>
<td>Snow In Summer</td>
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<tr>
<td>Euonymus coloratus</td>
<td>Purple Winter creeper</td>
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<tr>
<td>Hedera helix</td>
<td>English Ivy</td>
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<tr>
<td>Larlope spicata</td>
<td>Lily turf</td>
<td></td>
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<tr>
<td>Lysmachia nummelaria</td>
<td>Creeping Jenny</td>
<td></td>
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<tr>
<td>Phlox subulata/stolonifera</td>
<td>Creeping Phlox</td>
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<tr>
<td>Andropogon geradil</td>
<td>Big Bluestem</td>
<td>4-6'</td>
<td>1.5'</td>
<td>Full/Part Sun</td>
<td></td>
<td>Dry</td>
<td>Fast</td>
</tr>
<tr>
<td>Calamagrostis x acutiflora 'Eldorado'</td>
<td>Karl Foerester Grass (Variegated)</td>
<td>3'</td>
<td>18''</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
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<tr>
<td>Calamagrostis x acutiflora 'Karl Foerster'</td>
<td>Karl Foerester Grass</td>
<td>3'</td>
<td>18''</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
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<tr>
<td>Hakonechloa macra varieties</td>
<td>Japanese Forest Grass</td>
<td>1-2'</td>
<td>1-2'</td>
<td>Shade/Part Shade</td>
<td>x</td>
<td>Average</td>
<td>Medium</td>
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<tr>
<td>Miscanthus sinensis varieties</td>
<td>Miscanthus varieties</td>
<td>3-5'</td>
<td>2-5'</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
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<tr>
<td>Panicum amarum 'Dewey Blue'</td>
<td>Dewey Blue Switchgrass</td>
<td>3-4'</td>
<td>3'</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
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<td>Panicum virgatum 'Heavy Metal'</td>
<td>Heavy Metal Switchgrass</td>
<td>3-4'</td>
<td>2-3'</td>
<td>Full/Part Sun</td>
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<td>Fast</td>
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<td>Panicum virgatum 'Shenandoah'</td>
<td>Shenandoah Switchgrass</td>
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<td>18''</td>
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<td>Fast</td>
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<tr>
<td>Pennisetum alopecuroides 'Hameln'</td>
<td>Dwarf Fountain Grass</td>
<td>2'</td>
<td>2-3'</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
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<tr>
<td>Schizachyrium scoparium varieties</td>
<td>Little Bluestem varieties</td>
<td>3'</td>
<td>18''</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
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<tr>
<td>Sporobolus heterolepis</td>
<td>Prairie Dropseed</td>
<td>2'</td>
<td>2'</td>
<td>Full/Part Sun</td>
<td>x</td>
<td>Dry</td>
<td>Fast</td>
</tr>
</tbody>
</table>
LANDSCAPING TREE PROTECTION DETAIL

CRITICAL ROOT ZONE (CRZ)

1.5\(\times\)TREE DIA. (IN)

10' MIN

TREE DIAMETER TO BE MEASURED AT 4.5' OFF THE GROUND

PROJECT DURATIONS GREATER THAN 6 MONTHS
FENCE SHALL BE 4'-0" HIGH GALVANIZED CHAIN LINK FENCE WITH FABRIC FOR PROJECT DURATIONS GREATER THAN 6 MONTHS.

PROJECT DURATIONS LESS THAN 6 MONTHS
FENCE SHALL BE 4'-0" HIGH ORANGE CONSTRUCTION FENCE WITH 2X4 TOP RAIL. STEEL FENCE POSTS AT 6'-0" OCC MINIMUM.

ELEVATION

CRITICAL ROOT ZONE

EXISTING TREE

PLAN

NOTES:
1. TYPICAL ALL TREES INSIDE WORK AREA
2. FENCE LOCATION TO BE APPROVED BY THE OWNER'S REPRESENTATIVE PRIOR TO CONSTRUCTION ACTIVITIIES,
3. THE SOIL WITHIN THE CRZ SHALL NOT BE DISTURBED IN ANY MANNER DURING CONSTRUCTION. NO EQUIPMENT, MATERIALS, SUPPLIES, AND/OR SALVAGE SHALL BE STORED OR PLACED WITHIN THE ZONE. NO VEHICULAR OR EQUIPMENT TRAFFIC SHALL BE PERMITTED WITHIN THE CRZ. NO FILLING OR CURING OF EXISTING SOILS SHALL BE PERMITTED WITHIN THE CRZ. THE OWNER'S REPRESENTATIVE AND/OR LANDSCAPE SERVICES MUST APPROVE ANY DEVIATION FROM THE STANDARD.
## Lighting Control Devices and Manufacturer Details

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Sensor Technology</th>
<th>Locations</th>
<th>Cover Area (sq-ft)</th>
<th>Recommended Manufacturer</th>
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<tbody>
<tr>
<td>Wall Time Switch</td>
<td>Time Clock</td>
<td>Storage Closet SM. Maintenance Areas SM. Offices</td>
<td>N/A</td>
<td>Wattstopper</td>
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<td></td>
<td></td>
<td>SM. Conference Room Break Room Storage Closet</td>
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<td>Wall Switch</td>
<td>Passive Infrared</td>
<td>Sm. Private Office SM. Conference Room Break Room Storage Closet</td>
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<td>Hubbell</td>
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<td>Passive Infrared</td>
<td>Hallways Library Stacks</td>
<td>90 L.F.</td>
<td>Wattstopper</td>
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<td>100 L.F.</td>
<td>Leviton</td>
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<td>120 L.F.</td>
<td>Hubbell</td>
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<td>Ceiling or Wall Mnt.</td>
<td>Passive Infrared</td>
<td>Gymnasium Open Offices</td>
<td>500</td>
<td>Wattstopper</td>
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<td>Wall Mnt.</td>
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<td>Exterior</td>
<td>2500</td>
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<td>3100</td>
<td>Hubbell</td>
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LIGHTING FIXTURE TYPES AND MANUFACTURER DETAILS

The following standard products are to be used as a “basis of design” when selecting lighting fixtures for a project. These are intended to provide a basic fixture family for most common areas on a project and not be fully inclusive of all types of lighting that could be utilized.

LINEAR FLUORESCENT (T8, T5, T5HO – utilize only 4’ lamps)

<table>
<thead>
<tr>
<th>GENERIC FIXTURE DESCRIPTION</th>
<th>TYPICAL LOCATION</th>
<th>RECOMMENDED MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prismatic lensed troffer (2x4 only)</td>
<td>Storage, corridor, copy, break rooms</td>
<td>Columbia, Lithonia, Williams</td>
</tr>
<tr>
<td>Surface/ wall mounted wrap</td>
<td>Mechanical areas, utility, storage</td>
<td>Columbia, Lithonia, Williams</td>
</tr>
<tr>
<td>Recessed “volumetric” troffers</td>
<td>Classrooms, offices, meeting rooms</td>
<td>Finelite, Focal Point, Ledalite</td>
</tr>
<tr>
<td>High abuse surface mounted wrap</td>
<td>Stairwells, corridors</td>
<td>Kenall, Kurtzon, Luminaire</td>
</tr>
<tr>
<td>Parabolic- high performance (3” -4” louver)</td>
<td>Office areas, computer labs</td>
<td>Columbia, Lithonia, Williams</td>
</tr>
<tr>
<td>Recessed perimeter lighting</td>
<td>Restrooms, corridors</td>
<td>Focal Point, Metalumen, Prudential</td>
</tr>
<tr>
<td>Recessed “slot” (4” aperture minimum)</td>
<td>Classroom, corridors, lobbies</td>
<td>Focal Point, Linear Lighting, A-Light</td>
</tr>
<tr>
<td>Recessed linear wall wash</td>
<td>Corridors, lobbies, meeting rooms</td>
<td>Elliptipar, Litecontrol, Finelite</td>
</tr>
<tr>
<td>Linear white board light</td>
<td>Classrooms, meeting rooms</td>
<td>Elliptipar, Litecontrol, Finelite</td>
</tr>
<tr>
<td>Indirect cove lighting (high performance)</td>
<td>Corridors, lobbies</td>
<td>Elliptipar, Linear Lighting, Litecontrol</td>
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<tr>
<td>Indirect cove lighting (strip w/ reflector)</td>
<td>Corridors, lobbies, restrooms</td>
<td>Nulite, Williams, Birchwood</td>
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<tr>
<td>Industrial turret</td>
<td>Mechanical/ Utility areas</td>
<td>Columbia, Lithonia, Williams</td>
</tr>
<tr>
<td>Fluorescent high bay</td>
<td>Mechanical, storage, sports areas</td>
<td>ILP, Holophane, Lithonia, Williams</td>
</tr>
<tr>
<td>Industrial, harsh environment</td>
<td>Mechanical/ Utility areas</td>
<td>Kurtzon, Rig-a-Lite, Paramount</td>
</tr>
<tr>
<td>Linear indirect, indirect/ direct, direct (steel)</td>
<td>Classrooms, labs, offices, conf. room</td>
<td>Peerlite, Finelite, Corelite</td>
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<tr>
<td>Linear indirect, indirect/ direct, direct (alum.)</td>
<td>Classrooms, labs, offices, conf. room</td>
<td>Peerless, Linear Lighting, Focal Point</td>
</tr>
</tbody>
</table>

Fixtures no longer recommended:
- Indirect/direct style fixtures with “basket” style lamp shield (use volumetric troffers)
- Fluorescent under cabinet task lights (replace with LED)

DOWNLIGHTS (LED)

<table>
<thead>
<tr>
<th>GENERIC FIXTURE DESCRIPTION</th>
<th>TYPICAL LOCATION</th>
<th>RECOMMENDED MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>General downlight (LED) &lt;3000 lumens</td>
<td>Ceilings less than 10’</td>
<td>Prescolite, Lightolier, Gotham</td>
</tr>
<tr>
<td>General downlight (LED) &gt;3000 lumens</td>
<td>Ceilings greater than 10’</td>
<td>BetaLED, Gotham, Pathway</td>
</tr>
<tr>
<td>Adjustable accent downlight (LED)</td>
<td>Lobbies, galleries</td>
<td>USAI, Kurt Versen, Edison Price</td>
</tr>
<tr>
<td>Lensed wall wash (LED)</td>
<td>Corridor, lobbies, conference rooms</td>
<td>USAI, Kurt Versen, Lightolier, Pathway</td>
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</tbody>
</table>

Fixtures no longer allowed:
- Compact fluorescent downlights
- Halogen (MR16) accent or downlights

EXIT SIGNS AND EMERGENCY LIGHTING

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<thead>
<tr>
<th>GENERIC FIXTURE DESCRIPTION</th>
<th>TYPICAL LOCATION</th>
<th>RECOMMENDED MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoplastic exit sign (universal mounting)</td>
<td>Dual-lite, Emergilton, Lithonia</td>
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<tr>
<td>Cast aluminum exit sign (universal mounting)</td>
<td>Dual-lite, Emergilton, Lithonia</td>
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<tr>
<td>Edge lit exit sign (ceiling or wall)</td>
<td>Dual-lite, Emergilton, Lithonia</td>
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<tr>
<td>Emergency lighting (LED only)</td>
<td>Dual-lite, Lithonia</td>
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<tr>
<td>Emergency lighting (LED only)</td>
<td>Harsh environments</td>
<td>Kenall, Emergilton</td>
</tr>
<tr>
<td>Small inverters (lighting loads)</td>
<td>Dual-lite, Perfect Power Systems</td>
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## LOCKSET TYPES BY BUILDING DETAILS

<table>
<thead>
<tr>
<th>BUILDING</th>
<th>LOCKSET-TYPE</th>
<th>TRIM</th>
<th>CYLINDER/FINISH</th>
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<tbody>
<tr>
<td>ADLER JOURNALISM BUILDING</td>
<td>YALE 8800</td>
<td>CRR</td>
<td>RCMX26D</td>
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<td>ART BUILDING</td>
<td>SARGENT</td>
<td>LNJ</td>
<td>RCMX26D</td>
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<tr>
<td>ART BUILDING WEST</td>
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<td>CRR</td>
<td>MX26D</td>
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<td>BECKER COMMUNICATION STUDIES BUILDING</td>
<td>RUSSWIN</td>
<td>LWA</td>
<td>RCMX26D</td>
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<tr>
<td>BECKWITH BOAT HOUSE</td>
<td>SCHLAGE L</td>
<td>03A</td>
<td>RCMX26D</td>
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<td>BIOLOGY BUILDING</td>
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<td>CRXCN</td>
<td>MX26D</td>
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<tr>
<td>BIOLOGY BUILDING EAST</td>
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<td>MX26D</td>
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<td>RCMX26D</td>
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<tr>
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<td>CRR</td>
<td>MX26D</td>
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<td>BOYD LAW BUILDING</td>
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<td>RCMX26D</td>
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## LOCKSET TYPES BY BUILDING DETAILS

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<td>AUX</td>
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## Lockset Types by Building Details

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<thead>
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<th>Building</th>
<th>Lockset-Type</th>
<th>Trim</th>
<th>Cylinder/Finish</th>
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<td>Yale 5300</td>
<td>BR</td>
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<tr>
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<td>RCMX26D</td>
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NOTE: TYPICAL FOR ONE PUMP OR TWO.

NOTE: ISOLATION VALVE 2 1/2" OR LESS SHALL BE BALL VALVES. 3" OR LARGER SHALL BE BUTTERFLY VALVES.

CALIBRATED BALANCE VALVES SHALL BE PROPERLY SIZED PROVIDING ACCURATE MEASUREMENT OF THE FLOW DESIGNED FOR THE PUMP. (TYP)
REFERENCE NOTES:

1. Calibrated balance valves shall be properly sized providing accurate measurement of the flow designed for the pump.
Notes:
1. Install piping to allow for ease of coil removal.
NOTES:
1) INSTALL PIPING TO ALLOW FOR COIL REMOVAL.
2) STEAM PRESSURE SENSOR TO BE TIED TO THE BAS.
   DEVICE MUST BE SELECTED SO THAT THE MEASURED
   PRESSURE WILL BE IN THE MIDDLE OF THE SENSOR RANGE.
3) VERTICAL FACE AND BYPASS ONLY.
4) UNITS 3,000 CFM AND ABOVE MUST USE A 1/3 - 2/3
   STEAM VALVE ARRANGEMENT.
5) CONTROL VALVES SHALL BE NORMALLY OPEN.

STEAM PREHEAT COIL WITH
INTERNAL FACE + BY-PASS DAMPERS

2015 N.T.S. STM-PHC-2
TELECOMMUNICATION CABLE OUTLET DETAIL

NOTE:
Conduit shall be continuous from outlet box through wall to cable tray or pull box in corridor.

1" Conduit concealed within wall

Flush 4" square box, single gang plaster (mud) ring (typ)

16" A.F.F.

Floor

To primary cable tray or pull box

Install pull strings

J-hooks or cable tray in corridor ceiling space

Install pull strings

Wall
INSTALL PULL STRING

INSTALL BUSHING

1" CONDUIT STUBBED TO WITHIN 6" OF NEAREST PRIMARY PATHWAY LOCATED ABOVE NEAREST ACCESSIBLE CORRIDOR CEILING.

WALL

16" AFF

FLOOR

5' SQUARE 2 7/8" DEEP TELECOMMUNICATION BOX WITH SINGLE GANG EXTENSION MUD RING
UTILITY DISTRIBUTION CHILLED, DOMESTIC AND FIRE PROTECTION WATER FLOOR PENETRATION AND ANCHOR DETAIL

3/8" 304 STAINLESS STEEL RODS ANCHORED THROUGH WALL (4 REQ'D FOR 8" PIPE OF LARGER)

One PIECE CONSTRUCTION FACTORY INSTALLED 125# FLANGEX PLAIN END PIPE.

DIP - ONE PIECE CONSTRUCTION FACTORY INSTALLED 125# FLANGE

CORE DRILLED OR SLEEVED HOLE

CONCRETE FLOOR

EXTERIOR

INTERIOR

CONCRETE

MEGA LUG W/ THRUST BLOCK DESIGNED BY: ENGINEER

LINK SEAL

6" AND SMALLER = (2) ANCHOR RODS

8" AND LARGER = (4) ANCHOR RODS

LARGER THAN 14" = CONSULT UTILITIES DISTRIBUTION

NOTE: NO WELDING OF SS THREADED RODS OR ROD COUPLINGS IS ALLOWED

DUCTILE IRON PIPE
1. Automatic air vent model #813 Watson-McDaniel Air Eliminator, ¾" NPT and ball valve. Install at high point inside building.
2. Isolation valve.
3. Pressure gauge, ¾" NPT and ball valve.
4. Pressure transmitter, Foxboro Model IGP10-A22DIF ½" NPT and ¾" NPT ball valve.
5. Stainless steel temperature gauge to be ½" NPT, 5" Face, Everyangle, 30°F – 130°F ASHCROFT or equivalent. ¾" NPT stainless steel well to penetrate halfway through pipe.
6. Temperature transmitter with ¾" NPT stainless steel well, ABB controls, model TTH30 transmitter, with Pyromation 4 wire, 100 OHM Platinum RTD. Well to penetrate halfway through pipe.
7. ¾" NPT vent ball valve and cap
8. ¾" NPT drain valve, ball valve and cap
9. Chilled water meter, provide minimum straight lengths of pipe as indicated. Schlumberger industries, Neptune HP turbine water flow meter with strainer (no substitutions) and tricon/e transmitter, (4-20 mA), 24V DC supply with direct readout in 100’s. Meter size to be ___” diameter. Direct read out in 100’s. Mount strainer inverted, with bottom insertion.
10. Normally open, ___” diameter control valve, V-notch type with electric motor operator, 4-20mA signal with position feedback. Valve to be KTM with EPI2 Keystone actuator with mounting bracket. Designer to verify sizing with Ed Stroud (Chilled Water Plant Manager) 319-335-8625.
11. Pipe bridge size to match control valve, minimum length to be 7 pipe diameters.
12. Chilled water building pump (to be approved by the Owner.)
13. Provide one Veris Industries H908 current switch for each chilled water pump to provide monitoring by the PLC.
14. This pipe section is to match larger diameter of meter or valve. Add reducer/increaser if necessary to match smaller device.
15. Chilled water process pump (to be approved by the Owner.)

Note: All vents, drains, wells and pressure taps not to be spaced less than 8” on center (unless approved by the Owner. Exact location of wells, traps, etc. to be determined by FM personnel.)
1 Automatic air vent model #813 Watson-McDaniel Air Eliminator, ¾” NPT and ball valve. Install at high point inside building.
2 Isolation valve.
3 Pressure gauge, ¾” NPT and ball valve.
4 Pressure transmitter, Foxboro Model IGP10-A22DIF ½” NPT and ¾” NPT ball valve.
5 Stainless steel temperature gauge to be ½” NPT, 5” Face, Everyangle, 30°F – 130°F ASHCROFT or equivalent. ¾” NPT stainless steel well to penetrate halfway through pipe.
6 Temperature transmitter with ¾” NPT stainless steel well, ABB controls, model TTH30 transmitter, with Pyromation 4 wire, 100 OHM Platinum RTD. Well to penetrate halfway through pipe.
7 ¾” NPT vent ball valve and cap
8 ¾” NPT drain valve, ball valve and cap
9 Chilled water meter, provide minimum straight lengths of pipe as indicated. Schlumberger industries, Neptune HP turbine water flow meter with strainer (no substitutions) and tricon/e transmitter, (4-20 mA), 24V DC supply with direct readout in 100’s. Meter size to be ___” diameter. Direct read out in 100’s. Mount strainer inverted, with bottom insertion.
10 Normally open, ___” diameter control valve, V-notch type with electric motor operator, 4-20mA signal with position feedback. Valve to be KTM with EPI2 Keystone actuator with mounting bracket. Designer to verify sizing with Ed Stroud (Chilled Water Plant Manager) 319-335-8625.
11 Pipe bridge size to match control valve, minimum length to be 7 pipe diameters.
12 Chilled water building pump (to be approved by the Owner.)
13 This pipe section is to match larger diameter of meter or valve. Add reducer/increaser if necessary to match smaller device.

Note: All vents, drains, wells and pressure taps not to be spaced less than 8” on center (unless approved by the Owner. Exact location of wells, traps, etc. to be determined by FM personnel.)
NOTES:

1. PROVIDE TWO SEPARATE VENTS DIRECTLY FROM RECEIVER TANK. AT LEAST ONE MUST VENT INTO MECHANICAL SPACE; THE OTHER MAY VENT TO OUTSIDE.

2. VENT PIPING TO MATCH UNIT OUTLET SIZE.
1. Water meters shall be located inside building. Design professional shall coordinate sizing and location of meters with Owner.
2. Water meter shall be provided by contractor and shall be a Neptune meter and Tricon/E transmitter, (4-20 mA), 24V DC, Pro-Read register with direct readout. Owner will verify meter selection.
3. Contractor shall provide and install a Neptune brand strainer only.
4. Contractor shall provide and install a full-sized bypass.
5. Contractor shall be responsible for installation of meter, isolation valves, and associated piping to accomplish layout shown in detail above.
6. Contractor shall furnish and install all raceways and junction boxes
   a. Contractor shall furnish and install a 6”x6”x4” junction, with backplane, for every water meter and provide a min 3/4 inch raceway from junction box to the utilities PLC cabinet.
   b. If there are multiple water meters in the same vicinity, contractor shall furnish and install a shared 8”x8”x4” junction box, with backplane, and provide a min 3/4 inch raceway from shared junction box to utilities PLC cabinet.
7. Individual water meters shall be furnished with a 4 conductor, 18 AWG w/shielded cable. For multiple meter installations, contractor shall furnish minimum 6 conductor cable, 18 AWG shielded cable. Contractor to pull cable, owner will perform terminations.
UTILITY DISTRIBUTION DUPELEX BACKFLOW PREVENTER STATION

FOR DOMESTIC WATER:
WATTS #909 BACKFLOW PREVENTER
W/ AIR GAP VENT DRAIN, TYP.

GATE VALVE, TYP.

STRAINER W/ BLOWDOWN, TYP.

NOTE: DUCTILE IRON PIPING TO BE CEMENT LINED.

DOMESTIC WATER

FOR FIRE PROTECTION WATER:
WATTS #709 BACKFLOW PREVENTER
W/ AIR GAP VENT DRAIN (DOUBLE CHECK)

NOTE: ALL PIPING TO BE DUCTILE IRON, CEMENT LINED TO DOUBLE CHECK.

FIRE PROTECTION
1. A flanged turbine flowmeter and transmitter for the hot water shall be metered using a Meinecke WP/Dynamic Turbine Flow Meter-Transmitter with an OD-04 Opto Pulser and shall be provided by the contractor.

2. The pulse type transmitter frequency converter model shall be FM-1D/K, M/N 182023. Power shall be supplied from the Utility PLC in a dedicated conduit furnished by contractor. Contractor shall supply and pull the power cabling from the frequency converter into the Utility PLC.

3. Contractor shall supply and mount the flow transmitter frequency converter in a separate contractor supplied junction box within the reach of the factory supplied connection cable to the OPTO Pulser. The junction box location shall be located where it can be accessed from standing height.

4. A dedicated conduit for the OPTO Pulser to frequency converter cabling shall be supplied from contractor. Contractor shall account for the distance of the integral block in the OPTO Pulser cabling which shall not be inside the conduit. Contractor shall pull the cabling in the conduit.

5. Contractor shall supply pull and furnish the analog signal wire in a dedicated conduit from the frequency converter to the Utility PLC. The signal wire shall be Belden 88770.

6. A RTD temperature transmitter ABB model TTH30 and an associated ABB thermo-well shall all be supplied by contractor with a Belden 88770 signal cable in conduit back to the Utility PLC. The RTD shall be capable of accurately reporting 0-275 DEG F and placed approximately as shown in detail above.
7. Contractor shall provide and install a bypass and shall be responsible for installation of meter, isolation valves, strainer, RTD, and associated piping to accomplish layout shown in detail above. If reducers are needed, they shall be installed before the bypass arrangement.

8. All final terminations shall be by owner.
UTILITY DISTRIBUTION HYDRANT DETAIL

HYDRANT (MUeller SUPER CENTURION 250, FEDERAL SAFETY YELLOW, MODEL A-423 OPEN RIGHT, 6" D 150 SHOE)

FADE PUMPER NOZZLE TOWARDS STREET OR MAIN SIDEWALK

TO CONFORM TO MANUFACTURER'S SPECIFICATIONS

COVER GRAVEL WITH 4 MIL PLASTIC SHEETING

DEPTH AS SPECIFIED

TRENCH BACKFILL

HYDRANT DRAIN OPENINGS

12" SAND COVER

12" x 12" x 4" CONCRETE PAD

7 CUBIC FEET BACKFILL W/ CLEAN CONCRETE STONE TO 18" ABOVE BOTTOM OF HYDRANT STAND PIPE

LOCKING SPool OR RESTRAINT JOINT

LOCKING STOOL OR RESISTANT JOINT

AS REQUIRED

T HUST BLOCK WATER MAIN

8" GATE VALVE

12" SAND ENVELOPE

ADJUSTABLE CAST IRON VALVE BOX

MAIN TRENCH

3' CLEAR SPACE
UTILITY DISTRIBUTION PLC CABINET DETAIL

All penetrations in to or out of the cabinet should be set out 4" from the rear of the cabinet to avoid backplane interference.

*All penetrations of the cabinet will be from the bottom only!*
1. Contractor shall furnish and install a PLC cabinet for chilled water interfaces and/or metering.
2. Location of PLC cabinet shall be indicated on the documents. Confirm final location with Owner.
3. PLC cabinet shall be lockable NEMA 12 and 4 rated, 36 inch by 36 inch by 12 inch deep unless otherwise stated by Owner. Cabinet is to include the back plane.
4. Electronic components inside cabinet will be furnished, installed and programmed by Owner. All terminations at devices going to PLC and inside PLC cabinet will be performed by owner.
5. All penetrations into the PLC shall be from the bottom. All penetrations into or out of cabinet should be set out 4 inches minimum from back of cabinet.
6. Contractors shall provide raceways. Raceways for chilled water devices shall be separate from raceways used for steam metering devices.
7. Raceways and junction boxes shall be separate for each voltage class to include separating AC from DC. 480 VAC is to be at least 12 inches away from any lower voltage signal cabling raceways.
8. Raceways for the utilities PLC shall not be shared with the raceways used for building automation systems.
9. Metering and control cabling to be consolidated to a minimum 12 inch by 12 inch by 6 inch metal junction box, provided and installed by Contractor.
10. Contractor shall provide 120V, 20 amp dedicated circuit with duplex receptacle, located inside of PLC cabinet. Provide a label near the receptacle for which circuit is feeding the PLC.
11. Contractor shall provide a raceway from PLC to Utility Network Cabinet. 1 inch minimum rigid metal if in tunnel, otherwise EMT is acceptable, all with a minimum bend radius of 6 inches and provide a pull string. Owner shall provide, pull, and terminate all utilities network cabling.
12. For all devices except chilled water flow meters use Belden 88760 twisted shielded pair. For chilled water meter use Belden 88770 Triad. For domestic water meter, use a 4 conductor 18 AWG with shielded cable.
13. Utilities PLC and complete steam meter station with raceway shall to be in place prior to utility steam consumption. This includes consumption during construction.

UTILITY DISTRIBUTION STEAM METER AND TAPS DETAIL
Min. 18" clearance from top of RTD. Orientation to be verified by Owner.
1. Contractor shall provide McCrometer V-cone, with Rosemount multi-variable transmitter with Tri-loop. Provide transmitter with a HART tri-loop, integral manifold, and thin-film platinum RTD sensor with a 3” extension length. Coordinate final meter sizing with owner and part numbers with owner.

2. Meters shall have visible flow direction arrows. The meters shall have 150 pound, raised face, flanged bodies and be sized for 20:1 turndown. Meter to be installed on the horizontal with impulse legs as shown in detail.

3. Meters shall be installed in straight piping and upstream of any pressure reducing devices. The piping shall be free from bends, reducers, valves, and branch lines for a distance of 4 pipe diameters upstream from the meter and 3 pipe diameters downstream of the meter.

4. Contractor shall provide a raceway from each meter to Utility PLC. Raceway shall be 3/4 inch (min) RMC outside buildings, 3/4 inch (min) EMT in buildings, 2 inch (min) RMC, with #10 Cu wire for tracer, where buried. Cabling between meter and PLC shall be provided and installed by contractor and shall be Belden 88760 twisted shielded pair.

5. Owner will terminate all connections and perform start up services of transmitter with the as-built V-cone meter sheet calibration sheet from factory to be provided by contractor.

6. In case there is not an existing PLC, contractor shall furnish one. Refer to PLC cabinet specification detail.

1.7. Removable Insulation on meter body:

For X: On lines 6 inch diameter and under: Provide 6 inch of space from the meter flange to piping insulation. Above 6 inch diameter lines: one pipe diameter between permanent insulation and meter flange. For Y: On lines 6 inch diameter and under: minimum of 6 inch overlap of blanket over piping insulation. Above 6 inch diameter lines: one pipe diameter of overlap minimum. Cut, patch, fit, or add to permanent piping insulation to complete work so parts fit together with other piping insulation and the removable insulation as shown. Face ends to be finished off.
1. Control valve to be wafer style Cashco Ranger.
2. Block valves to be gate valves:
   a. 2" and smaller – Nibco Model T-174-SS
   b. Larger than 2” – Welded steel gate valve or lug-style butterfly valve.
3. Strainer to be bronze for 2" and smaller, steel for larger than 2”. (No cast iron.)
4. Relief valve sized to pressure reducing valve. Extend through roof.
5. Eccentric reducer

NOTE: Two PRV's in series shall not be allowed to replace the relief valve.
UTILITY DISTRIBUTION STEAM TRAPPING STATION DETAIL

Notes:
1. All fittings shall be 3000#.
2. Trap to be Armstrong 2011 or Spirax Sarco UIV30.
3. Refer to standards for drip-leg specifications.
4. Welded fittings shall not be used on trapping stations.
5. No bypass around steam traps.
Utility Distribution Utility Network Cabinet Detail

Utility Network Cabinet

Dedicated 120 V circuit entry

Min 2" EMT, metal, or Liquid Tight is acceptable

Utilities Electric Metering Raceway

Utilities PLC Raceway

12"x12"x6" Junction Box

2" min Raceway to connect to campus Utility network.

All penetrations of the cabinet will be from the bottom only!
1. Contractor shall furnish, and install cabinet.
2. UI Meters and Controls junction box shown. Contractor to specify furnish Cabinet with 19” rack mount.
2.1. Cabinet shall be NEMA 4 and 12 rated and lockable. Cabinet size is 36” high, 24” wide, and 24” deep unless otherwise specified by owner.
2.2. Location of cabinet and determine is to be on design documents and final location to be confirmed by owner.
2.3. UI Meters and Controls will provide, pull, and terminate all utility network cabling and program, and install all components inside the cabinet to include terminations.
3. Contractor shall provide 120V, 20 amp dedicated circuit with duplex receptacle to be located inside of utility network cabinet. Provide a label near the receptacle for which circuit is feeding the network cabinet.
4. Contractor shall furnish a min 2 inch metal raceway to connect utility network cabinet to existing campus utility network. UI Meters and Controls will specify location of connection to campus which typically comes through Electrical Duct bank and shall be confirmed by owner. A pull line is to be furnished in this raceway.
5. Contractor is to provide a raceway to the Utility PLC and any electric meters for utility revenue metering at a minimum of 1 inch. Contractor also to provide raceway and to back up generator if not going to the BAS system. All raceways shall be provided with a pull line.
6. Minimum fiber raceway bend radius is 6 inches.
NOTE:
Mount bracket to wall vertically.
VAV TERMINAL CLEARANCE INSTALLATION DETAIL
Notes:
1 Controls to be provided by Contractor for factory installation or installed in field as determined by project specifications.
2 EVAV similar, less RHC and access doors.
3 See plans for proper hand of controls and reheat coil connection.
4 Damper shaft to include permanent slot indication of damper position.
5 Multi-point center averaging velocity sensor to be provided for all terminals.