THE UNIVERSITY OF IOWA
DESIGN STANDARDS & PROCEDURES

12-31-2013 EDITION
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

Introduces the manual, outlines key sections and documents, and identifies primary contacts within Facilities Management.

## INTRODUCTION TO THE UNIVERSITY OF IOWA DESIGN STANDARDS AND PROCEDURES

1

# SECTION I – ORIENTATION

Describes the general business relations between the Design Professionals and the University.

I. THE UNIVERSITY OF IOWA GOVERNANCE

3

II. AGREEMENTS BETWEEN THE UNIVERSITY AND THE DESIGN PROFESSIONAL

3

III. DESIGN PROCESS AND APPROVAL

5

A. Project Management

5

B. Meetings and Stakeholders

5

C. Design and Construction Document Submittals

5

D. Standard of Care

6

E. Document Format Guidelines

6

IV. BIDDING

7

V. CONSTRUCTION

9

# SECTION II – DESIGN DOCUMENTATION AND DELIVERABLES

Outlines Design Documentation and Deliverables, lists University codes, standards, and design review requirements to assist Design Professionals in planning and estimating work effort.

I. GENERAL

11

II. BUILDING CODES AND STANDARDS

12

A. Basic Building Code Policy

12

B. Design Procedures

13

C. Code Change Administration

14

D. Environmental Compliance

15

E. Code Variance Procedures

16

III. BUILDING AREA DEFINITIONS

16

A. Gross Area

16

B. Net Assignable Area

17

C. Non-Assignable Area

17

IV. FEASIBILITY STUDY PHASE

17
SECTION III – GENERAL DESIGN STANDARDS

**Presents General Design Standards to be used in the design of University facilities.**

<table>
<thead>
<tr>
<th>I. GENERAL</th>
<th>33</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Accessibility</td>
<td>33</td>
</tr>
<tr>
<td>B. Commissioning</td>
<td>35</td>
</tr>
<tr>
<td>C. Energy</td>
<td>36</td>
</tr>
<tr>
<td>D. Hazardous Materials</td>
<td>40</td>
</tr>
<tr>
<td>E. Demolition</td>
<td>40</td>
</tr>
<tr>
<td>F. Warranty</td>
<td>40</td>
</tr>
<tr>
<td>G. Training</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II. CIVIL</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. General</td>
<td>41</td>
</tr>
<tr>
<td>B. Subsurface Investigation</td>
<td>41</td>
</tr>
<tr>
<td>C. Site Survey</td>
<td>42</td>
</tr>
<tr>
<td>D. Landscaping</td>
<td>42</td>
</tr>
<tr>
<td>1. General</td>
<td>42</td>
</tr>
<tr>
<td>2. Plants</td>
<td>42</td>
</tr>
<tr>
<td>3. Landscape Furniture and Fixtures</td>
<td>44</td>
</tr>
<tr>
<td>4. Exterior Building Signage</td>
<td>44</td>
</tr>
<tr>
<td>E. Roadways, Parking Lots and Walkways</td>
<td>45</td>
</tr>
<tr>
<td>1. General</td>
<td>45</td>
</tr>
<tr>
<td>2. Roadways</td>
<td>45</td>
</tr>
<tr>
<td>3. Parking Lots</td>
<td>45</td>
</tr>
<tr>
<td>4. Walkways</td>
<td>46</td>
</tr>
<tr>
<td>F. Temporary Traffic Control</td>
<td>46</td>
</tr>
<tr>
<td>1. General</td>
<td>46</td>
</tr>
<tr>
<td>2. Vehicular Traffic</td>
<td>48</td>
</tr>
<tr>
<td>3. Pedestrian Traffic</td>
<td>48</td>
</tr>
<tr>
<td>G. Sanitary Sewer</td>
<td>49</td>
</tr>
<tr>
<td>1. General</td>
<td>49</td>
</tr>
<tr>
<td>2. Piping</td>
<td>49</td>
</tr>
<tr>
<td>3. Accessories</td>
<td>49</td>
</tr>
<tr>
<td>H. Storm Sewer</td>
<td>49</td>
</tr>
<tr>
<td>1. General</td>
<td>49</td>
</tr>
<tr>
<td>2. Piping</td>
<td>51</td>
</tr>
</tbody>
</table>
3. Accessories

I. Domestic Water
   1. General
   2. Piping
   3. Accessories
   4. Testing

J. Natural Gas

K. Chilled Water
   1. General
   2. Piping
   3. Accessories
   4. Testing

L. Steam and Condensate
   1. General
   2. Piping
   3. Accessories
   4. Testing

M. Utility Tunnels

N. Electric Distribution
   1. General
   2. High Voltage Equipment
   3. Ductbank

O. Communications Distribution
   1. General
   2. Underground Pathways
   3. Building Entrance Pathway
   4. Communication Manholes
   5. Termination, Splicing and Testing

III. ARCHITECTURAL

A. General
   1. Building Elevations
   2. Standard Floor and Room Numbering

B. Building Envelope
   1. General
   2. Exterior Building Materials
   3. Exterior Enclosure Performance Requirements

C. Roofing
   1. General
   2. Roofing Systems
   3. Roofing Components
   4. Accessories

D. Doors, Windows, Curtain Walls and Glass
   1. Doors
   2. Hardware
   3. Windows
   4. Glass and Glazing
   5. Joint Sealants
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. Finishes</strong></td>
<td>60</td>
</tr>
<tr>
<td>1. Wall Systems</td>
<td>60</td>
</tr>
<tr>
<td>2. Ceiling Systems</td>
<td>60</td>
</tr>
<tr>
<td>3. Paint Finishes</td>
<td>60</td>
</tr>
<tr>
<td>4. Floor Finishes</td>
<td>60</td>
</tr>
<tr>
<td><strong>F. Furnishings</strong></td>
<td>61</td>
</tr>
<tr>
<td>1. Window Treatments</td>
<td>61</td>
</tr>
<tr>
<td><strong>G. Interior Signage</strong></td>
<td>62</td>
</tr>
<tr>
<td>1. General</td>
<td>62</td>
</tr>
<tr>
<td>2. Sign Types</td>
<td>63</td>
</tr>
<tr>
<td><strong>H. Specialties</strong></td>
<td>69</td>
</tr>
<tr>
<td>1. Visual Display and Bulletin Boards</td>
<td>69</td>
</tr>
<tr>
<td>2. Projection Screens</td>
<td>69</td>
</tr>
<tr>
<td>3. Restrooms and Restroom Accessories</td>
<td>69</td>
</tr>
<tr>
<td>4. Lactation Rooms</td>
<td>70</td>
</tr>
<tr>
<td>5. Recycling and Trash Receptacles</td>
<td>70</td>
</tr>
<tr>
<td>6. Vending Space</td>
<td>70</td>
</tr>
<tr>
<td>7. Custodial Work Spaces</td>
<td>71</td>
</tr>
<tr>
<td>8. Maintenance Rooms</td>
<td>74</td>
</tr>
<tr>
<td>9. Telecommunication Rooms</td>
<td>75</td>
</tr>
<tr>
<td>10. Classroom - General Assignment</td>
<td>76</td>
</tr>
<tr>
<td>11. Offices</td>
<td>85</td>
</tr>
<tr>
<td>12. Loading Dock Facilities</td>
<td>85</td>
</tr>
<tr>
<td>13. Animal Rooms</td>
<td>86</td>
</tr>
<tr>
<td><strong>I. Conveying systems</strong></td>
<td>86</td>
</tr>
<tr>
<td>1. Elevators</td>
<td>86</td>
</tr>
<tr>
<td>2. Lifts</td>
<td>86</td>
</tr>
<tr>
<td>3. Escalators</td>
<td>87</td>
</tr>
<tr>
<td><strong>IV. Structural</strong></td>
<td>87</td>
</tr>
<tr>
<td><strong>A. General</strong></td>
<td>87</td>
</tr>
<tr>
<td><strong>B. Foundations</strong></td>
<td>87</td>
</tr>
<tr>
<td><strong>C. Concrete</strong></td>
<td>87</td>
</tr>
<tr>
<td>1. Mix Design and Materials</td>
<td>87</td>
</tr>
<tr>
<td>2. Exposed Concrete</td>
<td>87</td>
</tr>
<tr>
<td>3. Precast Concrete</td>
<td>87</td>
</tr>
<tr>
<td>4. Placement</td>
<td>88</td>
</tr>
<tr>
<td>5. Testing</td>
<td>88</td>
</tr>
<tr>
<td><strong>D. Masonry</strong></td>
<td>88</td>
</tr>
<tr>
<td>1. General</td>
<td>88</td>
</tr>
<tr>
<td>2. Brick and Block Masonry</td>
<td>88</td>
</tr>
<tr>
<td>3. Stone Masonry</td>
<td>88</td>
</tr>
<tr>
<td>4. Accessories</td>
<td>88</td>
</tr>
<tr>
<td><strong>E. Metals</strong></td>
<td>89</td>
</tr>
<tr>
<td>1. Structural Steel</td>
<td>89</td>
</tr>
<tr>
<td>2. Testing</td>
<td>89</td>
</tr>
<tr>
<td>3. Miscellaneous Metals</td>
<td>89</td>
</tr>
<tr>
<td><strong>F. Wood and Plastics</strong></td>
<td>89</td>
</tr>
</tbody>
</table>
3. Raceways, Boxes and Supports 103
4. Wire and Cable 104

D. Emergency and Backup Power Systems 104
1. Packaged Generator Assemblies 104
2. Battery Equipment 105
3. Transfer Switches 105

E. Instrumentation 105
1. Metering 105

F. Lighting 105
1. General 105
2. Interior Lighting 107
3. Exterior Lighting 111
4. Lighting Controls 112

G. Communications 112
1. General 112
2. Telecommunication Pathways 112
3. Grounding and Bonding 112
4. Data and Voice Horizontal Infrastructure 112
5. Fiber Optic and Copper Backbone and Riser Cable 113
6. Outdoor Plant Fiber Optic Cable 113
7. Copper 113
8. CATV distribution and Horizontal Infrastructure 113

H. Electronic Safety and Security 113
1. Electronic Access Control and Security (AMAG) 113
2. Fire Alarm and Detection Systems 115

SECTION IV – OUTLINE SPECIFICATIONS AND DETAILS

Presents Outline Specifications and Details to be incorporated in specifications and construction documents.

I. GENERAL 123
A. Accessibility 123
B. Commissioning 123
C. Energy 123
D. Hazardous Materials 123
E. Demolition 124
F. Warranty 124
G. Training 124

II. CIVIL 124
A. General 124
B. Subsurface Investigation 124
C. Site Survey 126
D. Landscaping 126
1. General 126
2. Plants 126
3. Landscape Furniture and Fixtures 127
3. Exterior Building Signage 128
E. Roadways, Parking Lots and Walkways
   1. General
   2. Roadways
   3. Parking Lots
   4. Walkways
F. Temporary Traffic Control
   1. General
   2. Vehicular Traffic
   3. Pedestrian Traffic
G. Sanitary Sewer
   1. General
   2. Piping
   3. Accessories
H. Storm Sewer
   1. General
   2. Piping
   3. Accessories
I. Domestic Water
   1. General
   2. Piping
   3. Accessories
   4. Testing
J. Natural Gas
K. Chilled Water
   1. General
   2. Piping
   3. Accessories
   4. Testing
L. Steam and Condensate
   1. General
   2. Piping
   3. Accessories
   4. Testing
M. Utility Tunnels
N. Electric Distribution
   1. General
   2. High Voltage Equipment
   3. Ductbank
O. Communications Distribution
   1. General
   2. Underground Pathways
   3. Building Entrance Pathway
   4. Communication Manholes
   5. Termination, Splicing and Testing

III. ARCHITECTURAL
A. General
   1. Building Elevations
2. Standard Floor and Room Numbering 153

B. Building Envelope 153
   1. General 153
   2. Exterior Building Materials 154
   3. Exterior Enclosure Performance Requirements 154

C. Roofing 154
   1. General 154
   2. Roofing Systems 155
   3. Roofing Components 156
   4. Accessories 158

D. Doors, Windows, Curtain Walls and Glass 158
   1. Doors 159
   2. Hardware 162
   3. Windows 165
   4. Glass and Glazing 165
   5. Joint Sealants 166

E. Finishes 166
   1. Wall Systems 166
   2. Ceiling Systems 166
   3. Paint Finishes 167
   4. Floor Finishes 167

F. Furnishings 168
   1. Window Treatments 168

G. Interior Signage 168
   1. General 168
   2. Sign Types 168

H. Specialties 169
   1. Visual Display and Bulletin Boards 169
   2. Projection Screens 169
   3. Restrooms and Restroom Accessories 169
   4. Lactation Rooms 169
   5. Recycling and Trash Receptacles 170
   6. Vending Space 170
   7. Custodial Work Spaces 170
   8. Maintenance Rooms 170
   9. Telecommunication Rooms 171
   10. Classroom - General Assignment 171
   11. Offices 171
   12. Loading Dock Facilities 171
   13. Animal Rooms 171

I. Conveying systems 171
   1. Elevators 171
   2. Lifts 173
   3. Escalators 173

IV. STRUCTURAL 173
   A. General 173
   B. Foundations 173
C. Concrete 173
   1. Mix Design and Materials 173
   2. Exposed Concrete 173
   3. Precast Concrete 173
   4. Placement 174
   5. Testing 174

D. Masonry 174
   1. General 174
   2. Brick and Block Masonry 175
   3. Stone Masonry 175
   4. Accessories 175

E. Metals 175
   1. Structural Steel 175
   2. Testing 175
   3. Miscellaneous Metals 175

F. Wood and Plastics 176
   1. Rough Carpentry 176
   2. Architectural Millwork and Cabinetry 176

V. MECHANICAL 176
A. General 176
B. Fire Protection and Suppression 177
   1. General 177
   2. Piping and Pumps 177
   3. Accessories 178

C. Plumbing Systems 179
   1. General 179
   2. Insulation 179
   3. Instrumentation 179
   4. Piping and Pumps 179
   5. Equipment 181
   6. Fixtures 181

D. Heating, Ventilating, and Air Conditioning (HVAC) 182
   1. General 182
   2. Piping 182
   3. Insulation 184
   4. Air Distribution 185
   5. Equipment 185
   6. Lab Systems 187
   7. Steam Systems 187

E. Instrumentation 188
   1. Meters 188

F. Controls 188
   1. General 189
   2. Scope of Work 189
   3. User Interface 190
   4. Sensors and Equipment 193
   5. Installation 199
6. Air Flow Matrix

VI. ELECTRICAL

A. General
   1. General
   2. Identification
   3. Arc Flash
   4. Grounding

B. Medium-Voltage (601 Volts – 69k Volts) Electrical
   1. Metering
   2. Switchgear and Transformers
   3. Raceways
   4. Wire and Cable

C. Low-Voltage Electrical
   1. Equipment
   2. Devices
   3. Raceways, Boxes and Supports
   4. Wire and Cable

D. Emergency and Backup Equipment
   1. Packaged Generator Assemblies
   2. Battery Equipment
   3. Transfer Switches

E. Instrumentation
   1. Meters

F. Lighting
   1. General
   2. Interior Lighting
   3. Exterior Lighting
   4. Lighting Controls

G. Communications
   1. General
   2. Telecommunication Pathways
   3. Grounding and Bonding
   4. Data and Voice Horizontal Infrastructure
   5. Fiber Optic and Copper Backbone and Riser Cable
   6. Outdoor Plant Fiber Optic Cable
   7. Copper
   8. CATV distribution and Horizontal Infrastructure

H. Electronic Safety and Security
   1. Electronic Access Control and Security (AMAG)
   2. Fire Alarm and Detection Systems

APPENDICES

Presents diagrams, tables, and additional information pertaining to Sections I - IV.

AHU Condensate Drain Draw-Thru and Blow-Thru Detail
Building Fire Alarm System Details
Chilled Water Coil (CC) Piping Detail
## Table of Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled, Domestic, and Fire Protection Water Wall Penetration Detail</td>
<td>229</td>
</tr>
<tr>
<td>Chilled, Domestic, and Fire Protection Water Floor Penetration and Anchor Detail</td>
<td>230</td>
</tr>
<tr>
<td>Chilled Water Building Interface Detail (with off season cooling requirements)</td>
<td>231</td>
</tr>
<tr>
<td>Chilled Water Building Interface Detail</td>
<td>232</td>
</tr>
<tr>
<td>Condensate Return Unit Detail</td>
<td>233</td>
</tr>
<tr>
<td>Control Devices and Manufacturer Details</td>
<td>234</td>
</tr>
<tr>
<td>Differential Pressure Transducer (across chilled water delta P value)</td>
<td>235</td>
</tr>
<tr>
<td>Differential Pressure Transducer (across supply and return mains)</td>
<td>236</td>
</tr>
<tr>
<td>Duct System Detail</td>
<td>237</td>
</tr>
<tr>
<td>Duplex Backflow Preventer Station Detail (Domestic and Fire Protection)</td>
<td>238</td>
</tr>
<tr>
<td>End of Main Drip Station Piping (Building) Detail</td>
<td>239</td>
</tr>
<tr>
<td>Energy Impact Statement</td>
<td>240</td>
</tr>
<tr>
<td>Fume hood Installation Detail</td>
<td>241</td>
</tr>
<tr>
<td>Hot Water (Glycol) Preheat Coil Piping Detail</td>
<td>242</td>
</tr>
<tr>
<td>Hot Water Converter Steam and Condensate Piping Detail</td>
<td>243</td>
</tr>
<tr>
<td>Hot Water Preheat Coil Piping (2-Way Valve) Detail</td>
<td>244</td>
</tr>
<tr>
<td>Hydrant Detail</td>
<td>245</td>
</tr>
<tr>
<td>Hydronic System Expansion Tank Detail</td>
<td>246</td>
</tr>
<tr>
<td>Interior Signage Details</td>
<td>247</td>
</tr>
<tr>
<td>Lighting Fixture Types and Manufacturer Details</td>
<td>250</td>
</tr>
<tr>
<td>Lockset Types By Building Details</td>
<td>260</td>
</tr>
<tr>
<td>Post and Chain Fence Details</td>
<td>261</td>
</tr>
<tr>
<td>Pressure Gauge Installation Detail</td>
<td>264</td>
</tr>
<tr>
<td>Pressure Reducing Station Detail</td>
<td>265</td>
</tr>
<tr>
<td>Steam Preheat Coil with Internal Face and By-Pass Dampers Detail</td>
<td>266</td>
</tr>
<tr>
<td>Steam Pressure Taps Detail</td>
<td>267</td>
</tr>
<tr>
<td>Steam Trapping Station Detail</td>
<td>268</td>
</tr>
<tr>
<td>Telecommunication Cable Outlet Detail</td>
<td>269</td>
</tr>
<tr>
<td>Variable Frequency Drive Mounting Detail</td>
<td>270</td>
</tr>
<tr>
<td>VAV Terminal Clearance Installation Detail</td>
<td>271</td>
</tr>
<tr>
<td>VAV Terminal Installation Detail</td>
<td>272</td>
</tr>
<tr>
<td>Vertical Fire-Smoke Damper Detail</td>
<td>273</td>
</tr>
</tbody>
</table>

## MISCELLANEOUS FORMS

<table>
<thead>
<tr>
<th>Form</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHANGE REQUEST FORM</td>
<td>275</td>
</tr>
<tr>
<td>DEVIATION REQUEST FORM</td>
<td>277</td>
</tr>
</tbody>
</table>
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 Board of Regents Policy Manual. Chapter 9 of Board of Regents, State of Iowa Policy Manual outlines specific requirements, procedures and thresholds. The University of Iowa conforms strictly to these requirements and Design Professionals shall not work ahead of governing approvals.

II. AGREEMENTS BETWEEN THE UNIVERSITY AND THE DESIGN PROFESSIONAL
A. For design projects, the University’s Design Project Manager (PM) is the designated Owner’s Representative through the bidding phase of the project. The PM is also the Owner’s Representative for studies and non-construction services. All instructions and approvals come to the Design Professional from the PM. The University’s Construction Project Manager (CPM) replaces the PM as the Owner’s Representative during the construction phase of the project following contract award.

B. 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 the written request by the Design Professional and written concurrence of the Owner’s Representative. The Design Professional shall provide an experienced project manager capable of effectively coordinating a multi-disciplined architectural/engineering team.

C. The University uses a “Standard Form of Agreement between Owner and Design Professional” as the contract between the Design Professional and the University. Review this document carefully, as the University allows no exceptions to this agreement form. A sample agreement can be found at Facilities Management’s website (http://www.facilities.uiowa.edu). Other University standard agreements may be substituted depending on project scope and desired services. The University is in the process of transitioning to a new set of Standard Form of Agreements and expects to start utilizing the new documents by early 2014.

D. The Design Professional shall provide all basic services as stated in the Design Professional Agreement. On major projects the University may engage quality assurance professional services such as code review professionals, commissioning agents, document coordination consultants and others to ensure compliance with project goals and objectives.

E. The Design Professional may provide additional professional consultant services as determined by the scope of the project. When the Design Professional contracts with other professional consultants for these services, the Owner must approve the professional consultants. A change of professional consultants during the term of the agreement must be approved by the Owner’s Representative.

F. 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 consultants.
G. On occasions, the University shall request the Design Professional hire a specialty consultant, and/or a specialty consultant specifically selected by the University, to support and/or supplement the work of the Design Professional. The Design Professional shall be responsible for the performance of the specialty consultant per the terms of the Agreement between the Owner and the Design Professional.

H. Projects within existing facilities shall include an appropriate review of existing conditions as a part of the basic services to assist the Design Professional in this review. The University shall make existing documentation available to the Design Professional upon request.

I. Fee proposals should include the Design Professional’s perception of the University’s project scope of work and recommended scope of services. The Design Professional shall include a proposed fee and estimate of reimbursable expenses, project schedule, and any other University-requested information.

1. The University shall generally negotiate not-to-exceed fees for all limited/special scope projects and a fixed fee or percentage of construction cost fee for major projects. The PM shall instruct the Design Professional on the expected fee structure and what exceptions may apply.

2. Reimbursable and non-reimbursable expenses are described in the agreement. Reimbursable expenses must be approved in advance, shall be paid at cost, and must be accompanied by receipts.

3. The Design Professional’s proposal should identify project milestones, including design review submittals. The PM shall provide the Design Professional with any University schedule requirements.

4. All design review meetings should be included in the Design Professional’s basic services fee. Also, unless waived by the PM, basic services include, as a minimum, a written bid evaluation, a pre-bid meeting, a pre-construction meeting, construction progress meetings, punch list inspection(s), and a final inspection.

J. Unless a current certificate of insurance is on file with the University, proof of the required insurance specified in the agreement must be submitted for approval with the signed agreement. The University shall not execute the agreement or approve payments without approved insurance.

K. No payments shall be processed unless an executed agreement is on file.

L. The Design Professional must submit requests for amendments to the agreement, or requests for additional fees, prior to proceeding with the services resulting in such requests. Under no circumstances shall additional fees be allowed for services provided during the design phase after award of the prime construction contract.

M. Submit payment requests to Facilities Management Capital Accounting for services performed. Invoices shall be submitted in the Owner’s format (refer to UI FM website). Payment requests submitted by the Design Professional must be accompanied by invoices detailing work completed and must summarize the total bill for services to date, and the amount of the current request.
III. DESIGN PROCESS AND APPROVAL

A. PROJECT MANAGEMENT:

1. The University’s PM is the Owner’s Representative during the design of the project and the University’s CPM is the Owner’s Representative during the construction of the project. All instructions and approvals come to the Design Professional from the PM/CPM. Services rendered but not requested by the PM/CPM shall not be compensated.

2. The PM shall manage internal University approvals and instruct the Design Professional accordingly.

3. The University manages the total project budget and requires the Design Professional to design to the construction budget.

4. The Design Professional must notify the PM of Owner-related delays so as not to impact the design schedule.

5. If the Design Professional believes additional services are requested by the University that are beyond the scope of services defined by the Agreement, the Design Professional must notify the PM/CPM and seek approval before proceeding with the services. Additional fees must be negotiated and an amendment to the original agreement processed immediately. This also applies to terminated or suspended work.

B. MEETINGS AND STAKEHOLDERS:

1. University projects normally involve many academic, student, and service groups as stakeholders in a project. The PM arranges for and coordinates the Design Professional’s contact with these groups.

2. Project meetings are scheduled by the Owner’s office.

3. Meeting minutes are kept by the Design Professional and reviewed by the PM before issue. Unless otherwise directed by the project manager, meeting minutes should be issued to the PM for review within five working days. Following review by the PM, the Design Professional shall distribute the meeting minutes to all participants.

4. The Design Professional should conduct effective, productive meetings. The Design Professional should review the project budget summary and meeting agendas with the PM in advance.

C. DESIGN AND CONSTRUCTION DOCUMENT SUBMITTALS:

1. The Design Professional should provide timely and complete submittals. The University shall review the Design Professional’s work for program conformance and constructability. The PM is authorized to reject incomplete submittals.

2. The Design Professional is responsible for the management and performance of their professional consultants. Delay of a professional consultant’s part of a submittal is considered an incomplete submittal from the Design Professional.

3. Delay of a project due to incomplete submittals is the responsibility of the Design Professional.
4. Submittal requirements are described in detail in Section II.

7. The Design Professional shall allow two weeks of University review time between submittal of review documents and the review meeting, unless otherwise directed by the PM. The University considers the milestone achieved only when the review is complete.

8. The Design Professional shall obtain required bidding documents from UI/FM website before the project is ready to advertise. The Design Professional shall ensure that the most current version are utilized.

9. The University shall supply the Design Professional with an electronic copy of the bid form, special conditions, and Division 01 documents via the UI/FM website. The PM/CPM shall work with the Design Professional to tailor these for the project.

D. STANDARD OF CARE:

1. This document in its entirety, marked sets of review documents by UI staff, and other written instruction 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.

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

3. Marked review drawings and written instructions not incorporated into the design must be documented and approved by the PM.

4. The Design Professional shall be financially liable for deviations from this document, marked review drawings, and written instructions unless deviations are approved in writing. Requests to deviate from these Design Standards on a project-by-project basis may be made by submitting a Deviation Request Form provided in this document, to the appropriate PM.

E. DOCUMENT FORMAT GUIDELINES:

1. The electronic text program to be used for the Project Manual shall be Microsoft Word (.doc), latest version.

2. 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.

   a. All .dwgs files shall have all x-refs bound and all 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. The purge command shall be invoked to delete all unreferenced blocks, layers and line types.

   b. Layering Guidelines
(1) 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.

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

4. The Design Professional shall convert ALL electronic documents to Adobe Portable Document Format (.pdf) and provide to Owner as required by CD, DVD and/or publish to the Owner’s web site.

5. The format for all electronic documents on CD(s) or DVD(s) shall be as follows:
   a. The Project Manual shall read “Construction Set” or “Record Documents” as appropriate on the front cover and shall be a multi-page .pdf and have blank pages inserted.
   b. Drawings shall be labeled “Construction Set” or “Record Documents” as appropriate in the revision area of the title block and on the cover with a date. They shall include both single page .pdfs and .dwgs files named with U of I “project number-sheet number-sheet title”.
   c. The CD(s) or DVD(s) shall be labeled with U of I Project Number and Construction Set or Record Documents as appropriate.
   d. Note: The .pdf’s 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 .pdf’s will display all information correctly.

IV. BIDDING

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

B. The University shall distribute plans utilizing an outside vendor.


C. As directed, reviewed, and approved by the PM, the Design Professional must prepare addenda for distribution by the University related to construction document interpretation which is then incorporated in the contract for construction.

1. Addenda are issued prior to the bid opening and are part of the contract documents. Addenda items shall be approved by the PM before issuing. The Design Professional
shall prepare and the University shall distribute addenda directly to plan holders. The list of plan holders is maintained by University.

2. Addenda should be issued at least seven (7) calendar days before the bid date. If addenda must be issued six (6) days or less before the bid date, either the bid date is extended or the Design Professional must verify each plan holder has a copy of the addenda at least 48 hours before the bid opening.

D. The PM, assisted by the Design Professional, shall hold a prebid meeting if required by the agreement. The Design Professional shall describe the project including important facets of the work and schedule. Simple clarifications can be made in response to questions. Other questions shall be recorded and clarified by addenda. Questions requiring interpretations by the Design Professional shall be answered by addenda.

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

1. The Design Professional shall review the local bidding climate prior to the preparation of bidding documents. The size and composition of projects shall be considered to encourage competitive bidding. If it appears a conflict among projects shall occur in the bidding market, the rescheduling of the bids shall be considered if time permits and if this rescheduling can result in additional bids.

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

3. If little interest is shown in the project, the Design Professional shall contact potential bidders and determine the cause.

F. Bid opening: the University shall conduct a public bid opening for all projects with construction estimates exceeding $100,000. The Design Professional shall attend the bid opening if required by the agreement. Informal bid openings (bids received electronically with non-public bid opening) may be scheduled for projects with construction estimates less than $100,000, in order to expedite project schedule.

G. Bid evaluation by the Design Professional:

1. After the bids have been received, the Design Professional must prepare a review and analysis, including, but not limited to:
   a. An analysis of the bidder’s qualifications to determine if the low bidder is responsible [qualified].
   b. If requested by the PM, a thorough analysis of the low bidder’s breakdown of cost against the scope of work to determine if the bid is responsive.
   c. An analysis and explanation of the bid spread and its comparison to the Design Professional’s pre-bid construction estimate.
   d. An analysis and explanation of why there were variations in the bids.

2. The Design Professional shall provide a letter of recommendation for awarding the construction to the lowest, responsible bidder.
3. The PM must be notified if the Design Professional determines that the apparent low bidder is not responsible [qualified].

V. CONSTRUCTION
A. Once the contract is awarded, the University's primary representative is no longer the PM. Instead, the University's CPM serves as the Owner's Representative during the construction phase. The term CPM is intended to be general and represent a variety of positions within the University responsible for the management of construction. The titles include, but are not limited to, Senior Construction Project Manager, Construction Project Manager, and Construction Project Specialist.
B. All instructions and approvals come to the Design Professional from the CPM. Additional services rendered but not requested by the CPM shall not be compensated, including site visits.
C. Communications between the Design Professional and the Contractor during construction, including letters, memos, directives, etc., flow through the CPM with the exception of Contractor shop drawings. The CPM shall review communications with the Design Professional and the Contractor at the pre-construction meeting.
D. Shop drawings and submittals are submitted directly to the Design Professional by the Contractor, and are returned directly to the Contractor by the Design Professional. The Design Professional may be required to use Submittal Exchange on projects with construction estimates greater than $100,000 to electronically review, approve and track required Shop Drawings/Submittals. Subscription costs to Submittal Exchange for Design Professional access shall be included as a reimbursable expense item. The Design Professional shall establish and administer the Submittal Exchange process for the project.

1. The Design Professional shall use the following statements when reviewing Contractor shop drawings and submittals:
   R – Reviewed
   RAN – Reviewed as Noted
   R&R – Revise and Resubmit
   NAR – No Action Required

E. The Design Professional shall use Owner's on-line, secure project communications web site for Change Order Management, to enhance communications and storage of contract change document information.
F. Final decisions on finish materials and color selections, not made during the design phase, shall be reviewed with and approved by the CPM before instructions are given to the Contractors for the ordering of material. Submit color schedules and charts in duplicate for CPM review. Submit final approved color schedules in duplicate to the CPM.
G. During the construction period, the CPM shall generally schedule periodic progress meetings with the Contractor. The Design Professional and their appropriate consultants are expected to be present at these meetings. The Design Professional shall take and distribute minutes of these meetings. Meeting minutes shall be submitted to the CPM for review and approval prior to issuance. Meeting minutes to be furnished no more than 72 hours following each meeting. Design Professional shall furnish site observation reports for each site visit.
H. The Design Professional shall review all change order pricing and issue written responses within 5 working days following receipt. Change orders exceeding $10,000 will require a detailed, itemized estimate to include labor, equipment and material; plus applicable overhead and profit margins.

I. The Substantial Completion Inspection shall be scheduled by the CPM. The Design Professional, Owner, and Contractor must inspect the work, system-by-system and room-by-room, if appropriate, make a record of deficiencies or corrections required to fully comply with the contract documents.

J. The Design Professional must prepare a final punch list, by room, system, or area, and send the requested number of copies to the CPM, who shall make them available to the Contractor.

K. Project final acceptance: The Design Professional shall provide a letter to the CPM certifying the completion of the project and recommending final acceptance.

L. Record Documents shall be produced by the Design Professional within thirty (30) days following final acceptance of the project and shall be sent to FM – Planning, Design & Construction, Attn: Document Center. Record Documents shall be provided using CD(s) or DVD(s) and shall include:

1. Drawings and Project Manual modified to include addenda, post bid changes, including changes made via the submittal process, supplemental documents and the Contractor’s field changes.

M. The University will 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 planning information to be used by Design Professionals in the planning and development of University facilities.

The criteria represent minimum levels of performance, quality and/or standardization that are sometimes different from those accepted in private and commercial industry. This is in recognition that these facilities must be cost effective over the life of the facility, while supporting the academic, research and service missions of the University.

The planning and development criteria are presented to compliment the Section III - General Design Standards. The Design Professionals must familiarize themselves and be responsible for implementing all criteria and guidelines.

The Design Professional shall plan 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. GENERAL
A. Design submittals shall, as a minimum includes items in this section and as outlined in the Appendices.
B. The Design Professional shall develop economically justified designs within the prescribed budget and space allocations.
   1. Design to obtain the lowest life-cycle cost consistent with a high quality facility.
   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, as directed by the PM. The balance of the construction budget shall be accommodated with additive bid alternates so that an award can be made utilizing 100% of the approved construction budget.
C. In order to meet institutional design criteria, the proposed design may be periodically reviewed by the Campus Planning Committee.
D. Design Professional shall cooperate mutually with the Owner and with any other such Design Professionals that might be employed by the Owner.
E. Designs shall be in accordance with the applicable Codes and Standards as listed in this section of the manual.
F. All correspondence between the University and the Design Professional during the design phase shall be through the Design Professional's project manager and the University PM.
G. The Design Professional may be required to make presentations to the Board of Regents for the schematic design of major buildings.
H. If construction alternates are included in the design, then alternates shall be additional to the base bid design and shall be listed in order of importance. Unless approved by the PM, no more than four (4) additive alternates shall be allowed.

I. The Design Professional shall consider the University of Iowa’s 20/20 Vision when designing projects:  http://sustainability.uiowa.edu/assets/Uploads/2020-Vision-Ulowa-Sustainability-Targets.pdf

II. BUILDING CODES AND STANDARDS

A. BASIC BUILDING CODE POLICY

1. University facilities shall comply with all applicable codes.

2. University facilities shall be designed with flood protection/mitigation up to the 500’ + 2’-0”. Clarification shall be obtained by the Design Professional through the PM if needed.

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.

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.

5. Codes that apply to University design and construction:

a. ICC International Building Code and reference standards

b. ICC International Fire Code

c. Uniform Plumbing Code

d. ICC International Mechanical Code

e. ICC International Energy Conservation Code

f. NFPA 70 National Electric Code (NEC)

g. ADA Standards for Accessible Design


i. 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.

6. The following Chapters of the Iowa Administrative Code shall apply to University design and construction:


c. Public Safety [661], Chapter 18, “Parking for Persons with Disabilities”

d. Public Safety [661], Chapter 303, “Requirements For Energy Conservation In Construction”

e. Labor Services [875], Chapter 72, “Conveyances Installed on or After January 1, 1975”
f. Chapter 89A, “Elevators” (Iowa Code)

7. Standards that apply to University design and construction:
   a. National Fire Protection Association (NFPA) standards including current version of 70E
   b. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
   c. American Concrete Institute (ACI)
   d. American National Standards Institute (ANSI)
   e. American Refrigeration Institute (ARI)
   f. American Society for Testing and Materials (ASTM)
   g. Underwriter’s Laboratories, Inc. (UL), Federal Specifications
   h. National Electrical Manufacturers Association (NEMA)
   i. Williams Steiger Occupational Safety and Health Act of 1970 (OSHA)
   j. FM Global Company
   k. American Association of State Highway and Transportation Officials (AASHTO)
   m. National Institute of Building Science

8. Codes and Standards that apply to Telecommunications:
   a. Occupational Safety and Health Administration (OSHA) safety regulations
   b. Iowa “One Call”
   c. National Electrical Safety Code, (NESC)
   d. National Electrical Code, (NEC)
   e. Building Industry Consulting Service International’s (BICSI)
   f. Telecommunications Design Methods Manual (TDMM)
   g. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA), Building Wiring Standards
   h. National Institute of Building Science

B. DESIGN PROCEDURES

1. The University’s general policy is not to deviate from the adopted codes. Design Professional must certify in writing on the contract document that the project has been designed in compliance with the University applicable codes.

2. The Design Professional shall perform a project code analysis before the completion of design development, preferably during the schematic design phase. The Design Professional shall reference applicable codes and editions and note the occupancy, construction type, egress conditions, and other information necessary. The Design Professional is encouraged to use drawings to illustrate conditions. The code analysis shall note any potential nonconforming construction. The Design Professional may employ a Code Design Professional to augment their design team. 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. The University may employ an Independent Code Design Professional to review designs for code compliance. This does not relieve the Design Professional from responsibility to design to code. On major projects a follow-up code analysis shall be performed on design development and contract documents submittals.

4. 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 PM. The Design Professional shall be responsible for payment of associated fees. Such fees are considered a reimbursable expense.

5. Building permits are not required for construction on the Owner’s property; however, 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.

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

7. As required by the Iowa State Fire Marshal’s Office, the Design Professional shall assist the University in securing occupancy certificates.
   a. 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.
   b. The Design Professional shall account for this activity in the project schedule.

8. The Design Professional shall advise the PM if the project requires a construction activity that is outside the University’s property line. The PM shall contact appropriate agency to discuss project needs. The Design Professional shall assist the PM in the preparation of any material needed for appropriate submittals that may include easements and traffic control drawings.
   a. Agencies included but not limited to:
      (1) Iowa Department of Transportation (IDOT)
      (2) City of Iowa City
      (3) City of Coralville
      (4) Cedar Rapids and Iowa City (CRANDIC) Railroad
      (5) Iowa Interstate Railroad
      (6) Federal Aviation Administration

C. CODE CHANGE ADMINISTRATION

1. When new editions of applicable codes are adopted during the course of the design, the Design Professional shall seek direction from the PM on whether the new codes apply to the project.

2. The Design Professionals shall list the applicable codes in the Project Manual and on Code check/Fire Life Safety drawings.
D. ENVIRONMENTAL COMPLIANCE

1. Clean Air Compliance
   a. The construction, installation or alteration of any equipment capable of emitting air contaminants generally requires that a 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 the rules of the DNR. The following is a partial list of emissions sources which shall require a permit: boilers, emergency generators, incinerators, fuel burning equipment and pollution control equipment. Refer to Iowa Department of Natural Resources (DNR) Air Quality Bureau home page: http://www.iowadnr.gov/InsideDNR/RegulatoryAir for more information.
   b. In order to ensure that the project complies with the various environmental regulatory requirements, all permitting and emissions tracking activities shall be coordinated with and completed with the assistance of the PM.
   c. Sources:
      (1) Significant sources that require information for the Title V operating permit and a construction permit.
      (2) Insignificant sources that require information for Title V, only.

2. Spill Prevention Control and Countermeasures (SPCC) 40CFR112
   a. Where this Federal code is applied in designs for the University of Iowa, written notice of such must be made to the PM by the Design Professional before final review of drawings and specifications. This notice shall allow other 40CFR112 requirements to be provided by the University in order to comply with the code.
   b. The intent of this standard is that any “oil” spillage from storage tanks, reservoirs, etc., cannot find its way off of the immediate site through sanitary sewer, storm sewer or surface run-off. Secondary containment for reservoirs is a common component of the requirement.

   a. The University must comply with the National Pollutant Discharge Elimination Systems (NPDES), Phase II, Municipal Separate Storm Sewer System (MS4) requirements. If applicable, the Design Professional must include the following design elements as part of the project.
   b. Construction Site Runoff Control: As part of the University of Iowa’s Municipal Separate Storm Sewer System (MS4), NPDES Permit No. 52-25-0-06, requirements affecting construction fall into two categories.
      (1) Construction sites of an acre or more require a storm water construction permit and associated construction documents. The Owner shall be responsible for the preparation of these items as well as obtaining the Iowa NPDES Permit No. 2 for the project. The Design Professional shall request the documents from the PM and ensure they are included in the final set of review documents prior to bidding. Refer
also to Owner’s NPDES Permit No. 52-25-0-06 construction activity storm water, erosion, and sediment control standard procedure.

(2) Construction sites less than an acre require the contractor to provide sediment and erosion control measures to prevent sediment from leaving the site. Design Professional shall be responsible for the preparation of construction documents which shall satisfy the intent of the Owner’s NPDES Permit No. 52-25-0-06 and to be included in the final review documents prior to bidding.

c. Post-Construction Storm Water Management: The Design Professional shall endeavor to maintain or minimize storm water runoff to natural waterways or infrastructures. When elements of the plan have hard surfaces which will collect contaminants, appropriate design components shall be included to control discharge to natural waterways or infrastructures.

E. CODE VARIANCE PROCEDURES

1. Design Professional must request approval to seek code variances in writing through the PM. A code variance request must include:

   a. An explanation of the situation, the applicable codes, and the reason why code compliance is not possible. Copies of referenced codes, informational sketches, drawings, calculations, and supporting material should be attached to the request.

   b. A discussion and recommendation related to the impact on building use and occupant safety.

   c. A discussion and recommendation of equivalent systems available and cost implications of each.

III. BUILDING AREA DEFINITIONS

A. GROSS AREA

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. Calculate gross area by measuring from the outside faces of exterior walls, disregarding cornices, pilasters, buttresses, etc., that extend beyond the wall faces. Exclude areas having less than a 3-foot clear ceiling height. In addition to internal floored areas, gross area includes excavated basement areas; interstitial spaces (i.e., mechanical floor or walkways), mezzanines, penthouses, attics; garages; covered porches, whether walled or not; 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; 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. The footprints of stairways, elevator shafts, and vertical
duct shafts are counted as gross area on each floor through which they pass. Include the top, unroofed floor of parking structures where parking is available.

B. NET ASSIGNABLE AREA
1. Net assignable area is the sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use. Areas defined as building service (i.e., public rest rooms, custodial supply closets, custodial office/break room), circulation, mechanical (including electrical and telecommunications closets) and structural are not included.
2. Calculate net assignable area by measuring 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. Do not make deductions for necessary building columns and projections.

C. NON-ASSIGNABLE AREA
1. 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. This includes areas defined as building service (i.e., public restrooms, custodial supply closets, custodial office/break room), circulation, and mechanical (including electrical and telecommunications closets).
2. 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.

IV. FEASIBILITY STUDY PHASE
A. The Design Professional shall be directed by the Owner's PM regarding the specific scope of work related to a feasibility study.

V. SCHEMATIC DESIGN PHASE
A. BOARD OF REGENTS SCHEMATIC DESIGN REPORT:
The Design Professional may be directed to produce and present a Schematic Design Report to the University's Board of Regents. The report shall be distributed to Board members, University administrators, and other officials and may also be used in conjunction with development activities by the University. It is imperative this document be succinct, accurate, and of professional quality. The following outline should be used in developing the report along with any supplementary directions given by the PM. Provide electronic and printed copies in quantities as directed by the PM.
1. Provide a one to two page Executive Summary summarizing the size and scope of the project, estimated costs, and general programmatic information identifying programs and activities directly benefiting the University.
2. Provide background information on the history of the project; the programs benefiting from the project; and problems it will solve, e.g. space shortages, obsolete facilities, future growth. Describe other parameters affecting definition of the problem, such as
master planning issues, existing structural limitations, and site conditions. Typical subheadings might include Project Background, Space Program, Planning Issues and Design Objectives.

3. 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. 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.

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

5. Prepare a presentation rendering(s) at the direction of the PM.

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

7. 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. Include a Project Cost Estimate, formatted to University guidelines, with approved costs from the PM. See Details in Section II.IX.B.2.

9. Use the following project schedule outline of project schedule milestones (For projects with unknown construction awards and completes (usually due to funding), indicate the construction period in months.):
   a. Design Professional Selection (date)
   b. Schematic Design Approval (date)
   c. Contract Award (if known) (date)
   d. Construction Complete (if known) (date)

B. SCHEMATIC DESIGN SUBMITTAL

1. Submittal Requirements:
   a. All drawings submitted to the PM shall be dated, show scale and orientation of drawing, and shall carry the title of the project, the Owner’s project job number and the name of the Design Professional. Each project is given an official title which must be used with consistency on all documents. Contact PM for official project title.
   b. Floor plans are to have rooms identified by the Program Room Numbers and Program Room Name. Net and gross area of each floor and total gross area of the building shall be noted on the floor plan drawings.
c. The Design Professional shall prepare Schematic Design studies illustrating the scale and relationship of project components for approval by the PM. Schematic design drawings must include site drawings, floor plans, roof plan, primary elevations, at least one primary building section, and other drawings necessary to adequately convey important features of the proposed building.
d. The number of Schematic Design options prepared will vary with the complexity of the project. The Design Professional is expected to continue generating options until the requirements of the project are met and a schematic design is approved by the PM.

2. Project Cost Estimate
   a. Submit a written quantitative estimate of construction developed from complete schematic drawings and outline specifications.
   b. Break down construction estimate into the major architectural, civil, structural, mechanical, and electrical building components by major divisions of work.
   c. Indicate the Design Professional’s design contingency, if applicable.
   d. Exclude from the construction cost estimate the construction related services and procedures which are performed directly by Ul. The PM shall review the scope of work performed by Ul departments with the Design Professional.

3. Description of Construction
   a. Provide a project description using the following outline as a guide. This shall include a brief summary of building systems and materials proposed in the schematic design.
   b. Construction, i.e., structural system, wall system, roof design, waterproofing, vertical conveying system, exterior and interior finishes, etc.
      (1) Building controls, plumbing, air conditioning, heating and ventilating systems, ducts, filtration, and piping. Include appropriate code references to be followed in design.
      (2) 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.
      (3) Fire detection and protection systems required for intended occupancy of the building.
      (4) Site work issues including exterior utility connections.
      (5) The scope of finishes, furnishings and equipment.
      (6) The scope of communication systems and audiovisual equipment.
      (7) The scope of access and security.

4. Provide estimate for construction period and lead time for special items.
5. Energy Analysis: Furnish an Energy Impact Statement per Section III and provide calculations, models (including any computer printouts) and a written summary of the results (clearly indicating assumptions employed) to the Owner.
6. The Design Professional shall not proceed to the Design Development Phase until approval has been received from the PM.

VI. DESIGN DEVELOPMENT PHASE

A. GENERAL
1. Drawings shall show all room and space uses, including location of items of fixed equipment and major pieces of movable equipment whether Owner or Contractor supplied. 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.
2. The minimum submittal shall include drawings, interior and exterior elevations, sections and details on drawings. Drawings shall be developed with the current version of AutoCAD. Each sheet in the drawing set shall have one AutoCAD file which has all layers thawed and visible, and when plotted, shall produce a sheet identical to the respective sheet within the drawing set.
3. The PM shall clarify to the Design Professional as to the level of involvement of FM - Building & Landscape Services (BLS) in site design and site restoration work. It must be determined if BLS will accept the entire site design or site construction work. FM – BLS shall provide design review and assist in inspecting landscape construction work regardless of their involvement with site design or construction work.
4. List major components of the design, including a description of all required equipment.
5. The Design Professional is to verify with the PM review requirements of outside regulatory agencies. The Design Professional may be required at this time to review the design with FM Global and the State Building Code Bureau of the Iowa Department of Public Safety.
6. Tabulate net assignable square foot (NASF) and overall gross square foot (GSF) areas. Show space-by-space comparison of preliminary assignable area with program assignable areas. Tabulate by floor and include totals for the building.
7. Design Professional shall create and submit both full- and half-sized .pdfs.
   a) Cost Estimate: Submit a written quantitative estimate of construction developed from complete design development drawings and specifications.
   b) Show estimated Contractor overhead and profit.
8. Construction Phasing Schedule - Provide a construction-phasing schedule in bar chart and/or outline (narrative) form and/or a phasing floor plan.

B. DESIGN DEVELOPMENT DOCUMENTS
1. Technical Specifications
   a. Specifications shall be carefully checked to include all items pertaining to the project and to eliminate inclusion of items not incorporated in the project.
   b. The specifications shall include a complete list of extended guarantee items and list of items for which operations and maintenance data are required.
c. References to industry standards shall be checked to verify correct identification of numbers and date of issue.

d. During the review by Owner's Representative, specifications will be checked thoroughly, but the Design Professional shall not rely upon this in lieu of careful preparation Design Professional review.

e. This manual incorporates certain Owner requirements in the selection of materials and quality of workmanship to be incorporated in the technical sections of the Specifications.

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

g. Competitive bidding is required by State 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 equally acceptable manufacturers or suppliers. This name of one 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.

h. For consistency in format the following rules shall be observed:

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.

2. The term “Owner” and “Owner’s Representative” shall always be capitalized, and no other term shall be used in reference to the University as the Owner.

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.

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.

5. “General Conditions,” “Supplementary Conditions” and “Special Conditions” are conditions of the Contract and are not parts of the Technical Specifications. See website for the latest versions; http://www.facilities.uiowa.edu/pdc/fmspecdocs.html The University is in the process of transitioning to a new set of “Conditions of the Contract” and expects to start utilizing the new documents by early 2014.
2. Site Drawing(s)
   a. Overall dimensions of the proposed building(s) or work area including alternatives. Indicate reference to a benchmark and baseline. Show property lines.
   b. 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 PM. Identify structures and streets by proper names.
   c. Existing and proposed contours.
   d. Show method of general drainage of the site as affected by the proposed building and concepts for mitigating site runoff.
   e. Indication of exterior elements; e.g., outdoor facilities, streets, service drives, parking areas, disabled access, paved areas, covered walks, landscape development, stairs, pools, retaining walls, terraces, etc. Include any elements to be demolished. Unless directed by the PM, final landscape design shall be prepared by the University with input from the Design Professional.
   f. Section(s) through site, to explain changes in level in the proposed building as related to the site.
   g. Underground utilities and structures.
   h. Small-scale campus map indicating project location on title sheet.
   i. Potential location for utility locations.
   j. Snowmelt system feasibility shall be evaluated during early design for main buildings entrances involving steps and/or ADA ramps. This shall apply to all new buildings and any major building renovations involving planned construction at a building entrance involving steps and/or ADA ramps. Priority should be given to snowmelt system applications as follows:
      (1) ADA ramps and routes
      (2) Main building entrance on the north side with steps or ramps.
      (3) Any building entry point with six (6) or more risers to the building entrance.
      (4) Truck delivery points where delivery route is sloped.

3. Floor Plans
   a. Locations, sizes, and space numbers of programmed spaces and other required gross areas, including corridors (width), stairs, toilets, custodial closets, ITS rooms, mechanical spaces, storage rooms, etc.
   b. All Floor Plans and Room Finish Schedules shall indicate room numbers.
c. Location of doors and windows. Indicate door swings.
d. Overall dimensions of each major area of the building(s).
e. Location of plumbing fixtures such as lavatories, floor drains, water closets, urinals, service sinks, drinking fountains, fire hose cabinets, fire extinguishers, sprinkler systems, etc.
f. Indicate principal built-in features such as fixed auditorium seats, kitchen equipment, display cases, casework, counters, shelves, lockers, etc.
g. Indicate extent of any demolition work, site access, and dust barriers.
h. Interior signage drawings and details (to scale):
   (1) Locations shown on floor plan keyed by code number. See Appendices.
   (2) Sign schedule referencing location code number, sign type designation, and sign message. See Appendices.
   (3) All sign art shall be created in vector format to be used as mechanical art for sign fabricator.
   (4) All map art shall be created full color in vector format to be used as mechanical art for sign fabricator.

4. Roof Plans and Roof Details
   a. A roof plan and detail of existing conditions (reroof) or other components and penetrations (new).
   b. Photographs of overall roof condition and show locations of inspection openings (reroof project only).
   c. An outline of the method of reroofing.
   d. A narrative report discussing major design features and options (reroof).
   e. Identification of existing components and methods of attachment.
   f. Simple sketches showing method of detailing new system.
   g. Design Professional must submit to the PM calculations used to determine control and expansion joint width and spacing.

5. Elevations and Sections
   a. Exterior elevations for the building must show windows, doors, louvers, solar screening systems, stairs, platforms, retaining walls, etc. Indicate grades, paved areas, etc.
   b. Indicate floor heights and window sill heights.
   c. Include longitudinal and transverse sections for each major area, indicating floor elevations, finish exterior grades, ceiling heights, pipe tunnels, unexcavated areas, basement and areaways, rooflines, parapets, etc.
   d. Various floor and grade elevations including those for interior and exterior stairways, walls, terraces, walk, etc.

6. Interior Planning
   a. The following space types must be thoroughly dimensioned to illustrate details clearly:
      (1) Classrooms and lecture halls
      (2) Kitchens and related service areas
      (3) Laboratories and other programmed spaces
(4) Toilet, shower, and locker rooms

b. Include an interior finish schedule that indicates, in general terms, floor, wall, and ceiling finishes together with special items of finish.

c. Indicate location of moveable items of furniture and equipment listed in the space description sheets. Differentiate from built-in furniture and equipment.

d. Indicate elevations on reflected ceiling plans.

7. Design Summary (Basis of Design)

a. Provide design summary documentation in an indexed report format with all assumptions and references stated. (PM shall distribute to appropriate FM staff.) Include:

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

(3) 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).

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

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

(6) Basis of design equipment and material information (e.g. catalog material, charts, tables, performance curves, etc.).

(7) Update or furnish an Energy Impact Statement per Section III and provide calculations, models (including any computer printouts) and a written summary of the results (clearly indicating assumptions employed) to the Owner.

(8) Verification of compliance with University standards, guidelines, and codes.

8. Existing Utilities Capacity - Show verified capacity at points of connection to existing utilities.

9. Building Envelope – Show typical configuration and integration of the air and weather barrier into adjacent building envelope materials.

10. Landscape Development Drawings
a. Show all roadways, walks (including ADA), parking lots and other hard surface areas.
b. Show any anticipated snowmelt systems.
c. Show all existing plant material to remain; including plant material, type, variety, size and condition. Identify any significant plant material to be protected and/or retained on the site.
d. Proposed landscape drawing
e. Show existing and final site grading and identify any surface water drainage issues that must be corrected as part of the project.

11. Structural Drawings
a. 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.
b. 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.
c. Detail junctions between floors, roof, and exterior wall to assure continuity and load path.
d. Drawings shall clearly dimension and accurately describe non-standard details and construction requirements. Included but not limited to:
   (1) Construction and expansion joint
   (2) Special jacking and lifting procedures
   (3) Protective cover (concrete)
   (4) Anchor bolt material and projection
   (5) Special connection details
   (6) Shoring requirements (including soil nails)
   (7) Construction sequence
   (8) Bolt torque
   (9) Concrete reinforcing details
   (10) Connection capacity
   (11) Water stops, etc.
e. Show type, placement, and location of rebar splices.

12. Mechanical Drawings
a. Plumbing
   (1) All required demolition.
   (2) Indicate locations of main wastes and vents, as well as service mains. Include water, air, gas, vacuum, etc.
   (3) Indicate pieces of equipment, showing location and required piping connections. Include pumps, tanks, backflow preventers, generators, etc.
   (4) Provide equipment schedules for plumbing fixtures.
(5) Provide isometrics for water, sanitary, and gas piping.

b. Heating, Ventilating, Air Conditioning and Piping
(1) All required demolition and associated capping of piping and duct runs.
(2) Indicate service mains, including steam, condensate, compressed air, hot water, chilled water, condenser water, gas, etc.
(3) Indicate air moving equipment and double line duct runs to all outlets including supply and exhaust fan systems, fume hoods, etc.
(4) Indicate pieces of equipment, showing locations and required piping connections including pumps, tanks, converters, etc.
(5) Provide equipment schedules indicating sizes, capacities and operating characteristics.
(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) Control schematics and sequence of operations.

c. Large Scale Drawings of Equipment Rooms
(1) Indicate layout of equipment to assure adequate space allowance.
(2) Include elevations of built-up fan units to assure proper air flow and access to component parts of the units.
(3) Show pump layout and piping runs.
(4) Provide room section cuts assuring room accessibility for maintenance personnel.

d. Fire Protection and Detection
(1) Show pipe runs, sprinkler locations, standpipes, pumper connections, and test connections.
(2) Show coverage rate of sprinklers.
(3) Show any special equipment.
(4) Show control schematic.
(5) Show fire alarm panel locations.

13. Electrical Drawings
a. All required demolition.

b. Show the power and control layouts on one 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 sheet and electrical, data, and furniture/casework on a separate sheet.

c. 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.

d. Indicate the point of connection to external utilities.
e. Indicate and provide utilization schedule for each load center unit substation, motor control center, distribution and switchboards, telephone equipment rooms, and closets.

f. Indicate type and locations of lighting fixtures in typical offices, laboratories, corridors, examination rooms, etc., and use a schedule for detail.

g. Indicate type and locations of all exterior lighting fixtures. Provide a photometric drawing for exterior lighting for review and approval.

VII. CONTRACT DOCUMENTS

Information in this section shall be used by the Design Professionals in the preparation of the contract documents that consist of the project manual, the drawings, and addenda.

The term “Project Manual” refers to the written portion of the contract documents; Bid form, Uniform General Conditions, Supplementary Conditions, Special Conditions and Technical Specifications.

The term “Drawings” refers to the graphic portrayal of elements included within the scope of the contract documents.

There should be no duplication between portions of the contract documents; instead, they should be complementary.

A. GENERAL

1. Contract documents shall be complete and ready for seals and signatures.

2. 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 14 days of the project’s bid opening. The information block shall include the numbers of the pages or sheets, which are covered by certification.

3. All corrections to drawings and specifications identified during design development and subsequent intermediate reviews shall be completed and incorporated into the bid documents.

4. 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.

5. Revised, detailed construction estimates shall be submitted. These estimates shall become the basis for the University’s construction estimate to be used at bid opening. The estimates shall include separate estimated costs for any bid alternates included in the bid documents but not part of the base bid.

6. Update the Energy Impact Statement per Section III and provide calculations, models (including any computer printouts) and a written summary of the results (clearly indicating assumptions employed) to the Owner.
7. Drawings
   a. Drawing size shall be D size sheets (24” x 36”), unless otherwise directed by PM.
   b. Drawings shall be segregated into disciplines (Architectural, Civil, Structural, Mechanical, Plumbing, Electrical, Interior, Fire Protection Systems, etc.).
   c. 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.
   d. Schedules for mechanical equipment, electrical equipment, doors and windows, and room finishes shall be included.
   e. Manufacturer and product names shall be referenced in equipment schedules.
   f. Symbols and abbreviations shall be explained and shown on legends.
   g. Design details, sketches, and drawings shall be shown on the drawings, not in the specifications.
   h. Each drawing sheet shall display the following:
      (1) Advertisement/issue date
      (2) Title of the project
      (3) An individual sheet title
      (4) Alphanumerical number indicating discipline and sheet number
      (5) Graphic Scale
      (6) Project number
   i. Title sheet or sheets in each set of drawings shall contain the following:
      (1) Design Professional’s Seal
      (2) Title of the project and project number
      (3) Owner’s name: (University of Iowa)
      (4) Design Professional’s name
      (5) Drawing index (unless directed otherwise by PM)
      (6) Site location map (including street address)
      (7) Advertisement/issue date
   j. Sections and details shall be numbered and cross referenced.
   k. Provide a title sheet or sheets for each bound set. Identify abbreviations and symbols used on the drawings in a key or legend.
   l. 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.
   m. Drawings shall be carefully checked by the Design Professional to achieve coordination between architectural, structural, mechanical, electrical and fixed equipment drawings.
   n. All Floor Plans and Room Finish Schedules shall have room numbers. All Floor Plans shall have grid line designations noted.
   o. 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.
p. DDC control diagrams and sequence of operations are to be included as part of the Construction Drawings.

q. Project construction limits, construction fencing, and Contractor access shall be clearly shown on the site drawings. Include any required tree protection or special requirements.

u. Where necessary to control pedestrian traffic the standard post and chain fence shall be used. Refer to Appendices for details.

r. Roofing Construction Drawings:
   (1) The roof drawings shall include all features and elements of the roof, including roof slope and drainage, all penetrations and mechanical equipment. The following items should be shown on the roof plans, accurately located and drawn to scale.
      (a) Mechanical units, exhaust fans, vents
      (b) Piping, conduit and related supports
      (c) Roof walkways, screens, hatches and ladders
      (d) Roof drains, overflow drains and scuppers
      (e) Miscellaneous penetrations
      (f) Expansion joints and area divided curbs
      (g) Gutters and downspouts
      (h) Valley, ridges, saddles and crickets.

   (2) The drawings shall include as a minimum complete details of roof system and components including:
      (a) Each roof perimeter condition
      (b) Each penetration condition, including vent flashing
      (c) Each roof-related sheet metal fabrication
      (d) Equipment curbs, skylight curbs, and roof hatches
      (e) Roof expansion joints and area dividers
      (f) Piping and equipment supports.
      (g) Typical roof drain and overflow drain including sumps and flashings
      (h) Scuppers.

   (3) Roof flashing details shall indicate as a minimum following components:
      (a) Roof deck and wall substrate and other adjacent materials
           Insulation including separate layers and vapor retarders.
      (b) Roof and flashing membrane
      (c) Cant strips, if applicable
      (d) Flashing attachment, if applicable.
      (e) Counter flashing and reglets
      (f) Sealants
      (g) Wood nailers and blocking, including adequate attachment.

s. Drawings shall include roofing system interface(s) with rest of building envelope(s), as well as details indicating how penetrations are to be handled.
t. Structural construction drawings shall include: structural loadings and details (floor, roof, cross-sectional, etc.)

u. Mechanical and electrical construction drawings shall include:

(1) All ductwork drawings are to be shown double lined, 1/4” scale minimum. Provide an enlarged drawing for all mechanical rooms. All ductwork and piping 3” and larger to be shown double lined. Clearly identify locations for valves and dampers on drawings, sections and installation details.

(2) Completed equipment, lighting and power panel schedules

(3) All details, cross-sectional and elevation views.

(4) Air and water flow (balancing) diagrams (For reference only).

(5) Control schematic, point listing, and sequence of operation (For reference only.)

(6) Show equipment schedules and sequence of operation information on mechanical drawings.

(7) Identify circuits and show equipment schedules on electrical drawings.

v. The Design Professional, at the direction of the PM, shall incorporate drawings that illustrate the location of any expected asbestos containing materials. Design Professional shall not be responsible for the identification and removal of asbestos. Asbestos-containing materials shall not be used.

8. Project Manual


b. Language of the project manual shall be brief and consistent. Do not repeat information contained in the General Conditions, Supplementary Conditions, or the Special Conditions in any other section. Do not repeat information contained in the specifications (except in equipment schedules).

c. The end of each technical section shall be marked “End of Section.”

d. The Project Manual shall have the official project title, Owner’s project number, Design Professional’s name and date of issuance on the cover. The date of issue shall be the same date as on the Drawings. The Design Professional’s seal of professional registration in the State of Iowa shall be included in the Project Manual. Include Volume number if applicable.

e. No allowances shall be provided in the contract documents unless approved by the PM.

f. The term “Contractor” shall be used throughout the specifications in the context defined in the General Conditions.

g. The General Conditions cover all one-year warranties and guarantees. Warranties/Guarantees other than one year shall be stated in the applicable specification section(s). Do not repeat one year warranties and guarantees in the specifications. All extended warranties shall be reviewed with the PM.
h. Only the “Owner”, “Owner’s Representative”, “Design Professional”, and “Contractor” shall be referred to in the specifications.

i. Design Professional shall list all required submittals, shop drawings, operation and maintenance manuals, warranties and certifications required in UL Specifications Division 01.

j. The geotechnical report, if applicable, shall be included, for reference only, as part of the contract documents.

9. A color board shall be produced, if required.

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.

A. ACCESSIBILITY

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.

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.
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:

a. In new construction, all public entrances to the building shall be designed for universal accessibility. Entrances on an accessible route, including the main entrance, shall be provided with one (1) door, or set of power operated doors. 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. The main floor or centrally located Men's and Women's restroom shall include a power operated door or be designed without doors. Power operated doors that are sequentially operated shall allow for a one-second-per-foot delay.

b. 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.

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

d. 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.

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

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

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

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

i. 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.

j. 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.

k. 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.

l. 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).

m. Design Professionals shall include a path of travel accessibility scoping schedule to include the elements and associated costs. This schedule shall be provided to the Owner for review during the early stages of design.

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

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

B. COMMISSIONING

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

3. Systems and components to be Commissioned:
   a. 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.
   b. Systems and component selection is based on the following guidelines:
      (1) Can the facility afford a system or component malfunction without endangering safety, health or significant comfort of occupants or research?
      (2) Is the system unique when compared to other installations across campus?
      (3) Does the system operate interdependently with other building or campus systems?
      (4) Will there be significant impact on energy consumption to operate or maintain the system?
   c. Building Envelope Commissioning shall concentrate on verifying continuous thermal, air and vapor barriers.

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.

5. The Commissioning Authority is responsible for preparing the following documents, and providing them to the Design Professional for distribution.
   a. Design Review Comments
   c. Review Comments from Contractor Submittals – The focus of this review shall be to develop the Construction Checklists and Functional Performance Tests.
d. Construction Checklists – Project specific pre-functional checklists completed by the Contractor.

e. Functional Performance Tests – Project specific functional performance criteria completed and documented by the Commissioning Agent with Contractor assistance.

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

C. ENERGY

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.

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

   a. Reduce the total ownership cost of facilities.
   b. Improve energy efficiency and water conservation.
   c. Provide safe, healthy, and productive built environments.
   d. Promote sustainable environmental stewardship.

3. All projects are required to reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigerating and Air Conditioning Engineers, (ASHRAE) standard 90.1 as adopted by the State of Iowa and the Illuminating Engineering Society of North America (IESNA).

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

   a. Energy Impact Statement

      (1) The Design Professional shall complete an energy impact statement with the following information:

         (a) Project/Building Narrative: Provide a brief narrative describing the operational needs of the building, including but not limited to: gross square footage, space use type(s) (office, lab, classroom, etc.), hours of operation, utilities required, mechanical systems description, lighting systems description, and building shell description.

         (b) Methods and Assumptions: Describe methods and assumptions used to calculate estimated quantities for each of the following categories and discuss significant energy-consuming equipment:

            i. Electrical
            ii. Low Pressure Steam
            iii. High Pressure Steam
            iv. Chilled Water
            v. Domestic Cold Water
            vi. Domestic Hot Water
            vii. Natural Gas
            viii. Storm Drainage System
(2) The Design Professional shall include all relevant calculations including electronic copies of spreadsheets, energy models, equipment data sheets, etc.

b. ASHRAE standard 90.1 energy analysis:

(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.

(a) 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.

(b) 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.

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

(a) 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.

(b) 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) Renovation Projects (construction costs < $1 million) - energy analysis shall be as follows:

(a) 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.

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

(4) The Design Professional shall submit the energy analysis information to the Owner in electronic and hardcopy formats.

(5) Compliance shall be reviewed and approved by the Owner at the conclusion of design development and contract document phases. Redesign may be required if compliance is not achieved.

c. Investment Payback Calculations:
(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.

(2) Renovation Projects – The Design Professional shall conduct a life cycle cost analysis of energy options using the following 2-pronged analysis:
   (a) Simple Payback and Modified Life Cycle Cost.
      i. The Simple Payback: Each investment alternative shall be calculated using: \( \text{Payback Period} = \frac{\text{Annual Energy Savings}}{\text{Capital Cost of the ECM}} \)
      ii. 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) The service life shall be in accordance with ASHRAE Service Life and Maintenance Cost Database found at http://xp20.ashrae.org/publicdatabase.

   d. Lighting Energy Analysis:
      (1) Interior Lighting:
         (a) 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.
         (b) The Design Professional shall provide photometrics to the Owner for review.
         (c) The Design Professional shall use the Owner’s LPD compliance form outlining the following:
            i. all specific space types involved on the project according to the LPD classifications for the space-by-space method per ASHRAE 90.1. Submit the LPD compliance form to the Owner for review.
            ii. “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.
   1. The Design Professional shall use lighting calculation software to complete the foot candle calculations. Photopia or other lighting simulation files may not be used.
2. Calculation shall identify the room geometry including ceiling height and fixtures and room reflectance values.
3. Light loss factors shall be clearly noted.
4. Initial lighting levels are not acceptable.
5. Manufacturer photometric data (IES file) is required.

(d) The Design Professional shall provide 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.

e. Exterior Lighting Analysis:
   (a) 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.
   (b) The Design Professional shall provide photometrics to the Owner for review.
   (c) The Design Professional shall use the Owner’s table outlining all specific space types involved on the project according to the LPD classifications for Building Exteriors as listed in ASHRAE 90.1. Format table as follows and include the following:

<table>
<thead>
<tr>
<th>SPACE TYPE</th>
<th>ASHRAE W/SF</th>
<th>U OF I (30% BETTER)</th>
<th>TARGET FC LEVEL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 1</td>
<td>0.15</td>
<td>0.10</td>
<td>1</td>
<td>Dusk to dawn parking area</td>
</tr>
</tbody>
</table>

*Note specific areas and determine if they are tradable or non-tradable based on ASHRAE 90.1.*

   i. all specific space types involved on the project according to the LPD classifications for building exteriors as per ASHRAE 90.1. Submit the LPD table to the Owner for review.
   ii. “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.

1. Calculation shall identify the fixture mounting heights.
2. Light loss factors shall be clearly noted.
3. Include horizontal point by point plots as well as vertical foot candle levels at the property line.
and 15 feet beyond the property line of the project taking into consideration adjacent lighting.

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

5. The Design Professional shall submit the above energy analysis information to the Owner in electronic and hardcopy formats.

6. Compliance shall be reviewed and approved by the Owner at the conclusion of schematic design, design development and contract document phases. Redesign may be required if compliance is not achieved.

D. HAZARDOUS MATERIALS

1. Spill Prevention
   a. No “oil” spillage from storage tanks, reservoirs, etc., shall find its way off of the immediate site through sanitary sewer, storm sewer or surface run-off.
   b. Comply with Spill Prevention, Control and Counter Measures (SPCC) 40CFR112.
   c. Any and all oil storage devices shall be double walled/vented or have secondary containment per SPCC 40CFR112.7. Oil includes oil of any kind or in any form, including, but not limited to, petroleum, hydraulic oil, fuel oil, vegetable oil, animal oils, sludge oil refuse and oil mixes with wastes other than dredged spoil.
   d. Where this Federal code is applied in designs for The University of Iowa, written notice of such shall be made to the Owner by the Design Professional prior to final review of drawings and specifications. This notice shall allow other 40CFR112 requirements to be provided by the University in order to comply with the code.

E. DEMOLITION

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

F. WARRANTY

1. Product and installation warranty requirements and manufacturer warranty requirements shall all be reviewed with the Owner prior to bidding.

G. TRAINING

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

II. CIVIL

The following information is provided as a general guideline in establishing Civil Engineering design requirements.
A. GENERAL
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.
2. Ensure movement of trucks and equipment on Owner’s property is in accordance with Owner’s instructions and depicted on construction documents.
3. Topsoil shall be stripped from the construction site when possible and stockpiled in designated area for reuse.
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.
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.
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.
7. Design Professional shall specify inspection and testing requirements and shall include procedures for evaluation of test data. 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. Owner shall retain the services of an Engineering Inspection and Testing Firm. Contractor shall be responsible for coordinating and scheduling inspections.

B. SUBSURFACE INVESTIGATION
1. The Owner shall be responsible for providing record information of underground utility lines and structures.
2. Contractor shall contact Iowa One-Call for location of utilities 48 hours before any excavation takes place. All locates shall be Joint Locates.
3. If investigative soils analysis is required during project design, Owner shall retain a Geotechnical Engineer.
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.
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.
6. The plan shall show:
   a. A graphic scale, north arrow, and location of existing buildings and trees.
b. Above and below ground service/utility lines (both utility company and University-owned).

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

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

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

C. SITE SURVEY

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:

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

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

   c. 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.

   d. Location and type of all site lighting fixtures.

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

D. LANDSCAPING

1. General
   a. Selection of landscape plant materials shall be based on plant hardiness and growth success within the area used.

   b. Preservation and protection of existing trees and landscape shall be a primary consideration in any project.

   c. All proposed plant material selections shall be approved by Owner.

2. Plants
   a. Trees
      (1) Design Professional shall use the Campus Urban Forest Study as a guide to tree selection.

      (2) The Design Professional shall meet with the Owner during design development to evaluate project impact on existing trees and shall clearly identify any trees or plant materials that are proposed for removal. Proposed removals shall be reviewed and approved by the Owner.

      (3) Critical Root Zone Protection
          (a) The critical root zone (CRZ) shall be shown for each tree to be protected.
(b) Trees determined to be saved shall be protected by durable 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
   i. Diameter of tree trunk is measured 4 1/2 feet above ground level.
   ii. The diameter in inches is multiplied by 1.5 feet to obtain the critical root zone radius.

(c) Fence shall be maintained throughout the construction period.

(d) 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.

(e) Plan notes and specifications shall restrict construction activity within this critical root zone.

(f) The soil within this protected CRZ shall not be disturbed in any manner during construction. No filling or cutting of existing soil shall be permitted within the CRZ.

(g) No equipment, materials, supplies and/or salvage shall be stored or placed within the zone.

b. Lawns
   (1) Finished lawn areas shall have a finished slope 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.

   (2) Seed and Sod
      (a) Preference is given to sod versus seed to provide a more immediate appearance of completion.
      (b) 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.
      (c) Determination to seed shall be based on availability of the site for seeding and its conformity to normal, accepted seeding dates.
      (d) Dormant seeding is not recommended, but if required due to schedule, a protective barrier shall be included.
      (e) Selection of seed mix shall be based on site specific issues and reviewed with Owner.
      (f) Projects shall include all necessary water maintenance as required by weather conditions for the first sixty (60) calendar days after installation or to final acceptance of the project, whichever is later.
c. Planting Schedules
   (1) A planting schedule shall be provided and timed in relation to planting season and the Owner’s acceptance of the project.

3. Landscape Furniture and Fixtures
   a. Site plans shall indicate the location of all site furniture (benches, signs, fences/barriers, trash receptacles, etc.)
   b. Selected manufacturers and styles shall be reviewed and approved by Owner. Custom designed site furnishings shall not be allowed.
   c. All metal shall be painted black steel.
   d. All wood shall be Ipe.
   e. 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 with skateboard and inline skate damage prevention in mind. 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.
   f. Where necessary to control pedestrian traffic, the standard post and chain fence shall be used. See Appendices for details.
   g. Bicycles
      (1) Bicycle parking shall be addressed.
      (2) Bicycle parking shall be evaluated based on the building programming, existing demand, and future growth. 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. Minimum of two (2) spaces, as based on the Association of Pedestrian and Bicycle Professionals’ Bicycle Parking Guidelines. Final bicycle count shall be approved by Owner.
      (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. Exterior Building Signage
   a. 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.
   b. Signs or lettering shall not be applied to an exterior building surface.
   c. Design Professional shall incorporate a sign location in their design bid documents.
d. Proposed signage shall be submitted to the Campus Planning Committee for review and approval.

E. ROADWAYS, PARKING LOTS AND WALKWAYS

1. General
   a. Curbs shall be Portland cement concrete.
   b. Pavements shall be designed to accommodate the design vehicle for the pavement’s use.
   c. 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.
   d. 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.
   e. All sidewalks, ramps, and other paved, exterior walking surfaces shall be concrete. Concrete pavers may be used in limited areas as accents.
   f. All materials shall be slip resistant.
   g. 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. Any ramp not able to comply with these standards shall have a snowmelt system.
   h. Design shall be in accordance with AASHTO “GREEN BOOK”—A Policy on Geometric Design of Highways and Streets.
   i. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.
   j. Snowmelt Systems
      (1) Snowmelt systems shall provide 24/7 protection from accumulation of snow and ice at major building entrances and ADA ramps.
      (2) Snowmelt systems shall circulate glycol under low pressure through closed-loop piping embedded in concrete.
      (3) Snowmelt systems shall be controlled through the Building Automation System (BAS).
      (4) Conceptual design shall use a base typical system for 150 Btu-h per square foot with a 10 mph wind at 0 degrees F.

2. Roadways
   a. Asphalt and Portland Cement Concrete Paving
   b. The ratio of slab width to length shall not exceed 1.67 for street pavements.
      (1) Variance in joint spacing may be permitted to achieve desired architectural effect as approved by Owner.

3. Parking Lots
a. All accessible parking spaces shall be designed per "universal accessible" criteria defined in Iowa Administrative Code Section 661-18.3 Exception.

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

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

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

4. Walkways

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

b. 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.

c. 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.

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

e. Site steps are discouraged. Design accessible exterior routes without ramps when possible and use alternatives such as sidewalks and proper grading to achieve gentler slopes.

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

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

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

F. TEMPORARY TRAFFIC CONTROL

1. General

a. Barricades

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

(2) Barricades shall be installed in the following locations:

(a) Between the pedestrian access route and any adjacent construction site.

(b) Between the alternate circulation path and any adjacent construction site.

(c) Between the alternate circulation path and the vehicular way, if the alternate circulation path is diverted into the street.

(d) Between the alternate circulation path and any protruding objects, drop-offs, or other hazards to pedestrians.
(e) At the down curb ramp of an intersection, if the opposite up curb ramp is temporarily and completely blocked, and no adjacent alternative circulation path is provided.

(3) Wooden railing, fencing, and similar systems placed immediately adjacent to motor vehicle traffic shall not be used as substitutes for crashworthy temporary traffic barriers.

(4) Tape, rope or chain shall not be used as a control for pedestrian movements or as a safeguard to protect individuals from hazards.

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

(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.

(7) Barricade specifications

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

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

(c) 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.

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

(e) 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.

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

b. Warnings and Signage

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

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

(3) 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).
(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.

(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) Adequate lighting shall be required to provide visibility of signage during non-daylight hours.

(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.

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

2. Vehicular Traffic
   a. Temporary traffic control shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).
   b. Construction activity impacting any street shall have a temporary traffic control plan approved by the appropriate agency
      (1) Iowa City Engineer’s Office
      (2) Coralville City Engineer’s Office
      (3) Iowa Department of Transportation
      (4) The University of Iowa - Building & Landscape Services
   c. 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.
   d. Signs may be installed on the project fencing or supported independently, depending on site conditions.

3. Pedestrian Traffic
   a. 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:
      (1) Limits of construction (staging areas, entrance to construction site / staging areas, vehicular circulation to and through site).
      (2) Pedestrian routes around construction site (accessible routes, accessible parking locations, crosswalks, curb-cuts).
      (3) Building entrances (key building entrances and service areas to be maintained, accessible building entrances).
      (4) Signage plan (proposed pedestrian signage, designated pedestrian routes, signage location).
(5) Details of proposed pedestrian safety improvements (temporary sidewalks, ramps, etc.).

(6) Phasing (separate plans indicating construction phasing and schedule).

b. Pedestrian control plans shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) Part 6: Temporary Traffic Control

c. Alternate / Temporary Pedestrian Circulation Paths

(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.

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

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

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

(5) Access to transit stops shall be maintained.

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

(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.

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

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

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

G. SANITARY SEWER

1. General

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

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

2. Piping

a. See Section IV for information.

3. Accessories

a. Review manhole numbering with Owner.

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

c. Cast-in-place manholes shall be fully detailed in the construction documents.

H. STORM SEWER

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

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

c. 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.

d. 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.

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

f. Return Periods

(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.

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

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

(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.

g. 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.

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

(2) Sidewalk grade shall be set to prevent surface from collecting and channeling surface drainage.

h. 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) 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.

(4) Best Management Practices (BMP) using storm water detention and retention, grass swales, bio retention swales, riparian buffers and
proper operation and maintenance of these facilities shall be included in
the design and reviewed with Owner prior to design.

2. Piping
   a. Storm pipes shall run on a straight line and grade between structures.
   b. 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.

3. Accessories
   a. Bicycle and wheelchair safety shall be taken into consideration in the design of
storm drainage systems.
   b. Grate bars shall be placed perpendicular to direction of traffic flow.
   c. Grates in pedestrian areas shall be sized to avoid catching heels of shoes.

I. DOMESTIC WATER
   1. General
      a. Additional water loads to the water distribution systems proposed by a project
shall have the load design requirements presented for Owner approval prior to
50% Construction Documents. The anticipated loads shall be added to the
Owner’s current hydraulic model to determine what is acceptable and what
changes may be required.
      b. Flushing instructions shall be explicit in drawings, including source of water,
outlet point, air relief vents, and final destination of water.

2. Piping
   a. Piping shall conform to AWWA standards and the requirements of the Iowa
DNR.
   b. Piping shall have an Iowa DNR permit.

3. Accessories
   a. Water meters shall be located inside buildings with a ¾ inch conduit back to a
central PLC location.
   b. 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. See Appendices for detail.

4. Testing
   a. See Section IV for information.

J. NATURAL GAS
   1. General
      a. Coordinate all work with MidAmerican Energy Company.

K. CHILLED WATER
   1. General
a. Coordinate the building central chilled water interface design and anticipated usage with Owner.
b. 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.
c. 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.
d. Provide controls for every device.
e. Three-way or on/off valves shall not be used.
f. 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.
g. Verify final valve sizing with The University of Iowa Chilled Water Plant.

2. Piping
   a. See Section IV for information.

3. Accessories
   a. See Section IV for information.

4. Testing
   a. See Section IV for information.

L. STEAM AND CONDENSATE

1. General
   a. Steam lines designated as a main Campus steam service shall be installed in a utility tunnel.
   b. Review use of direct-buried steam and condensate systems with Owner.
   c. Design steam and condensate systems to 175 psig, and 500 degrees F.
   d. 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.
   e. Coordinate steam distribution system load design requirements, available steam distribution facilities and operational needs of the steam plant with Owner.
   f. Provide provisions for pipe expansion.

2. Piping
   a. The Design Professional shall furnish design pipe size and flow information to the Owner.

3. Accessories
   a. Meters
     (1) Meters are required for steam system usage points.
(2) Meter station shall consist of a pressure transmitter, a temperature transmitter, and a steam flow meter.

(3) Coordinate specifications, sizing, product numbers and codes with Owner.

b. Steam Trapping Stations
(1) Trapping stations shall be located every 250 feet and at elevation changes on steam lines.

(2) Direct-bury steam systems shall require steam vaults to access trapping stations.

c. Pressure Reducing Valves (PRV)
(1) Every building shall have a PRV.

d. Piping Penetrations
(1) Through walls shall be detailed on drawings.

(2) Shall be an anchor point and shall be reviewed by a structural engineer.

e. Supports and Anchors
(1) All piping hangers and anchors shall be properly designed to avoid excessive stress in any pipe section.

(2) Details shall be provided for all piping 4 inches and larger on the low pressure steam or condensate systems, and all piping over 2 inches on the high pressure system.

4. Testing
a. Provisions for Steam-Blow shall be shown on design drawings and procedures shall be reviewed with the Owner.

M. UTILITY TUNNELS
1. See Section IV for information.

N. ELECTRIC DISTRIBUTION
1. General
   a. See Section IV for information.

2. High Voltage Equipment
   a. See Section IV for information.

3. Ductbank
   a. See Section IV for information.

O. COMMUNICATIONS DISTRIBUTION
1. General
   a. See Section IV for information.

2. Underground Pathways
   a. See Section IV for information.

3. Building Entrance Pathway
   a. See Section IV for information.
4. Communication Manholes  
   a. See Section IV for information.

5. Termination, Splicing and Testing  
   a. See 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.

A. GENERAL

1. Building Elevations  
   a. Finished floor height shall be expressed on contract documents as actual elevation based on The University of Iowa’s datum.  
   b. Floor elevations shall be continuous without height transitions between floor types.

2. Standard Floor and Room Numbering  
   a. Space Planning & Utilization (SPU) shall assign all building and room numbers.  
   b. 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.  
   c. Process to Assign and Update Room Numbers  
      (1) At the end of the Schematic Design phase, the Design Professional shall provide floor plan(s) to Space Planning and Utilization. Rooms and other spaces, including exterior entries, shall be numbered in accordance with University conventions and returned.  
      (2) The project shall use the room numbers provided for in the Design Development documents.  
      (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.  
      (4) Bid/Construction Documents shall not be issued without completing steps 2 and 3.  
      (5) Per the Standard Form of Agreement, the Design Professional shall submit CAD drawings of the Construction Documents to SPU within ten (10) working days of the award of construction contract.  
      (6) Design Professional shall notify Owner of any changes during the course of construction that impact room numbering or entry doorways. Owner will provide new room numbering designations. The Design Professional shall update the Construction Documents, including finish and door schedules, with the new room numbering designations.
(7) The Design Professional shall provide Record Documents with the final room number designations and updated schedules.

B. BUILDING ENVELOPE

1. General
   a. The building envelope shall comply with ASHRAE/IES Standard 90.1.

2. Exterior Building Materials
   a. 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.
   b. Materials shall be practical, maintenance free, durable, and cost effective.
   c. Exterior walls systems of brick or stone are preferred over metal.
   d. Block backup is preferred over the use of steel stud backup.
   e. Exterior insulation and finish systems (EIFS) stucco and plaster shall not be used as the primary finish of a building or renovation.

3. Exterior Enclosure Performance Requirements
   a. Materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed $0.0002 \text{ cfm/ft}^2$ under a pressure differential of 0.3 inch water (1.57 psf) (0.02 L/s.m$^2$ @ 75 Pa) when tested in accordance with ASTM E2178.
   b. 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.

C. ROOFING

1. General
   a. Roofing systems shall comply with the following:
      (1) Underwriters Laboratory (UL)
         (a) UL labels are required for each membrane, with top side fire rating meeting ASTM E108 Class A.
      (2) National Roofing Contractors Association (NRCA), Roofing and Waterproofing Manual.
      (5) FM Global RoofNav
         (a) Minimum 1-60 SH (severe hail) approved rating.
         (b) All components shall be approved for both individual and use in a listed assembly.
   b. Verify wind velocity requirements with Owner.
c. All roofing materials shall be asbestos-free.
d. The Design Professional shall consider the following design parameters when selecting a roof system:
   (1) Life expectancy of building
   (2) Life of the roof system
   (3) Present and future use of building, including specific uses in the building that could affect the roof system
   (4) Aesthetics
   (5) Initial cost of the roof system and additional building costs required for recommended roof system
   (6) Maintenance costs and requirements
   (7) Energy costs associated with recommended roof system
   (8) Building height, roof slope, wind resistance requirements
   (9) Local environmental issues, contaminants and pollutants
   (10) Structural properties of roof superstructure
   (11) Type of roof deck
   (12) Vapor retarder requirements
   (13) Roof traffic, access and penetrations
   (14) Code and insurance requirements and restrictions
   (15) HVAC internal pressures
   (16) Application issues, such as staging
e. The Design Professional shall follow these roofing guidelines when designing the roofing system:
   (1) Single-ply ballasted roofs and spray foam roofing system shall not be used.
   (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) Locate roof drains at projected low points.
   (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.
   (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>
</tbody>
</table>
49-61 inches | 30 inches  
|-------------------|-----------------|
Over 61 inches     48 inches

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

(7) Existing roof access shall be evaluated, and roof access hatches, ladders, and other components shall be installed.

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

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

(10) Account for thermal break(s).

(11) In new construction, roof shall have a minimum design slope of 3/4 inch per foot.

(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.

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

(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.

2. Roofing Systems
   a. Green Roof Systems
      (1) Systems shall be modular and non-compartmentalizing.
      (2) Shall have direct access to green roof installations. Access through office space, classrooms, labs or other non-public areas is not acceptable.

   b. Metal Roofing-Structural Standing Seam (SSR)
      (1) Structural metal roofing shall meet UL 90 uplift rating.
      (2) Minimum design slope 1 inch per foot.

   c. Slate
      (1) Slate material shall be ASTM C406, Type-S1, with ninety (90) to one hundred (110) year performance-life.
      (2) Use of artificial slate requires Owner approval.
      (3) Minimum design slope 5 inches per foot. Slopes down to 3 inches per foot are acceptable with adhered polyethylene reinforced bitumen sheet underlayment.

   d. Asphalt Shingles
      (1) Asphalt shingles shall be fiberglass seal-tab type with minimum twenty-five (25) year warranty.
      (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. Roofing Components
   a. Membrane and Insulation Assemblies
      (1) See Section IV for information.
   b. Roof Deck
      (1) Systems shall be designed by a registered Structural Engineer.
      (2) Design Professional shall determine expected wind uplift conditions and determine suitability of the recommended system.
      (3) Roof deck securement shall be per FM Global Property Loss Prevention Data Sheet 1-29.
      (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.
      (5) Gypsum, wood or wood fiber cement decks shall not be used.
   c. Vapor Retarders
      (1) Design Professional shall determine the need for a vapor retarder. Provide calculations to Owner for record.

4. Accessories
   a. See Section IV for information.

D. DOORS, HARDWARE, WINDOWS, CURTAIN WALLS AND GLASS
   1. Doors
      a. 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.
      b. Exterior wood doors are not allowed.
      c. Doors shall have an intermediate rail at the centerline of exit device.
      d. Glass revolving, glass folding, and glass sliding doors are not allowed.
      e. Aluminum entrances and storefronts shall have thermal break construction and comply with American Architectural Metal Association (AAMA) standards. Framing shall be thermally broken from any interior construction.
      f. Door frames installed in existing structures shall match the color of existing door frames.
   2. Hardware
      a. All door hardware shall be heavy-duty, institutional grade.
      b. All classrooms shall have double cylinder classroom security locksets (excluding electronic locksets).
      c. All General Assignment Classrooms shall have electronic access control. All ITS telecommunication rooms shall have electronic locks, door closers, and access control.
      d. Hardware specifications shall be provided by a Door & Hardware Institute Certified Architectural Hardware Consultant.
e. Openings consisting of electrified hardware shall include a narrative in the Construction Documents explaining the intended design and function of the hardware.

f. 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.

g. Hinges
   (1) Hinges shall be of full mortise-type with concealed bearings. Exterior hinges shall be stainless steel.
   (2) Use non-removable pins on all out-swing doors which are to be secure.

h. Door Closers
   (1) Floor and concealed top jamb-mounted closers are not acceptable.
   (2) Cushion stops shall not be used.
   (3) Delayed action may be used in animal care facilities only.
   (4) Door closers shall be installed on all custodial, maintenance, and telecommunication rooms.

i. Power Operators
   (1) Power operators shall be push plate operated only. Radio frequency types shall not be used.

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

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

b. 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.

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

d. 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.

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

4. Glass and Glazing
a. All new construction and major renovations shall use low-E glazing.

b. 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.

c. 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 debridged type thermal breaks. Steel framing shall not be exposed to the exterior except where required by code.

d. 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.

e. Exterior windows and exterior glazed doors shall have ¾ inch double glazing, certified by the Insulating Glass Certification Council (IGCC).

5. Joint Sealants
a. See Section IV for information.

E. FINISHES

1. Wall Systems
a. Follow the USG gypsum board construction manual guidelines.
b. Wall Finishes
   (1) Finish selection shall be based on ease of cleaning and serviceability.
   (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.
   (3) Public stairways and corridors shall have durable wall finishes.
   (4) Mechanical rooms shall have masonry or concrete walls.
   (5) Restrooms shall have ceramic tile wainscot.
   (6) Lactation Rooms shall have painted walls.
   (7) Commercial-grade wall covering may be used with Owner approval. If vinyl, shall be Type II.
   (8) Chair rails shall be provided in conference rooms, classrooms or similar multi-use spaces.

2. Ceiling Systems
a. List appearance as criteria requirement when including “approved equal” to allow for coordination with maintenance stock.
b. Specialty ceiling tiles/systems require Owner approval. Ceiling tiles/systems shall be removable without requiring the use of specialty tools.
c. Sound attenuation shall be used at partitions and above ceilings. Review criteria for acoustical separation with Owner.
d. 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).
e. Ceiling systems shall use noncombustible materials.

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

4. Floor Finishes
a. Entry mats are required at all main entrances.
(1) Entries shall have removable, roll-up “Entrap” matting installed into a mat well. Mat wells shall not have drains.

(2) 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.

b. Hard, durable, slip resistant surfaces requiring minimum maintenance shall be used in the following rooms:
   (1) Lobbies and public areas
   (2) Stairwells and shall have applied nosing one (1) piece full width of riser.
   (3) Entry level corridors
   (4) Classrooms, Auditoriums and Lecture Halls
   (5) Computer labs

c. Carpet tiles may be used in the following rooms:
   (1) Auxiliary corridors
   (2) Computer labs
   (3) Offices
   (4) Conference rooms

d. Sealed concrete shall be used in the following rooms:
   (1) Restrooms
   (2) Mechanical rooms
   (3) Custodial closets
   (4) Storage rooms
   (5) Laboratories

e. Ceramic tile shall be used in the following rooms:
   (1) Lactation rooms

f. Vinyl tile (premium quality products only) shall be used in the following rooms:
   (1) Lactation rooms
   (2) Laboratories

g. Non-slip quarry tile shall be used in the following rooms:
   (1) Food preparation and service spaces

h. Epoxy coating shall be used in the following rooms:
   (1) Laboratories
   (2) Food preparation and service spaces
   (3) Animal quarters
   (4) Mechanical rooms located above another space with all corners, edges, cracks etc. caulked to prevent leakage to spaces below.

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

F. FURNISHINGS

1. Window Treatments
   a. Window treatment shall match building standard.
   b. Roller shades are preferred.
c. Shade opacity shall be reviewed with Owner.

G. INTERIOR SIGNAGE

1. General

a. Signage shall adhere to current ADA Standards for Accessible Design.
   (1) Copy shall provide appropriate contrast with background as identified by the ADA guidelines.
   (2) Mounting locations shall be as identified by the ADA guidelines.
   (3) Digital displays outside rooms shall include an ADA compliant component.
   (4) Provide direction to accessible seating within auditoriums and tiered classrooms.
   (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 telecoil-compatible system.

b. Signage shall follow the International Fire Code (IFC).
   (1) Rooms with one (1) or more breaker panels shall be identified as "Electrical Room".
   (2) Access door to building generator shall be identified as "Generator".
   (3) Door openings onto a roof shall have a sign reading "Roof Access", including within penthouses.
   (4) Rooms that have a fire pump, main sprinkler valve, or fire command center shall be identified as “Fire Equipment”. Copy shall be red.
   (5) Elevator machine rooms shall be identified as "Elevator Equipment".
   (6) Mechanical rooms shall be identified as "Mechanical".
   (7) Custodial rooms shall be identified as "Custodial".
   (8) NFPA 704 diamond signs shall be displayed as allowed by variance with Coralville Fire Department or Iowa City Fire Department.
      (a) Verify requirements for municipalities other than Iowa City and Coralville with Owner.
   (9) NFPA 101 inside stairwell signs shall be located in stairwells of three (3) or more landings.
   (10) "In Case of Fire Use Stairs, Do Not Use Elevator" signs shall be located at elevators without message applied to call button panel.

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

d. Signage mock-ups shall be reviewed and approved by Owner prior to completion of the sign design and specifications.

e. Signs shall be designed to be updateable while maintaining vandal and tamper resistance.
f. Every room shall be identified. The minimum signage required shall be a sign type room number.

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

h. Departmental policies may require additional signage.

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

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

k. Signs referencing public venues include the following rooms:
   (1) Restrooms
   (2) Accessible restrooms
   (3) Unisex restrooms
   (4) Lactation rooms
   (5) Classrooms
   (6) Ending rooms
   (7) Cafeterias.

2. Sign Types
   a. See appendices for examples of sign types.

   b. Building Directory
      (1) Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
      (2) Directory to be immediately viewable upon entering the building from the primary entrance and in major circulation areas.
      (3) Directory shall permanently identify level number and may include building name. Copy shall be permanently printed.
      (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.
      (5) Destinations shall be listed alphabetically. Provide minimum capacity of 10 percent greater than the current list of destinations.
      (6) Locations shall be keyed to floor levels, room numbers or map artwork.
      (7) Map artwork shall be plan view or stacked perspective.
         (a) Artwork shall schematically replicate the footprint of each level.
         (b) Features to be shown shall be stairs, elevators, restrooms, accessible restrooms, unisex restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances, and department identification.
         (c) Room number ranges shall be identified.
         (d) A uniquely shaped and/or colored "YOU ARE HERE" symbol shall be placed in the plan location of the viewer.
         (e) Map artwork shall be oriented so that top of map is the direction the viewer is facing.
(f) Map shall be sized to convey information clearly.

c. Elevator Directory
(1) Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
(2) Directory shall permanently identify level number. Building name may be included as directed by the Owner.
(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.
(4) Destinations shall be listed alphabetically. Provide capacity of 10 percent greater than the current list of destinations.
(5) Sign shall be located adjacent to the entrance into an elevator cab. One (1) directory can serve two (2) adjacent elevator cabs.

d. Elevator Cab Directory
(1) Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
(2) Elevator Cab Directory shall be used in addition to Elevator Directory.
(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.

e. Overhead Directional
(1) Use of overhead directional signs shall be limited.
(2) Overhead directional signs shall be used to direct to primary destinations or range of room numbers.
(3) Copy on overhead directional signs shall be at a minimum of 3 inch height and comply with ADA requirements for visual character height. Copy shall be self-adhesive vinyl, silkscreened or applied cut-out lettering.

f. Wall-mount Directional
(1) Wall-mount directional shall be designed to hold an in-house, updatable, single changeable insert or modular inserts.
(2) Wall-mount directional shall permanently identify level number. Building name may be included as directed by the Owner.
(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.
(4) Signs shall be located at decision points.
(5) Wall-mount directional may include map artwork.
(6) Map artwork
   (a) Artwork shall be plan view or stacked perspective.
   (b) Artwork shall schematically replicate the footprint of each level.
(c) Features shall include stairs, elevators, restrooms, accessible restrooms, unisex restrooms, lactation rooms, classrooms, vending / cafeterias, building entrances.

(d) Room number ranges shall be identified.

(e) A uniquely shaped and/or colored symbol labeled "You Are Here" shall be placed in the plan location of the viewer.

(f) Map art shall be oriented with top of map the direction the viewer is facing.

g. Overhead Identification
   (1) Use of overhead identification signs shall be limited.
   (2) Overhead identification signs shall be used to identify primary destinations.
   (3) Copy shall comply with ADA requirements for visual character height.
   (4) Copy shall be self-adhesive vinyl, silkscreened, or applied cut-out lettering.
   (5) Sign shall be used in conjunction with wall-mounted department identification.

h. Projecting Flag Identification
   (1) Projecting flag identification shall be used for public areas visually hidden from direct view.
   (2) Flag shall be an acrylic blade fastened to an aluminum armature.
   (3) Copy shall comply with ADA requirements for visual character height.
   (4) Graphics shall be limited to symbol glyphs for public venues.
   (5) Glyphs shall be silkscreened or self-adhesive vinyl.

i. Department Directory
   (1) Directory shall be designed to hold an in-house, updatable, single changeable insert or modular inserts. Changeable inserts shall be 8 ¹/₂ x 11, 8 ¹/₂ x 14, 11 x 17 or as approved by Owner.
   (2) Directory shall be used as display of destination addresses within the department. Content may include program names, faculty / staff identification and room numbers.
   (3) Destinations shall be listed alphabetically. Provide capacity of 10 percent greater than the current list of destinations.

j. Department Identification Plaque
   (1) Department identification plaque shall be wall-mounted.
   (2) Plaque shall be scaled larger than room identification signage to provide more significance.
   (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.
   (4) Supporting copy shall be silk-screened.
   (5) Sign face shall be matte.
(6) Sign location shall not be viewable from the exterior of the building.

k. Department Identification Vinyl Lettering
(1) Vinyl lettering shall be scaled larger than room identification signage to provide more significance.
(2) Vinyl lettering identifying a permanent space shall include ADA compliant identification.
(3) Vinyl lettering shall not be viewable from the exterior of the building.

l. Room Number
(1) Room number shall be wall-mounted.
(2) Rooms identified by number only include general storage rooms and rooms whose purposes are to be discreet.
(3) Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille.
(4) Sign face shall be matte.

m. Room Identification
(1) Room Identification shall be wall-mounted.
(2) Rooms whose purpose or room information is not likely to change frequently shall be identified by room text and room number.
(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.
(4) Sign face shall be matte.

n. Conference Room Identification
(1) Conference Room identification shall be wall-mounted.
(2) Sign shall include “Conference” and room number.
(3) Signs shall incorporate gripper bar paper holder. Gripper bars shall be constructed of extruded aluminum.
(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.
(5) Sign face shall be matte.

o. Office and Multi-purpose Room Identification
(1) Office and multi-purpose room Identification shall be wall-mounted.
(2) Sign shall identify rooms by room number and in-house, updatable insert.
(3) Typical rooms include offices and rooms whose purpose or room information may change frequently.
(4) Sign shall use uppercase sans-serif ADA spec tactile number and Grade II Braille for the room number.
(5) In-house, updatable 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.
(6) Signs shall incorporate gripper bar paper holder. Gripper bars shall be constructed of extruded aluminum.

(7) Sign face shall be matte.

p. Open Office Work Station Identification

(1) Each open office work station shall receive an identification sign
(2) Open office work station signage shall not include room number.
(3) Sign shall identify occupant or use by in-house, updateable insert.
(4) Confirm mounting detail with Owner.
(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.
(6) Sign face shall be matte.

q. Symbol Identification

(1) Symbol identification shall be wall-mounted.
(2) Information shall be organized with room number on top, symbol glyph on 6 inch area in the middle and supporting text on bottom.
(3) Typical rooms include unisex, men’s, and women’s restrooms, and stairwells.
(4) Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.
(5) Sign face shall be matte.

r. Large Symbol Identification

(1) Large symbol identification shall be wall-mounted.
(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.
(3) Typical rooms include family restrooms and locker rooms.
(4) Sign shall use uppercase sans-serif ADA spec tactile characters and Grade II Braille for the room number and room text.
(5) Sign face shall be matte.

s. Entrance Number Plaque

(1) An entrance number plaque shall be placed at each exterior door, including entrances from rooftop and balconies.
(2) Plaque shall be an exterior grade 1/8 inch 2-ply material with contrasting color layers, Rowmark Ultra-Matte material or approved equal.
(3) Numbers shall be assigned by Owner. "ENT" shall precede all numbers. Sign shall use uppercase sans-serif.
(4) Plaques shall be sized to fit on doorframe, centered over door on outside of facility. Typical size plaque is 1-1/2 inch x 6 inch with 1 inch copy.

Subject: Loading Dock Entrance Number Plaque
(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.

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

(3) Typical plaque size is 12 inch x 12 inch with 4 inch copy or sized in accordance with specific building criteria.

(4) Sign shall be placed adjacent to door and viewable from street.

u. Code Specified Information

(1) Code Specified Information shall be wall-mounted.

(2) Refer to applicable code for text, symbols, size and sign layout.

(3) Smoke-free signage shall coordinate with building design and placed at all building entrances.

(4) Sign face shall be matte.

v. Architectural Lettering

(1) Architectural lettering may be used to identify the following:
   (a) Building
   (b) Department
   (c) Special venues
   (d) Points of sale

(2) Letters shall be individually cut out characters from acrylic sheet, solid surface material, metal or cast from metal.

(3) Architectural Lettering identifying a permanent space shall also include ADA compliant identification.

w. Custom Signage

(1) Custom signage may be used to identify the following:
   (a) Donor Signage
   (b) Building
   (c) Department
   (d) Special venues
   (e) Points of sale

(2) Donor Signage
   (a) Donor recognition signage shall be designed as part of the interior signage. Finished product shall complement and coordinate with building design.
   (b) Coordinate with The University of Iowa Foundation to design the signage types for the various donation levels.
   (c) Donor Signage types
      i. donor wall
      ii. room
      iii. departments
      iv. building
H. SPECIALTIES

1. Visual Display and Bulletin Boards
   a. Bulletin boards in public areas shall be enclosed.

2. Projection Screens
   a. Screen size, surface and placement shall be specified or approved by ITS EI - Physical Infrastructure.
   b. Provide motorized tension projection screen when screen size is larger than 50 inches x 80 inches.

3. Restrooms and Restroom Accessories
   a. Restrooms
      (1) Water closets shall be wall-mounted.
      (2) Provide floor drains and centrally located hose bibbs.
      (3) Unisex Restroom Standards
          (a) Accessible unisex restrooms shall not be used as a substitute for accessible multi-user restrooms.
          (b) Shall contain no more than one (1) lavatory and two (2) water closets without urinals or one (1) water closet and one (1) urinal.
          (c) Location of room shall be on the main floor of the facility within the main circulation path.
          (d) Shall contain one (1) baby changing station.
          (e) Signage shall include word “UNISEX”.
   b. Toilet Partitions
      (1) Partitions shall be High Density Polyethylene (HDPE) material.
      (2) Overhead braces shall have anti-grip design.
   c. Restroom Accessories
      (1) Locate electric hand dryers or paper towel dispensers to minimize water in walking path.
      (2) Paper towel dispensers shall require Owner approval.
Lavatories shall be installed in countertops and not as separate wall-hung fixtures.

Mirrors shall be the full width of the counter, without a shelf.

A narrow shelf shall be located near the entrance of restroom. Coat hooks shall be included either below or near the shelf.

Ceramic toilet accessories shall not be used.

Provide alcove to accommodate freestanding waste can. Built-in waste receptacles shall not be used.

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.

Dual-unit sanitary napkin and tampon machines with quarter mechanisms shall be ADA compliant.

Each stall in women’s restrooms shall have a sanitary napkin and tampon disposal container.

Lactation Rooms

a. Minimum room size shall be 6 feet x 9 feet.

b. Room shall be accessed directly from the women’s restroom where possible.

c. Door shall be keyed with storage room lock with deadbolt and occupancy indicator.

d. Counter shall be 6 feet x 2 feet, no lower storage, with a small sink and gooseneck faucet located at one (1) end of the counter.

e. 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.

f. Mirror a minimum size of 4 foot high x 3 foot wide shall be mounted above the non-sink side of the counter.

g. Provide 4 feet x 4 feet bulletin board.

h. Provide one (1) upholstered, non-caster chair with arms.

i. Provide wall-mounted clock.

Recycling and Trash Receptacles

a. Recycling and trash receptacles shall be located in all buildings for use by visitors, students, faculty and staff.

b. Types of Receptacles
   (1) Freestanding
   (2) Casework-enclosed roll-in receptacles

c. A paired recycling and trash receptacle shall be at each location.

d. Receptacle type, locations and quantities to be confirmed by Owner.

Vending Space
a. 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.

(1) Royal 660
   (a) All can machines, non-glass front bottle machine.
   (b) Dimensions shall be 72 inches H X 37 inches W X 34 inches D.
   (c) Power shall be 115 volts, 12 amps.

(2) Royal 804
   (a) Taller version of Royal 660.
   (b) Dimensions shall be 80 inches H X 37 inches W X 34 inches D.
   (c) Power shall be 115 volts, 12 amps.

(3) RVV500
   (a) Smaller glass front, may hold cans or bottles.
   (b) Dimensions shall be 72 inches H X 37 inches W X 35 ½ inches D.
   (c) Power shall be 115 volts, 12 amps.

(4) D5000
   (a) Large glass front.
   (b) Dimensions shall be 72 inches H X 52 inches W X 35 inches D.
   (c) Power shall be 115 volts, 12 amps.

(5) Vendo Vue
   (a) Mid-size glass front.
   (b) Dimensions shall be 72 inches H X 41 ½ inches W X 35 inches D.
   (c) Power shall be 115 volts, 10 amps.

7. Custodial Work Spaces

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

(1) Locate on the ground floor near the Supplies Storage and Delivery room.

(2) Room shall be 20 feet x 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.

(3) Provide
   (a) Fire rated ceilings.
   (b) Lighting levels at 20 foot candles.
   (c) 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.
   (d) Two (2) telecom-data telephones.
   (e) 3 foot 0 inch door. Door shall open outwards.
   (f) 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.
b. Supply Storage and Delivery Room: The main storage room for cleaning supplies.
   (1) Room shall be a minimum of 10 feet x 14 feet for a four (4) person custodial group, and shall increase in length by 2 feet for each additional person above four (4).
   (2) Provide
      (a) 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.
      (b) HVAC. Maintain 60 degree F minimum.
      (c) Lighting levels at 20 foot candles.
      (d) Two (2) duplex electrical outlets (GFCI) on shelving wall.
      (e) 3 foot 6 inch door. Door shall open outwards.

c. Equipment Storage Room: Room is used to store large equipment including vacuums, carpet extractors, carpet drying fans, ladders, etc.
   (1) Room shall be a minimum 12 feet x 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.
   (2) Provide
      (a) 2 feet 6 inch floor 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.
      (b) 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.
      (c) Floor sink with strainer basket to empty scrubbers, slope floor to the drain.
      (d) 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.
      (e) Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.
      (f) Emergency eye wash with backflow preventer and 8 foot flexible hose hard piped to cold water feed only.
      (g) Minimum of three (3) wall-mounted shelves 4 feet 0 inch AFF to support charging units for battery-powered machinery.
      (h) Heating and ventilation for recharging battery-powered machinery.
      (i) One (1) duplex electrical outlet (GFCI) for each charger unit, located 4 feet 0 inches AFF on wall next to the battery charger shelves.
(j) Lighting levels at 20 foot candles.
(k) One (1) duplex electrical outlet (GFCI) near the floor by the door.
(l) Door shall be 3 foot 6 inch and shall open outwards.
(m) Enamel painted concrete walls. Gypsum board walls with 18 inch high metal plating may be used with Owner approval.
(n) Washer/dryer hook-up.

d. Custodial Service Room
(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.
(2) Room shall be a minimum 7 feet x 9 feet.
(3) Utility panels, gauges, meters or pipes shall not be placed in the custodial service room.
(4) Provide:
(a) Three (3) white painted or laminated 3/4 inch x 12 inch deep plywood shelves mounted on adjustable brackets and standards, bottom shelf 30 inches AFF, top shelf 60 inches AFF.
(b) Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.
(c) Emergency eye wash with backflow preventer and 8 foot flexible hose hard piped to cold water feed only.
(d) Wall bracket to support a 6 foot 0 inch step ladder.
(e) Lighting levels at 20 foot candles.
(f) One (1) duplex electrical outlet (GFCI) located on shelving wall.
(g) 3 foot 6 inch door. Door shall open outwards.
(h) 2 feet 6 inch floor 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.
(i) 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.

e. Heavy Equipment Room: Room houses rider scrubbers and sweepers.
(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.
(2) Room shall be a minimum 15 feet x 15 feet.
(3) Utility panels, gauges, meters or pipes shall not be placed in the custodial service room.
(4) Provide:
(a) Heating and ventilation for recharging battery-powered machinery.
(b) One (1) 1 foot 0 inch wide adjustable shelf, mounted on the wall 3 feet 4 inches AFF.
(c) Plumbing to accommodate a chemical dispensing unit located near the sink, with separate cold water hose bibb.
(d) Emergency eye wash with backflow preventer and 8 foot flexible hose hard piped to cold water feed only.
(e) 2 feet 6 inch floor 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.
(f) 2 feet 0 inch Panolam white fiberglass reinforced all panel back splash around the two (2) sides of the sink.
(g) Wall-mounted shelf 4 feet 6 inch AFF to support charging units for battery-powered machinery.
(h) Lighting levels at 20 foot candles.
(i) One (1) duplex electrical outlet (GFCI) near the floor by the door.
(j) Enamel painted concrete walls. Gypsum board walls with 18 inch high metal plating may be used with Owner approval.
(k) 7 foot double door. Door shall open outwards.

f. Light Bulb Storage Room: The main storage room for light tubes and lamps.
   (1) Room size shall be reviewed with the Owner.
   (2) Provide:
       (a) 3 foot 6 inch door. Door shall open outwards.
       (b) 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.
       (c) One (1) duplex GFCI receptacle located near the floor by the door.
       (d) HVAC is required with 60 degree F, winter heat minimum.
       (e) Lighting levels at 20 foot candles.

8. Maintenance Rooms
   a. Building Maintenance Work Control Center: Houses building control work station, maintenance staffing, and general computer access.
      (1) Located separately from Building Maintenance Shop and Building Maintenance Material / Equipment Storage Room.
      (2) Room shall be 20 feet x 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.
(3) **Provide:**
   (a) 3 foot 0 inch door. Door shall open outwards.
   (b) Fire rated ceilings
   (c) Lighting levels at 20 foot candles.
   (d) 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.
   (e) Two (2) telecom-data telephones.

b. **Building Maintenance Shop:** Houses work benches, tools, equipment, carts, barrels and supplies.
   (1) Room shall be minimum 200 square feet.
   (2) Located adjacent to the Building Maintenance Material / Equipment Storage Room.
   (3) **Provide:**
       (a) 3 foot 0 inch door. Door shall open outwards.
       (b) Fire rated ceilings
       (c) Lighting levels at 20 foot candles.
       (d) 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.
       (e) Two (2) telecom-data telephones.

c. **Building Maintenance Material / Equipment Storage Room:** Main storage room for building maintenance supplies and attic stock.
   (1) Room shall be minimum 200 square feet.
   (2) **Provide:**
       (a) 3 foot 6 inch door. Door shall open outwards.
       (b) Fire rated ceilings
       (c) Lighting levels at 20 foot candles.
       (d) 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.
       (e) Two (2) duplex outlets on shelving wall. All receptacles shall be GFCI.
       (f) HVAC is required with 60 degree F winter heat minimum.

9. **Telecommunication Rooms (TR)**
a. 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.
b. TRs shall be aligned vertically and centrally located to meet current ANSI/EIA/TIA allowable cable lengths.

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

d. Access to telecommunication rooms shall be coordinated with ITS EI - Physical Infrastructure.

e. Room shall not have a ceiling.

f. Provide:

(1) Year-round cooling with continuous air flow to maintain.
   (a) 72 to 80 degrees F
   (b) 45 to 55 percent maximum relative humidity
   (c) Positive air pressure with a minimum of one (1) complete exchange per hour.

(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.

(3) Minimum of two (2) 20 AMP outlets per data switch.

(4) Minimum if one (1) convenience receptacle per wall.

(5) Grounding and bonding for communication systems.

(6) Equipment racks, ladder racking, and cable management.

(7) ⅜ inch A/C (A side out) rated plywood on all walls, mounted from 6 inches to 8 feet 6 inches AFF.

(8) Lighting
   (a) Minimum lighting levels equivalent of 50 lumens measured at 3 feet AFF.
   (b) Provide manual wall switches only. Automatic lighting controls shall not be installed.
   (c) Connect a minimum of one (1) light Fixture to emergency power.
   (d) Bottom of fixtures shall be 8 feet 6 inches AFF.
   (e) Coordinate with ITS EI - Physical Infrastructure for TR/Light Fixture Layout
   (f) Door closer and door sweep.

10. Classrooms - General Assignment

a. General Approach to Classroom Design

(1) Develop rooms with good sight lines and efficient seating layout. Design shall proceed from the "inside out"
   (a) Determine projection screen quantity, size and location.
   (b) Determine seat size, orientation and size of the instructor area.
   (c) Draw viewing angles from each screen and insure that all seats fit within.
   (d) Determine location and width of access aisles.
(e) After these steps, determine location of walls.

(2) Classrooms shall be shaped and sized to maximize seating and occupant comfort and interaction.

(3) Design corridors and alcoves to provide informal student spaces with flexible, comfortable furniture to encourage collaboration.

b. Classroom design details may vary to accommodate the latest best practices for teaching.

c. Classroom Design Specifics

(1) Classroom Location

(a) 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.

(b) Group classrooms together on the common floor.

(c) 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.

(d) Locate restrooms near lecture halls. Avoid common walls between restrooms and classrooms.

(e) Provide corridor seating outside lecture halls and along hallways outside classrooms.

(2) Accessibility

(a) Specialized equipment shall be included as follows:
   i. Remote Real Time Captioning - Place an Ethernet connection and an electrical outlet in the front of the room for all auditoria seating 100+.
   ii. 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.

(b) Accessible seating in lecture halls shall be fixed table and moveable chairs and/or open space for wheelchairs.

(c) 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.

(3) Acoustics

(a) All classrooms shall be designed with three (3) acoustic goals:
   i. Prevent external and background noise from affecting the room.
ii. Prevent sounds generated within the room from affecting adjacent spaces.

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

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

(c) Extend walls to structure.

(d) Use absorptive materials, in addition to upholstered seating, to control reverberation time.

(e) Acoustical ceiling tile may be considered part of the acoustical treatment.

(f) Acoustical Wall Panels, as needed
   i. Shall be placed beyond arm’s reach where possible.
   ii. 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.
   iii. 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.
   iv. Panel configuration does not have to be continuous, panels may be spaced rather than butted against each other.
   v. Specific recommended quantities are shown in the following tables:

<table>
<thead>
<tr>
<th>ROOM SIZE IN SQUARE FEET</th>
<th>RECOMMENDED ACOUSTICAL TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEMINAR ROOM</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 500</td>
<td>100 sf</td>
</tr>
<tr>
<td>500+</td>
<td>200 sf</td>
</tr>
<tr>
<td><strong>SMALL CLASSROOM</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 500</td>
<td>200 sf</td>
</tr>
<tr>
<td>501-750</td>
<td>300 sf</td>
</tr>
<tr>
<td>750+</td>
<td>450 sf</td>
</tr>
</tbody>
</table>
### LARGE CLASSROOM

<table>
<thead>
<tr>
<th>Room Size in Square Feet</th>
<th>Ceiling Height</th>
<th>Recommended Acoustical Treatment (Panels with Min NRC of .9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,000+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ROOM SIZE IN SQUARE FEET

<table>
<thead>
<tr>
<th>Room Size in Square Feet</th>
<th>Ceiling Height</th>
<th>Recommended Acoustical Treatment (Panels with Min NRC of .9)</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>

#### (4) Ceiling

(a) 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.

(b) Ceiling height requirements may differ for seminar rooms, classrooms, and auditoria within the same building.

(c) Provide maintenance access to equipment mounted at or above ceilings.

#### (5) Wall Finishes

(a) See Finishes, above.

(b) Locate chair rail on back and side walls.

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

#### (6) Windows

(a) Windows shall not be located at at the front or back of classroom.

(b) 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.

#### (7) Doors

(a) Preferred door location is at the rear of the classroom.

(b) In rooms with tiered or sloped floors, place doors to allow wheeled access to the teaching area and multiple seating areas.

(c) 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.

(d) Doors shall operate quietly and provide acoustic separation.
(e) Doors open outward and shall not block corridor traffic.

(8) Flooring
(a) Flat floors shall be hard, durable and slip-resistant requiring
minimal maintenance.
(b) Seating areas in sloped and tiered floors may be sealed
concrete.
   i. Carpet may be used when a more luxurious floor finish
      than resilient flooring is required and operating budgets
      allow for proper maintenance.
   ii. Carpet shall be variegated in color, not solid, in order to
       hide dirt and wear.
   iii. Edge of stair risers shall be visible on carpeted stair
       aisles to prevent tripping.

(9) Furnishings
(a) Furniture shall be selected for durability, ease of maintenance,
    and comfort.
(b) General assignment classroom furniture shall have an
    appearance distinct from other furnishings in the building.
(c) Writing surfaces shall be dark finish and resist marks.
(d) Tablet arms shall be large enough to hold both an 8 ½ x 11 inch
    pad and electronic device.
(e) In renovations, color and finish of moveable furnishings shall be
    consistent with overall building materials.
(f) 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).
(g) Auditoria seating width shall be 23 to 24 inches on center. Riser
    mounted seating may be preferred for new riser construction –
    confirm with Owner.
(h) Student tables shall be minimum depth of 18 inches.
(i) Moveable tables shall be equipped with casters.
(j) Moveable seating shall not have arm rests.
(k) Caster or chair-glide shall match room flooring type.
(l) Ten (10) percent of all seating shall be suited for left-handed
    users.
(m) Lecture and Seminar Room seating shall be heavy-duty, stain
    repellent, upholstered fabrics.
(n) Lecture room seating shall be attached to risers.
Instructor table shall be 48 to 60 inches wide x 24 inches deep and include a modesty panel.

Instructor chair shall be provided.

Provide battery-operated GPS clock, part of existing campus clock system, in each classroom.

Rooms shall have a multimedia lectern.

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

Coordinate need for waste and recycling receptacles with Owner’s recycling program requirements.

Coat racks shall not be provided.

Pencil sharpeners shall not be provided.

Tack surfaces in the general assignment classrooms shall not be provided.

**Typical Classroom Front**

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.

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

The multimedia lectern shall not obstruct students’ view of the writing surface and projection screen.

Classroom seating layout

- Locate seats within the viewing angle. The viewing angle is considered 45-degrees each side of the center of the projection screen.
- Classrooms shall be narrow enough to permit all seats to be within the viewing angle from the front wall.

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.

Provide space for a moveable instructor’s table, 48 to 60 inches wide x 24 inches deep, and instructor chair. Instructor’s chair is not required in seminar classrooms.

**Writing Surfaces**

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

Writing surface shall be porcelain-covered steel, dry-erase marker board with continuous full-length tray.

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.
(d) Provide continuous cork tack strip at top. Strip shall be equipped with map hooks at 24 inch intervals.

(12) Projection booth
(a) An enclosed booth is preferred in Lecture Halls and Auditoria.
(b) Booth shall include projector shelf and window with access for equipment maintenance.
(c) Include additional mechanical cooling for large-venue projection equipment.
(d) Provide cabling raceway from the lectern or A/V rack to the booth.
(e) Where an enclosed booth is not possible, a securable cabinet may be used.
(f) Acoustically isolate the booth.

(13) Mechanical Systems
(a) HVAC equipment mounted in rooms adjacent to classrooms shall be isolated for vibration and noise control.
(b) HVAC diffusers and intakes shall not be placed near or directed toward projection screens.
(c) The HVAC system shall provide for year-round service.

(14) Electrical Systems
(a) The front teaching wall shall have minimum of one (1) duplex outlet.
(b) The number and location of the outlets shall be coordinated with Owner.
(c) Electrical outlets shall be provided in all fixed student tables, with outlets for each pair of seats.

(15) Lighting
(a) Provide back-lit toggle switches at each room entrance.
(b) Locate clearly labeled lighting controls on the instructor multimedia lectern and on wall nearest to the instructional area.
(c) Consult ITS EI - Physical Infrastructure for any programmable/scene lighting configuration. Where programmable lighting is planned, provide a mock-up for instructor review prior to planned installation, allowing time for modifications.
(d) Lighting controls shall be integrated into the multimedia control panel.
(e) 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.
(f) General classroom lighting shall provide 45 - 65 foot candles on writing surfaces.

(g) Lighting in rooms with sloped or tiered floors shall take into account the slope to provide consistent foot candles across the entire seating area.

(h) Lighting shall be evenly distributed for reading and writing and allow occupants to see each other’s faces.

(i) 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.

(j) Provide independent, adjustable lighting at projection screens.

(k) Provide independent, adjustable lighting at writing surface. Writing surface shall be evenly illuminated.

(l) Maintain lighting levels at the lectern adequate for reading.

(m) Avoid suspending fixtures from the ceiling to prevent conflict with ceiling-mounted projectors.

(n) Provide task lighting on the equipment rack or technology controls.

(o) Provide LED step lights at all level changes in a classroom or auditorium. Step lights shall not be part of the room control system.

(p) Mount luminaires so lamps are parallel to front wall.

(16) Technology

(a) Provide portable media equipment storage closet, with storeroom lock, in each classroom building. Closet shall include one (1) data and one (1) electrical outlet.

(b) Classrooms shall include projector, screen and multimedia equipment.

(c) Consult ITS EI - Physical Infrastructure for multimedia equipment, rack, lectern, and controls requirements.

(d) Multimedia lecterns shall be adjustable to allow for a variety of positions and ADA access.

(e) Multimedia Lecterns
   i. Shall have minimum 15 RUs for A/V equipment.
   ii. Surface space for a 24 inch monitor, 7 inch control touch panel, document camera, and 24 inches of writing space.
   iii. Minimum of one (1) dedicated 20 amp circuit at the lectern.
   iv. Minimum of five (5) data outlets and one (1) phone line.
v. Phone for hotline calls, located at the lectern or wall nearest lectern.

vi. Provide mock-up of the lectern for instructors review. Allow sufficient time for any modifications before production.

(f) Audio/visual signal pathways, conduit size, and termination points in the general assignment classrooms shall be approved or specified by ITS EI - Physical Infrastructure.

(g) 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 multiboxes.

(h) Provide full wireless coverage for all classroom spaces.

(i) 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.

(j) 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.

d. Classroom Types

(1) Seminar room

(a) Furnish with a large central table or multiple small tables that can be grouped into one (1) central table.

(b) Furnish with moveable chairs.

(c) Design for up to twenty-two (22) students.

(d) Basis of design is 25 square foot per seat.

(2) Small classroom

(a) Flat floor.

(b) Furnish with moveable tables and chairs.

(c) Design for up to fifty (50) students.

(d) Basis of design is 25 square foot per seat.

(e) When tablet arm chairs are authorized, allow 18 square foot per seat.

(3) Large classroom

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

(b) Tiered floor.

(c) Furnish with fixed tables and moveable chairs.

(d) Design for fifty-one (51) to ninety-nine (99) students.

(e) Basis of design is 20 square foot per seat.

(4) Lecture Hall/Auditoria
11. Offices

(a) Sloped or tiered floor.
(b) Furnish with low maintenance, fixed tablet arm chairs. Seats shall be labeled with row and number.
(c) Design for one-hundred (100) or more students.
(d) Basis of design is 12 square feet per seat.
(e) Design to include lobby or gathering area adjacent to space for circulation and seating.

(5) TILE (Transform, Interact, Learn, Engage) Inquiry-Based Learning Space
(a) Flat floor.
(b) Furnish with tables and moveable chairs.
(c) Spaces shall be designed creatively with primary focus on student and instructor collaboration.

(6) Shared Informal Study Space
(a) These spaces are defined as individual and collaborative study space available on an unscheduled basis.
(b) Furnish with equipment and infrastructure to support individual and group work.

11. Offices

a. Guidelines for office size
   (1) Dean or Vice President: 200 to 300 square feet
   (2) Departmental Executive: 180 square feet
   (3) Faculty private office: 140 square feet
   (4) Staff private office: 120 square feet

12. Loading Dock Facilities

a. Review loading dock facility requirements with Owner.
b. Potential requirements:
   (1) Trash dumpster or compactor equipment with appropriate decking, railings and access.
      (a) Costs associated to procure and account for dumpsters or compactors shall be part of the project.
      (b) Dumpsters shall be accessible by a front-loading truck
      (c) Compactors and recycle roll-off containers are removed by a rear hook and lift system truck.
      (d) Provide either hydraulic or manual lift and/or catwalks for servicing trash / recycle containers.
      (e) Refuse trucks shall not be expected to back up more than fifty (50) feet to access or exit dock.
      (f) Dock levelers shall be sealed to prevent air infiltration.
   (2) Truck dock bays at grade and/or at loading height. Bays may include a recessed lift.
   (3) Minimum of two (2) spaces for service vehicle parking.
   (4) Dedicated receiving area.
(5) Dedicated holding area (hazardous materials, chemicals, spent lamp storage).
(6) Keyed hose bibbs with easy access and an isolated shut-off valve.
(7) Two (2) floor drains, one (1) in open areas and one (1) near dumpster locations in enclosed areas.

13. Animal Rooms
   a. All animal rooms shall comply with the current edition of AAALAC standards.
   b. 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).

I. CONVEYING SYSTEMS
   1. Elevators
      a. Elevators shall be designed to the current ASME/ANSI A17.1, Safety Code for Elevators and Escalators.
      b. Passenger elevators shall be high-efficiency electric traction.
      c. Hydraulic elevators may be considered for fewer than four (4) stops or when higher load capacities are required.
      d. Elevator machine rooms, hoist ways and lobby spaces shall be environmentally conditioned to allow for proper operation of the elevator.
      e. Provide a minimum of one (1) elevator per each new building with inside car dimension minimum 96 inches x 70 inches and a door opening width of 48 inches. Minimum of one (1) elevator shall provide service to mechanical penthouses.
      f. Access to basement and penthouse mechanical spaces shall be provided.
      g. Elevator pit shall have a sump pit, a sump pump with an alarm connected to the building control system, and no floor drain.
      h. Provide one (1) GFCI receptacle in the elevator car.
      i. Elevator car lighting shall be LED.
      j. Elevator finishes
         (1) Freight elevators shall have textured aluminum or textured steel floors. Wall finishes shall be steel.
         (2) Passenger elevator shall have entry-mat quality carpet tile floors or hard surfaces.
            (a) Carpet tiles shall not contain animal hair.
            (b) Hard surface options include terrazzo and VCT.
            (c) Rolled goods shall not be used.
   
2. Lifts
   a. Vertical platform lifts and incline stair lifts are not allowed.
   b. Loading dock lifts for material transportation are allowed.
3. Escalators
   a. 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.

A. GENERAL
1. Load Criteria
   a. Load criteria for all structural systems shall be noted on the drawings.
   b. Roof Loadings
      (1) Minimum ground snow load design is 30 psf. The snow load design shall also account for drift-loading on lower roof surfaces.
   c. Floor Loadings
      (1) Shall account for program requirements.
   d. Wind Design
      (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.
2. Separate additions from existing structures with an expansion joint.
3. Vertical loads shall not be transferred through horizontal expansion joints.
4. Facilities shall be constructed of fire resistant materials.

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

C. CONCRETE
1. Mix Design and Material
   a. Concrete strengths shall be specified in accordance with actual requirements.
   b. Concrete mix shall be specified with minimum cement content, as well as maximum water/cement ratio.
   c. 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.
   d. Calcium chloride or fly ash in concrete mixes shall not be permitted.
2. Exposed Concrete
   a. Exposed concrete intended as a finish material shall be clearly identified in the drawings and specifications.
3. Precast Concrete
   a. Fabricator shall submit compliance with the following codes and standards
      (1) ACI-318 “Building Code Requirements for Reinforced Concrete”
      (2) CRSI “Manual of Standard Practice”
b. Panels shall be designed with adequate structural integrity to permit handling, transportation, storage, and erection.

4. Placement
   a. 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 3/4 to 1 inch clean rock with a plastic vapor barrier.
   b. Areas having floor drains shall have positive slope to the floor drain. Indicate direction of pitch on drawings.
   c. Slab flatness and levelness shall be within 1/8 inch in 10 feet.
   d. ASTM E1155 shall be used to specify flatness and levelness when a high level of accuracy is required.
   e. Joint spacing and detail shall be shown on the drawings.

5. Testing
   a. Design Professional shall specify allowable limits for each test required.

D. MASONRY
1. General
   a. Stone coping shall be used for modification to existing facilities with stone coping.
   b. Use of stone coping for design effect shall require approval from Owner.
   c. Masonry units shall not be used for foundation walls below grade.
   d. Waterproofing materials shall not be used on new masonry or stone surfaces.
   e. Design Professional shall indicate wall expansion joints on drawings.

2. Brick and Block Masonry
   a. Follow Brick Institute of America (BIA) and Masonry Advisory Council (MAC) for design requirements.
   b. Allowances may be specified for brick only if specific selections cannot be made.
   c. Brick used as paving material shall be paving grade, set in a concrete base, with an asphalt leveling course.
   d. Testing
      (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.
      (2) Lab certification of brick shall be based on samples taken the project specific production run and shall be approved prior to delivery.

3. Stone Masonry

4. 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.

E. METALS

1. Structural Steel
   a. Construction Documents shall clearly assign the responsibility for the design of steel connections. The responsible party shall seal the connection designs.
   b. Design Professional shall use twist-off bolts and load indicator washers for field structural connections where possible.
   c. Pre-engineered metal building roof purlins shall be adequately braced on the compression flange to resist all design loads.
   d. Purlin slide clips commonly used with standing seam systems shall not be considered an effective brace for the purlin.
   e. Separate purlin bracing such as threaded rods or sag angles shall be provided in addition to the slide clips.

2. Testing
   a. Design Professional shall specify allowable limits for each test required.

3. Miscellaneous Metals
   a. See Section IV for information.

F. WOODS AND PLASTICS

1. Rough Carpentry
   a. Fire-retardant lumber shall be in accordance with American Wood Preservers Association standards.

2. Architectural Millwork and Cabinetry
   a. Architectural millwork and cabinetry shall meet Architectural Woodwork Institute standards.

V. MECHANICAL
The following information is provided as a general guideline in establishing Mechanical Engineering design requirements.

A. GENERAL

1. The Design Professional shall plan access for servicing and maintenance of equipment.
   a. Wall and Ceiling Access Doors
      (1) Access doors shall be placed in a reasonable and safe location. Location points shall be noted if under carpet.

2. Mechanical rooms shall include ventilation and temperature management where the space may exceed 85 degrees F.

3. Minimize rooftop equipment and roof penetrations by consolidating equipment in mechanical rooms.
4. Piping riser shall not be routed through Custodial Rooms.
5. Shut-off valves shall be provided at pipe branches and where required to facilitate partial system isolation.
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.
7. All valves shall be located with sufficient room for maintenance or replacement.

B. FIRE PROTECTION AND SUPPRESSION

1. General
   a. 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.
   b. Refer to UL Fire Safety Department Guide Specifications.
   c. All projects shall be hydraulically recalculated to prevent incorrect information from old hydraulic calculations.
   d. System shall be designed in accordance with NFPA and FM Global for the application intended.
   e. Each individual floor shall be isolated into its own sprinkler zone.
   f. Size exterior fire department connections according to requirements of the local authorities having jurisdiction.
   g. Sprinkler system tamper and flow valves shall be monitored by the building’s fire alarm panel.
   h. Use dry pipe system in non-heated areas in lieu of chemical system.
   i. Fire pump room shall have outdoor and direct interior access.

2. Piping and Pumps
   a. Piping
      (1) Mains shall be run in hallways and corridors.
      (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.
   b. Pumps
      (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) 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.

3. Accessories
   a. Valves
C. PLUMBING SYSTEMS

1. General
   a. Campus water distribution systems operate between 60 and 100 psig. Coordinate need for pressure reducing stations, or other application specific requirements, with Owner.
   b. Domestic water heating systems shall be designed in accordance with Chapter 49 ASHRAE Handbook, HVAC System and Applications.
   c. Desired temperature for normal faucet applications is a maximum of 110 degrees F at the point of usage.
   d. 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.
   e. Domestic Water Systems shall have ¾ inch pathway to a central location for water metering.

2. Insulation
   a. All insulation shall comply with ASHRAE 90.1 and shall be asbestos-free.

3. Instrumentation
   a. See Section IV for information.

4. Piping and Pumps
   a. General
Domestic Water

(1) See Section IV for information.

Sanitary Waste and Vent

(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.
   (a) Size drain for combined load.
   (b) Floor drains are preferred.

(2) Drain piping shall not be routed across walkways, maintenance areas, or other traffic areas.

Storm Sewer

(1) All surface water shall be directed to a storm sewer system.

(2) Storm water shall not be placed in a sanitary sewer system.

Special Systems

(1) See Section IV for information.

Pumps

(1) See Section IV for information.

Equipment

a. Water Heaters

(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.

(2) Steam is the preferred heat source for all hot water systems on the Main Campus.

(3) Heated water shall be outside the tube if anticipate rapid fouling due to heavily mineralized water.

(4) Instantaneous, steam, tankless water heating systems are preferred.

b. Expansion tanks

(1) Dumping excess water due to expansion shall not be allowed.

c. Water Softeners

(1) Central hot water systems shall have water softening. Other water shall be softened only in specific applications.

(2) Design water softening systems to supply water at less than 1 grain of hardness.

(3) 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.

(4) The Design Professional shall coordinate the sizing and specifications of water softeners with Owner.
d. Backflow preventers
   (1) Domestic water systems shall have backflow prevention devices at the
       point of building entry.
   (2) Metering devices, taps, or other fittings shall not 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.

6. Fixtures
   a. General
      (1) Water flow control devices shall be water conserving.
      (2) Waterless urinals shall not be allowed.
      (3) Fixtures shall be wall-mounted.
   b. Water Coolers
      (1) Water coolers shall be refrigerated type.
   c. Hose Bibbs and Wall Hydrants
      (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.
      (2) A hose connection shall be installed on roofs and in each mechanical
          room.
      (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.
   d. Floor Drains
      (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.
      (2) Mechanical room floor drains shall not be connected to the storm sewer
          system.
      (3) Flooring shall pitch toward the floor drain to eliminate standing water.
      (4) Provide floor drains in all toilet rooms. Square drains shall be used for
          tile floors, round drains for concrete floors.
   e. Emergency Showers and Eyewash Stations
      (1) Emergency showers and eyewashes shall be provided as required by
          OSHA or project program requirements. Coordinate with Owner.
      (2) Piping to emergency showers and eyewashes shall comply with ANSI
          Z358.1 2004.
      (3) In new construction, any situation requiring an emergency shower shall
          be onto the floor (no floor drain), unless directed otherwise by Owner.
Emergency showers shall have a local alarm.

D. HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

1. General
   a. 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.
   b. 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.
   c. Heating design temperature shall not be lower than the 99 percent dry-bulb (dB).
   d. Cooling design temperature shall be 92 F dB, 76 F wb and for cooling towers 79 F wb.
   e. Winter humidification shall not be provided for general comfort applications.
   f. Humidification shall be provided for 100 percent outdoor air systems or special areas (e.g. labs, museums, rare books).
   g. Ventilation systems shall be designed to provide outdoor air ventilation rates in accordance with ANSI/ASHRAE Standard 62.
   h. Exhaust/return fans shall be included in the HVAC design. Single fan systems are prohibited.
   i. Fresh air intakes shall be designed above grade and shall be no closer than 50 feet to parking areas.
   j. Piping systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.
   k. 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.
   l. 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.
   m. Electric heating systems shall not be used.
   n. 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.
   o. 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.
p. The water velocity in piping shall not exceed 7 feet/second. Maximum design pressure drop of 4 feet/100 feet of equivalent pipe length.

q. 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.

2. Piping
   a. General
      (1) Expansion tanks shall be bladder-type and located on the suction side of pumps.
      (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:
         (a) Loads are widely-spread throughout the project scope area.
         (b) 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.
         (c) The project scope area is greater than 5,000 square feet.
         (d) The hydronic system flow rate for the project scope area is greater than 25 gpm.
      (3) Hydronic piping systems shall always utilize a reverse return piping arrangement in the following situations:
         (a) Multiple identical devices require equal flow proportions from a common supply.
         (b) Multiple devices are served by a common zone valve or circulator (e.g. several fin tube elements served by one (1) zone valve)

b. Hot Water Piping
   (1) Combination air/dirt separators are required on all systems and shall be coalescing-type.

c. Chilled Water Piping
   (1) Chilled water loops shall be two (2) pipe systems.
   (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.
   (3) If large pressure differentials are unavoidable, use pressure independent control valves in lieu of pressure reducing devices such as circuit setters.
   (4) Some applications (large temperature rise, water quality issues) may require separation of the chilled water and the medium cooling the device.
(a) 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.

(b) Control chilled water flow to the heat exchanger according to the temperature of the departing chilled water.

3. Insulation
   a. Heating and Chilled Water piping insulation shall be fiberglass, flexible unicellular foam, or cellular glass.
   b. Closed cell (Armaflex) insulation is acceptable on refrigerant piping.
   c. Provide insulation on equipment, pipes, and ducts where:
      (1) Heat transmitted shall significantly affect ambient temperatures in controlled spaces.
      (2) Heating or cooling effects shall be significantly affected due to heat flow into or out of pipes or ducts.
      (3) Condensation will occur as a result of surface temperature approaching dew point of the ambient air.
      (4) Significant energy loss would result from heat transfer.
      (5) External surface temperature is greater than 120 degrees F.
      (6) Continuous vapor barrier on all cold surfaces shall be insulated.

4. Air Distribution
   a. Ductwork
      (1) Supply/return air systems shall be designed in accordance with the latest edition of ASHRAE Handbook - Fundamentals.
      (2) Return air shall be ducted.
      (3) Return air ceiling plenum systems shall not be permitted.
   b. Accessories
      (1) See Section IV for information.

5. Equipment
   a. General
      (1) See Section IV for information.
   b. Refrigerant Systems
      (1) Mechanical room installations shall comply with ASHRAE Standard 15.
      (2) Air-cooled condensing units shall not be placed in conditioned spaces or machine rooms.
      (3) Waste-water cooled units shall not be used.
      (4) Design all roof-mounted condensing units to 115 degrees F outside air temperature.
      (5) 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.
   c. Pumps
(1) Design Professional shall evaluate the need for vibration isolation on the pump.

d. Air Handling Equipment
   (1) See Section IV for information.

e. Humidifiers
   (1) Reverse Osmosis water shall be used for humidification.
   (2) Direct-steam humidification systems shall not be used.

6. Lab Systems
a. See Section IV for information.

7. Steam Systems
a. General
   (1) The campus pumped condensate return system operates with low pressure and is by gravity flow in most areas.
   (2) Low pressure steam is 20 psig. Medium pressure steam is defined as having 20 to 85 psig.
   (3) Building systems shall be designed for a maximum operating pressure of 15 psig.
   (4) Sizing of control valves, PRV, traps, etc., shall be based on a delivery pressure setting of 5 to 7 psig.

b. Piping and Pumps
   (1) Pumps
      (a) The University of Iowa Research Park (Oakdale) Campus condensate pumps may operate off of steam pressure.
      (b) Pressure powered pump
         i. Pump shall be a pressure powered design, using 60 psig steam to pump low pressure steam condensate.
         ii. Pump shall be constructed with a cast iron body, designed for maximum operating pressure of 125 psig at 450 degrees F.
         iii. Pump shall include bronze or stainless steel check valves on the inlet and outlet, and connections for high pressure steam and vent. All connections shall be threaded or flanged.
         iv. The pump shall contain a float operated snap acting mechanism to actuate fill and discharge cycles. All internal components shall be stainless steel.
         v. Pump shall be equipped with a gauge glass with brass cocks and manufacturer-furnished insulating jacket.
   (2) PRVs
      (a) See Section IV for information.

(3) Medium and Low Pressure Steam - Above Grade
   (a) See Section IV for information.
c. Equipment  
(1) 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.  
(2) Condensate receiving tank shall have a drain installed.  
(3) 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) Locate heat exchangers to allow removal of the bundle.  
(5) Install gauges and thermometers to indicate the following:  
   (a) Pressure of entering steam  
   (b) Pressure and temperature of entering water  
   (c) Pressure and temperature of leaving water  
(6) Install expansion tanks on the water side of all heat exchangers with a sight glass and provisions for draining and venting.  
(7) 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.  
(8) All coils shall be tube-in-tube, non-freezing type with a minimum 1 inch O.D. tubing.  
(9) 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.

E. INSTRUMENTATION  
1. Meters  
   a. Domestic Water Meters  
      (1) Design Professional shall coordinate sizing and location of meters with Owner.

F. CONTROLS  
1. General  
   a. All systems shall be fully compatible and integrate into the existing University building automation network.  
   b. 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.  
   c. Existing Buildings  
      (1) Control systems in existing buildings shall be an extension of the existing system. Integration of multiple control systems is not acceptable.  
      (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.
(3) Minor renovations in buildings with pneumatic zone control may re-use existing components with prior approval. New components shall utilize DDC technology.

d. 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.

e. BACnet Integration

(1) Design Professional shall require direct communication with the manufacturer's highest level of customer support, and may need to converse with the manufacturer's BACnet development team during project design, and implementation to make sure that the BACnet controller is capable of accomplishing 100 percent of the Sequence of Operation.

(2) 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.

(3) BACnet conformance disputes that may arise with the equipment manufacturers with BACnet devices will be resolved by the project Design Professional working directly with equipment manufacturer

2. Scopes of Work
   a. See Section IV for information.

3. User Interface
   a. See Section IV for information.

4. Sensors and Equipment
   a. Sensors and equipment shall be standard nonproprietary components regularly manufactured for this and/or other systems and not custom-designed specifically for this project.

5. Installation
   a. See Section IV for information.

6. Air Flow Matrix
   a. Design Professional shall provide an Air Flow Matrix for the Contractor using the Air Flow Matrix Detail as follows:
VI. ELECTRICAL

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

A. GENERAL

1. General
   a. 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.
   b. Only UL or equivalent approved appliances and equipment shall be specified.
   c. When installing or changing electrical equipment, the Design Professional shall evaluate available fault currents and size the ampere interruption capacity accordingly.
   d. Provide separate demolition and construction drawings.
   e. Show conduit sizes, routings, number and sizes of conductors for all feeder and homerun circuits.

Note: The Air Flow Matrix above is intended to be displayed in a horizontal fashion as a header starting with the "Room Number" column on the top left and ending with the "Unoc ACPH" column on the top right. This will be located on the project drawings in the HVAC Mechanical Schedules.
f. Show lighting and power circuits on the drawings. Identify the panel terminal point for each circuit.

g. Provide a schematic wiring diagram of power and lighting related control circuits on the construction drawings.

h. New buildings or building additions may require ground fault zone interlocking. Review options with Owner regarding project needs.

i. Provide a riser diagram for each system covered under Division 26.

j. Show electrical schedules for panel boards, distribution boards, motor control centers and related items on the drawings. Indicate connected demand load.

k. Electrical distribution equipment shall not be located in stairwells.

l. 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.

m. Electrically heated snow/ice melting systems are not allowed.

n. The Design Professional shall evaluate anticipated building loads for potential harmonic design requirements.

o. Power circuits shall not share neutrals.

p. Provide lighting and GFCI receptacles in all accessible pipe spaces, pipe shafts, duct shafts, attic spaces, tunnels and mechanical equipment rooms.

q. Fire alarm and miscellaneous signals shall be in conduit.

2. Identification

a. The Design Professional shall clearly indicate the required wording of all labels.

3. Arc Flash

a. Provide preliminary loading for transformer sizing, proposed secondary voltage, and shall perform fault current/load flow, harmonic, distortion (including neutral current estimate) and Arc Flash Analysis.

b. Identify to the Owner how arc flash hazards were reduced or mitigated.

c. Provide Contractor with data to meet compliance 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.

4. Grounding


b. Driven grounds shall not be specified where soil conditions consist of rock. In such conditions, use a counterpoise system or another approved alternative.

c. Building steel shall not be used for grounding unless specifically designed and tested for this application.
d. Building columns, roof steel, and steel reinforcing shall be made electrically continuous for grounding purposes.

e. Water lines, building steel, and a grounding conductor from existing building shall be bonded together.

f. Grounding electrode shall have a resistance to ground between 2 to 5 ohms.

g. Ground systems shall be connected to the primary power system ground mat serving the facility.

h. All grounding system conductors shall be copper.

i. Provide a separate grounding conductor with all circuits.

B. MEDIUM-VOLTAGE (601 VOLTS – 69k VOLTS) ELECTRICAL

1. Metering
   a. Building main transformers are metered at the primary side of the transformer. Meters are provided and installed by the Owner.

2. Switchgear and Transformers
   a. Medium voltage switchgear and primary transformers shall be furnished and installed by Owner.

3. Raceways
   a. See Section IV for information.

4. Wire and Cable
   a. Medium voltage cables shall be furnished and installed by Owner.

C. LOW-VOLTAGE ELECTRICAL

1. Equipment
   a. Design
      (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.
      (2) Service entrance switchboards shall have a main circuit breaker.
      (3) Phase, neutral and ground buss shall be copper.
      (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.
      (5) Provide a minimum 20 percent spare, usable space in new switchboards, panelboards, and motor control centers.
      (6) In existing buildings, new switchboards, panelboards, motor control centers, enclosed switches, circuit breakers and VFD shall match existing.

   b. Transient Voltage Surge Suppression
      (1) Locate suppression equipment in the enclosure of the equipment being served.
      (2) Provide a disconnecting means to isolate the suppression equipment.
c. Switchboards
(1) Provide continuous ground bus the full length of the switchboard.
(2) All switchboards shall have separate neutral and grounding busses.

d. Panelboards
(1) Provide continuous ground bus the full length of the panelboard.
(2) All panelboards shall have separate neutral and grounding busses.

e. Motor Control Center
(1) Starters shall have fusible disconnects rather than circuit breakers.
(2) Control circuit voltage shall be 120 volts or less.
(3) Provide a minimum of two (2) additional auxiliary contacts (1 N.O. and 1 N.C.) in magnetic starters.
(4) Design each motor control center section so starter units may be rearranged, removed or added.

f. Breakers, Fuses and Safety Switches
(1) Renewable fuses shall not be used.
(2) Equipment shall be specified with fuse holders that accept fuses dimensionally the same as Class H fuses.
(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.
(4) Locate equipment disconnects adjacent to equipment served. If not feasible, locate per NEC.
(5) Tandem branch circuit breakers shall not be used.

g. Variable Frequency Drive (VFD)
(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.
(2) Bypass shall not be provided.
(3) Drives shall include manual bypass of the VFD for the following:
   (a) 480 volt drives 125-horsepower and larger
   (b) 208 volt drives 60-horsepower and larger
   (c) Critical applications
(4) A VFD shall not serve more than one (1) piece of equipment.
(5) Provide 480 volt VFD, with step-up transformer, for motors 40-horsepower and larger.

2. Devices
a. Receptacles shall be provided on the ground floor of all stairwells and in all elevator lobbies.

b. Locate floor maintenance receptacles so that all areas are accessible with a 25 foot cord.

c. GFCI receptacles shall be used in lieu of GFCI breakers.

3. Raceways, Boxes and Supports
1. Raceway and Boxes
   (1) All systems shall be installed in conduit. Flexible wiring systems shall not be used.
   (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) A red plastic tracer tape shall be buried 18 inches above all underground cable or conduit installations.
   (4) PVC conduit for Blue Cap phones and parking gates shall be sized a minimum of 1 inch.
   (5) To reduce sound transmission, wall outlet boxes shall not be installed back-to-back in a partition stud space.
   (6) Maintain a 6 inch minimum from top of ceiling tile support grid to any raceway.

b. Supports
   (1) See Section IV for information.

4. Wire and Cable
   a. Neutral conductors shall be a minimum of full size. Neutral conductor capacity shall be increased as necessary for harmonics.
   b. Conductors and buss shall be copper. Aluminum conductors or buss shall not be used.
   c. 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.
   d. Conductors carrying more than 150v to ground shall not be installed in conduits with conductors carrying less than 150v to ground.

D. EMERGENCY AND BACKUP POWER SYSTEMS

1. Packaged Generator Assemblies
   a. Generators are not the Owner’s first choice for emergency power.
   b. Generator assemblies shall be located outside the building when possible. If generators are located indoors, they shall be located in 3 hour cutoff rooms provided with doorway curbing and emergency drainage.
   c. 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.
   d. On-site fuel source shall provide for a minimum of 8 hours of run time.
   e. The generator fuel system shall be arranged to automatically shut down upon a fire, detected leak or high day tank level.
   f. All generators 1500 KW and larger require a Utility grade relay package.
   g. Consult with the Owner for information on generator air construction permits and Spill Prevention Control and Countermeasures (SPCC) Plan requirements.
h. All generators shall be monitored through The University of Iowa Power Management system.
i. All generator sets shall be located to disperse exhaust fumes (vertical exhausts), vibration and noise without affecting the normal functions of the building and surrounding site.

2. Battery Equipment
   a. Provide adequate ventilation and cooling of battery rooms and battery cabinets to maintain full life-expectancy.

3. Transfer Switches
   a. Coordinate need for closed transition transfer switches with Owner.
   b. Provide a minimum of two (2) sets of auxiliary form-C contacts for normal and emergency transfer switch positions.

E. INSTRUMENTATION
1. Metering
   a. See Section IV for information.

F. LIGHTING
1. General
   a. Ensure products conform to the following standards, as applicable to the project:
      (1) ANSI C78.1 (with supplements), Dimensional and Electrical Characteristics of Fluorescent Lamps, Rapid Start Types.
      (2) ANSI C78.2 (with supplements), Dimensional and Electrical Characteristics of Fluorescent Lamps, Preheat Start Types.
      (3) ANSI C78.20, Characteristics of Incandescent Lamps of A, G, PS, and Similar Shapes with E26 Medium Screw Bases.
      (4) ANSI C78.21, Characteristics of Incandescent Lamps of PAR and R Shapes.
      (5) ANSI C78.1350 through C78.1359, High-Pressure Sodium Lamps.
      (6) ANSI C78.1375 through C78.1381, Metal Halide Lamps.
      (7) ANSI C82.1, Specifications for Fluorescent Lamp Ballasts.
      (8) ANSI C82.2, Methods of Measurement of Fluorescent Lamp Ballasts.
      (9) ANSI C82.3, Specifications for Fluorescent Lamp Reference Ballasts.
      (10) ANSI C82.4 (with supplement), Specifications for High-Intensity-Discharge and Low-Pressure Sodium Lamp Ballasts (Multiple-Supply Type).
      (11) ANSI C82.5 (with supplement), Specification for High-Intensity Discharge Lamp Reference Ballasts.
      (12) ANSI C82.6 (with supplement), Methods of Measurement of High-Intensity Discharge Lamp Ballasts.
      (13) UL 935, Fluorescent-Lamp Ballasts.
b. Conform to IES recommended foot-candle levels.

c. 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).

d. 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.

e. 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.
f. 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.

g. 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.

h. Warranties
   (1) Contractor shall be capable of being onsite within 4 hours for all
       warranty calls during the warranty period.
   (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.

2. Interior Lighting
   a. Design
      (1) The lighting design shall maximize the use of recessed and volumetric 2
          feet x 4 feet luminaires using linear fluorescent or LED fixtures.
      (2) Interior light sources shall be fluorescent or LED, except as follows:
          (a) When installed in high ceiling spaces (over 12 feet) in finished
              areas, interior light sources shall be LED fixtures.
          (b) 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.
      (3) 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.
      (4) Coordinate luminaire locations with architectural features and adjacent
          structural and mechanical elements.
      (5) Wholly indirect lighting systems are not acceptable.
      (6) Where the control of glare is a consideration, parabolic louvers are
          preferred.
(7) In rooms where video display terminals are used, fixtures shall have a minimum 0.7 visual comfort probability (VCP) value.

(8) Three (3) and four (4) lamp fluorescent fixtures are prohibited.

(9) Interior lighting systems shall operate at either 277 volt or 120 volt.

(10) Lighting Designer shall work with the architect and/or Interior Designer to specify high reflectivity interior finishes achieving the following minimum reflectance values:
   (a) Ceilings: 90 percent
   (b) Walls: 50 percent
   (c) Floors: 20 percent

(11) Efficacy
   (a) Non-LED type fixtures shall carry a Luminaire Efficacy Rating (LER) of 55 or greater.
   (b) All LED products shall carry a Lighting Facts label listing the LPW for that product.
   (c) All LPW ratings shall be at the color temperature (CCT) used on the project
   (d) LED type fixtures shall carry a Lumens per watt (LPW) with minimum values as follows:
      i. Recessed LED troffer style: 95 LPW
      ii. Recessed linear LED: 70 LPW
      iii. Recessed LED downlights: 50 LPW
      iv. Linear indirect or indirect/direct LED fixtures: 80 LPW
      v. LED cove lights: 75 LPW
      vi. LED step lights: 30 LPW
      vii. LED under cabinet or task lighting: 60 LPW
      viii. LED track lighting fixtures: 45 LPW

(12) Efficiencies
   (a) Non-LED type fixtures shall have the minimum following efficiencies:
      i. Recessed linear fluorescent – 80 percent
      ii. Linear indirect/direct – 85 percent

b. Daylighting
   (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.
   (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.
   (3) All daylighting shall be incorporated free of glare to the occupants.
(4) Uplighting under skylights is prohibited. Downlights in skylight wells or adjacent spaces shall be controlled thru automatic daylight dimming or switching.

(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:

(a) Wall switches placed for occupant convenience
(b) Automated dimming controls, which may include multi-level stepping or switching
(c) Photo sensors
(d) Programmable central control systems

**c. Ballasts**

(1) Ballasts shall be high efficiency, NEMA premium, electronic-type selected to match the lamp and output of fixture.

(a) 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.

(b) 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.

(c) 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.

(d) Limit the ballast factor in each building to a maximum of one (1) ballast factor per lamp type.

d. **Lamps**

(1) In new construction, building shall have no more than six (6) lamp types.

(2) All lamps shall be TCLP compliant (low mercury).

(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.

(4) 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>
<tbody>
<tr>
<td>Linear fluorescent (T8)</td>
<td>Bi-pin, 4’ tube, 4100k, 80+ CRI, 32w, 2800L</td>
<td>36,000+</td>
<td>GE, Sylvania,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Philips</td>
</tr>
<tr>
<td>Linear fluorescent (T8ES)</td>
<td>Bi-pin, 4’ tube, 4100k, 80+ CRI, 28w, 2725L</td>
<td>36,000+</td>
<td>GE, Philips</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sylvania,</td>
</tr>
<tr>
<td>Linear fluorescent (T8HL – Super T8)</td>
<td>Bi-pin, 4’ tube, 4100k, 80+ CRI, 32w, 3100L</td>
<td>36,000+</td>
<td>GE, Sylvania,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Philips</td>
</tr>
<tr>
<td>Linear fluorescent (T5)</td>
<td>Bi-pin, 4’ tube, 4100k, 80+ CRI, 28w, 2900L</td>
<td>36,000+</td>
<td>GE, Sylvania,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Philips</td>
</tr>
<tr>
<td>Linear fluorescent (TSHO)</td>
<td>Bi-pin, 4’ tube, 4100k, 80+ CRI, 54w, 5000L</td>
<td>36,000+</td>
<td>GE, Sylvania,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Philips</td>
</tr>
</tbody>
</table>

(5) There shall be only one (1) type of T8 or one (1) type of T5 within a building. Renovation projects shall match existing lamps.

(6) Incandescent, compact fluorescent, halogen, or metal halide lamps are prohibited.

e. Lighting Fixtures (luminaries)

(1) Custom lighting fixtures are prohibited.

(2) All downlights shall be LED.

(3) Exposed fixture housing surfaces, trim frames, door frames, and lens frames shall be free of light leaks.

(4) Lens doors shall close in a light tight manner.

(5) Hinged door closure frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

(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.

(7) Contacts for recessed double-contact lamp holders and slim-line lamp holders shall be silver plated.

(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.

(9) Light Transmitting Components for Fluorescent Fixtures

(a) 100 percent virgin acrylic plastic or water white, annealed, crystal glass.

(b) Flat lens panels shall have minimum 1/8 inch average thickness.

(c) 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.

(d) Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches, and safety catches to facilitate safe, convenient cleaning and re-lamping.

(e) Vapor tight fixtures shall have pressure clamping devices in lieu of latches.

(10) Open-tube Fluorescent Fixtures
(a) Provide two (2) self-locking sockets or lamp retainers, per lamp.

(b) Lamps shall have non-yellowing shatter-resistant coating, shall be nominal thickness of 1/8 inch and minimum 97 percent light transmission.

(c) 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.

(11) Metal Finishes
(a) Interior light reflecting finishes shall be white with minimum 85 percent reflectance.
(b) Exterior finishes shall be a baked, electrostatic powder coat.

f. LED Lamps and Fixtures
(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.

(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.

g. Emergency Lighting and Exit Signs
(1) Systems that use a central battery system are prohibited.
(2) Units shall provide a minimum of 90-minutes emergency use.
(3) Provide self-contained emergency lighting units connected to an unswitched lighting branch circuit conductor where only normal distribution system is available.

h. Fixture Installation
(1) All light fixtures shall be accessible without scaffolding.
(2) Lighting fixtures shall not be installed above stair treads.
(3) Lighting fixtures at landings shall meet ADA requirements for mounting heights.
(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.

3. Exterior Lighting

b. Exterior lighting not attached to the building shall be controlled by Utilities & Energy Management and shall NOT be wired into the Building Automation System.
c. Lighting bollards and luminaires in sidewalks, roadways and retaining walls are prohibited.

d. Sidewalk, street, and parking lot lighting shall be photocell controlled and metered separately.
   (1) Photocell shall control a lighting contactor.
   (2) Meter shall be installed ahead of the contactor.
   (3) Mount manual-automatic selector switches on the contactors.

e. All lamps shall be LED. If color rendition is critical to the activity anticipated for the area (baseball games, tennis matches, etc.) alternate types of lamps may be used with Owner approval.

f. Incandescent and HPS lamps shall are prohibited.

4. Lighting Controls
   a. Design
      (1) Conform to IECC and ASHRAE 90.1 requirements for automated lighting controls.
      (2) All rooms require lighting controls. Rooms with more than one (1) entry shall have lighting controls reviewed with Owner.
      (3) Develop Sequence of Operation with the Owner.
      (4) Use daylighting strategies and occupancy sensors to control lighting in areas subject to extended unoccupied periods during normal hours of occupancy.

   b. Central Dimming Controls
      (1) See Section IV for information.

   c. Sensors
      (1) Wall switch sensors shall be factory-set to vacancy mode (manual on/auto off).

G. COMMUNICATIONS

1. General
   a. Telephone, Wired Network, and Wireless Network hardware shall be included within the project scope. Cost and quantity estimates shall be provided by ITS.
   b. Telephone, Wired Network, and Wireless Network infrastructure shall be included within the project scope. Cost and quantity estimates shall be provided by Design Professional.
   c. Wireless connectivity shall not replace wired connections, but rather is a supplement.

2. Telecommunication Pathways
   a. See Section IV for information.

3. Grounding and Bonding
   a. See Section IV for information.

4. Data and Voice Horizontal Infrastructure
   a. See Section IV for information.
5. Fiber Optic and Copper Backbone and Riser Cable
   a. See Section IV for information.

6. Outdoor Plant Fiber Optic Cable
   a. See Section IV for information.

7. Copper
   a. See Section IV for information.

8. CATV Distribution and Horizontal Infrastructure

H. ELECTRONIC SAFETY AND SECURITY

1. Electronic Access Control and Security (AMAG)
   a. Electronic Access
      (1) Owner shall be involved in the planning and design of all AMAG projects.
      (2) Buildings shall be designed to have individual lockdown capability.
      (3) Exterior doors shall be monitored and alarmed. Main entrances shall have electronic locks, alarms, proximity readers and door closers.
      (4) Proximity readers shall only control one (1) opening. Each entrance door shall be controlled by its own DCU.
      (5) The AMAG system may require a door unlock key switch located at the fire alarm control panel for First Responder entry to stairwells or other doors, per Owner direction.
      (6) Large-occupancy spaces, such as classrooms and auditoriums to have auto-lock and auto-unlock features through the access control system, shall also have emergency locking push-button switches located on the interior side of the room, near the door. If more than one (1) door enters the room, one (1) button shall lock all doors.
      (7) ITS spaces and general assignment classrooms shall have electronic locks.
      (8) The Design Professional shall develop a Sequence of Operations narrative and include Sequence on drawings.
      (9) The drawings shall include a door schedule for all monitored and controlled doors and a camera schedule. Schedules shall identify the door/room served, functionality, type of device(s), and location.
      (10) Room numbers, door names, and other programming names shall be approved by Owner prior to programming.
      (11) AMAG Symmetry Enterprise for Central Station shall be used for all projects. New/expanded access control and monitoring systems shall be networked with the existing system managed by Facilities Management. Server(s), central station software, back-up systems, proximity cards, badging station, printer, etc. shall be provided by the Owner.
      (12) The Security Management System (SMS) equipment room shall have:
(a) 120 volt emergency power direct-wired into outlet strip (outlet strip provided by the SMS Contractor, circuit installed by a State licensed electrician). A circuit from an ITS electrical panel may be used if SMS equipment is installed in an ITS space.

(b) Entry door shall have an electronic lock, alarms, and card reader.

(13) Design Professional shall review condition of existing doors and hardware and advise Owner of necessary or recommended replacements or upgrades.

(14) Biometric devices shall be hand geometry readers.

(15) Building Security Levels

(a) Level 1: Low Risk - Building is accessible during normal working hours and locked after hours. Exterior doors have alarms that register in the software and self-closers, main entrance doors have electronic locks and card readers. Scheduled exterior doors have electronic locks. Occupants are responsible for security of interior doors.

(b) 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.

(c) 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.

(d) 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.

(e) Level 5: Extremely High Risk – Building and spaces have restricted access. All items in Level 4, plus video recording system and 2-factor authentication.

(16) Security Management System design (video, access control, and/or intrusion) shall be reviewed and approved by Department of Public Safety.

(17) Security Management System (SMS) Equipment and Devices

(a) Wire and cable from the processors to all devices at each door shall be home-run, unless otherwise specified.

(b) 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.
(c) The use of an ITS closet as a pass-thru shall be permitted only when the door has access control installed.

(d) All exterior doors (including overhead doors) shall have door position switch monitoring.

(e) All exterior and interior doors which are to receive access control shall have door-position switch monitoring, latch bolt hardware monitoring, and integral hardware request-to-exit switches.
   i. All exterior doors shall be either monitored or controlled.
   ii. Monitored exterior doors shall have door position switch, latch bolt hardware monitoring, and request to exit. Doors shall have no hardware on the exterior of the door as these are exit-only doors.
   iii. Controlled exterior doors shall have key override. At least one (1) card reader shall be provided for entrances with multiple openings.

(f) Utilization of a reader port shall be required on doors that are electronically controlled and monitored.

(g) Electronic strikes shall not be used.

(h) Control of call buttons shall be approved by Owner.

(i) Trigger commands and other server based commands shall not be used.

b. Video Surveillance Systems
   (1) Video surveillance systems require Owner approval.
   (2) Video recording for IP cameras shall be on a server managed and maintained by ITS.
   (3) The video license for each camera shall be purchased as part of the project.
   (4) Design Professional shall present a set of Construction Documents for camera locations and equipment.

c. Security Alarm/Intrusion Alarm Systems
   (1) Shall be approved by Department of Public Safety.
   (2) Shall utilize AMAG or a system approved by Department of Public Safety.
   (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.

2. Fire Alarm and Detection Systems
   a. General
      (1) Refer to Ul Fire Safety Department Guide Specifications.
(2) Separate fire alarm and detection system drawings shall be prepared. Fire alarm and detection system drawings shall not be incorporated into the electrical or communications drawings.

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

(4) Location of all damper indicator lights shall be shown on drawings.

(5) Any proposed changes affecting the fire alarm system require Owner approval.

(6) Design Professional shall identify on the fire alarm drawings the estimated quantity of dry contacts required for the fire alarm system.

(7) During Design Development, Design Professional shall provide outline of Sequence of Operation for auxiliary controls from fire alarm system (smoke purge, damper control, HVAC control, etc.).

(8) A complete Sequence of Operation shall be included in the Contract Documents.

(9) AHU shut-down circuit shall automatically reset after FACP is reset.

b. Fire Alarm Control Panel (FACP)

(1) General
   (a) Systems shall include capacity for handling a minimum of 20 percent more circuits and alarm causing and signaling devices.
   (b) A separate Signaling Line Circuit shall be installed per floor.
   (c) FACP Bypass Switches
   (d) Access Level 3
      i. City disconnect (for both alarms and troubles)
      ii. Audio by-pass
      iii. Visual circuit by-pass
      iv. Electronic door latches / locks
      v. Air handler by-pass
   (e) Access Level 1
      i. Dampers by-pass
      ii. Elevator by-pass
      iii. Fire Door by-pass
      iv. Provide separate fan shutdown switches for each air handler.
      v. Smoke purge by-pass (where applicable)

(2) System Resets
   (a) A fire alarm resets shall require a security level access level of 3.
   (b) Equipment that has been bypassed in software shall not change state-of-condition during a reset.

(3) Voice Control Point Switches
   (a) “All Clear” message
   (b) “Weather Alert” message

SECTION III – GENERAL DESIGN STANDARDS
(c) “All Speakers” talk switch
(d) Audio zone momentary contact switches to manually select the following individual speaker circuits:
   i. Each elevator car
   ii. Each stairwell, connected to adjacent floor zone
   iii. Each building level and approved fire zone
   iv. Outside speakers

(4) LED Lights
(a) Only fire alarm zone lights and device type lights shall annunciate with a red LED.
(b) Device type, address, and exact location shall annunciate on the digital readout.
(c) Any bypass, disable or trouble condition shall annunciate with an amber LED, a trouble sounder and annunciate on the digital readout.
(d) When speakers or phone circuits are active, green LEDs shall annunciate the appropriate speaker circuits.
(e) Individual speaker circuits shall be capable of being activated without a pass code.
(f) Individual speaker control shall be possible with loss of A/C power.

(5) Communications
(a) DACT shall be installed within fire panels. New installations require fiber optic network connection.
(b) Send the following signals to The University of Iowa Police Dispatch Office:
   i. Alarms (Zone 1)
   ii. Troubles (Zone 3)
   iii. Supervisory (Zone 4)
(c) The DACT trouble signal shall track the FACP trouble piezo.
(d) Provide a ¾ inch conduit with pull string from the fire alarm control panel to designated telephone switch room.
(e) 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.
(f) Radio repeaters shall be installed as required by local fire department and AHJ.

(6) Audio System
(a) Amplifiers shall be a minimum 100 watts, except in dual-channel applications where the elevator channel may use 25 watt amplifiers.
(b) Amplifiers shall have redundant back-up amplifier(s) that automatically transfer.

(c) Amplifier sizing calculations:
   i. One (1) watt per interior speaker (in restrooms and small rooms set taps to ¼ watt).
   ii. Two (2) watts per outside and mechanical room speaker.
   iii. Each audio amplifier shall be sized to include 20 percent spare capacity for future connection of audio speakers.

(7) Minimum Sprinkler Systems Monitoring Points
   (a) Fire pump items include pump running, fire pump power, and fire pump phase reversal.
   (b) Jockey pump power.
   (c) Water flow switches by fire zone with separate address for each device.
   (d) Tamper switches by fire zone with separate address for each device.

(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.

c. Releasing Panels
   (1) The main FACP shall not be used as a releasing panel for special hazard or alternative suppression systems.
   (2) Key pad controls shall be within visual distance of releasing agent location.
   (3) The main FACP may be used for releasing sprinkler pre-action or dry systems.

d. Initiation Devices
   (1) General
      (a) Comply with NFPA 80 for smoke detector location and quantity.
      (b) End-of-line resistors shall be located at the device that is farthest away from the panel or module.
      (c) Detectors shall be placed so that they can be tested directly from the floor level
      (d) Each device shall have a separate address.
      (e) When ceiling mounted applications are required, devices shall be mounted to have 80 percent surface coverage or larger. They shall not be installed in pockets or out of sight areas.
      (f) Device Locations
         i. Photo Electric Smoke Detectors
            1. Corridors
            2. Custodial rooms
3. Telephone Rooms
4. Libraries
5. Storage rooms
6. Laboratories (where required) (Heat detectors are preferred, but a variance is required.)
7. Mechanical rooms (except high temperature areas)
8. Elevator lobbies

ii. Heat Detectors
   1. Copy centers, vending rooms, kitchens
   2. High temperature mechanical rooms
   3. Labs (A variance is required)

iii. Duct Smoke Detectors
   1. Supply Air Handlers greater than 2,000 CFM.
   2. Return Air Handlers greater than 15,000 CFM or when AHU serves more than one (1) floor.

iv. Pull Stations
   1. At exits leading to the exterior.
   2. At stairwell exits on each floor.
   3. As required by NFPA and fire code official reviews.
   4. Maximum distance between pulls shall be less than 200 feet.

(2) Smoke Detectors
   (a) Shall provide a solid red LED on the detector or base when the device is in the alarm condition.
   (b) Smoke detectors shall be low-profile analog.

(3) Duct Detectors
   (a) Duct detectors shall be installed when the conditions listed in NFPA 72E and NFPA 90A-14, Sec. 4-2 through 4-4 are met.
   (b) Duct smoke detectors shall be used only in duct larger than 12 inches in diameter.

(4) Heat Detector
   (a) Heat detectors shall be restorable and provide a red LED on the detector or base when the device is in the alarm condition.
   (b) Heat detectors shall be analog addressable unless high temperature devices.
   (c) All detectors shall be magnet-testable.

(5) Beam Detectors
   (a) If beam detectors are proposed, design shall be reviewed by University of Iowa - Fire Safety for appropriate application, maintenance, and accessibility.
(b) Provide a beam detector test switch for each detector.
(c) All beam detectors shall have a transmitter and a mirror, no receiver.
(d) All beam detectors shall have a key or magnet test station.

e. Annunciation Devices
   (1) General
       (a) Signaling devices shall be placed so that they shall provide a sound of 15 dBA above the ambient noise level in all areas.
       (b) Place outside, weatherproof speakers at all major entrances.
       (c) Visual devices shall be a single combo unit when both devices are required.
       (d) Message Boards shall be used only in ADA selected areas.
   (2) Strobe Devices
       (a) Strobe intensity shall be determined by ADA requirements.
       (b) All strobes within line of site shall be synchronized.
       (c) 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.
       (d) Each fire floor and fire zone shall have individual strobe circuit control.

f. Other Devices
   (1) General
       (a) 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.
       (b) Auxiliary equipment shall not be directly connected to an addressable control module.
       (c) 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.
   (2) Smoke Dampers
       (a) Smoke damper indicator lights shall be Select-A-Switch, Model SL53413-6-BG.
       (b) Place damper indicator lights in corridors whenever possible. Graph displays are not allowed.
   (3) Door Hold Open
       (a) Door magnets shall be powered by 24 volt power source other than the FACP.
       (b) Powering down the FACP shall not automatically close the fire doors. Door hold-opens shall not close on loss of power to the FACP.
(c) Electronic door hold-opens shall be 24 volt DC
(d) Electronic door hold-opens with built-in smoke detectors shall not be allowed.

(4) Building Automation Controls
(a) The fire alarm system shall provide dry contacts for Direct Digital Control (DDC) system to control HVAC or purge system during alarm.

(5) Fire Shutters
(a) Fire shutters are not recommended. If use is required, shall be readily-accessible and motorized, with push-button to re-open the shutter.

g. Raceways, Boxes, and Cables
(1) Each floor shall have a separate conduit feed.
(2) All fire alarm devices, junction and pull boxes shall be easily accessible without removing light fixtures, equipment, conduits, junction boxes or other items.

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.

A. ACCESSIBILITY
   1. The detectable warning plate shall be Neenah Foundry in cast iron and unpainted.
   2. Adequate and safe detour(s) shall be provided when sidewalks and/or building entrances are closed and blocked.
      a. Use audible and visual signage to give advance notification of closures ahead and inform pedestrians of alternate accessible routes.
      b. On signage, use terms such as “universal” and “accessible” and the International Symbol of Accessibility. The terms “ADA” or “handicap” shall not be used.
      c. 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.

B. COMMISSIONING
   1. For commissioning requirements, please refer to the Owner’s Document 01 91 13, Commissioning. The document is available at the following web site: http://www.facilities.uiowa.edu/pdc/consultants/?submenuheader=2

C. ENERGY
   1. See Section III for information.

D. HAZARDOUS MATERIALS
   1. PCB containing material may be present in existing fluorescent light fixture ballasts.
      a. PCB containing ballasts shall not be discarded in the regular trash or demolition debris.
      b. PCB containing ballasts not salvaged shall be removed from the fixture and turned over to the Owner for disposal, at no cost to the Contractor.
      c. Fluorescent light fixtures containing non-PCB ballasts may be salvaged.
      d. These ballasts shall have a label that specifies no PCB, Non-PCB, or PCB Free.
e. The Contractor shall properly remove the light fixtures intact and relocate them per Owner direction.

2. Mercury Vapor Fluorescent Lamps may be salvaged.
   a. The Contractor shall properly remove the light fixtures intact and relocate them per Owner direction.
   b. Fluorescent tubes which will not be reused shall be recycled.
      (1) The Contractor shall remove the tubes, fixtures undamaged, pack them securely in tube boxes, and ship them to a fluorescent tube recycler.
      (2) Fluorescent lamp tubes shall not be discarded in the regular trash or with demolition debris.

3. Mold growth may be present in existing building materials.
   a. Use standard mold remediation (clean-up) techniques to properly control and dispose.
   b. Report any unusual or severe mold growth to Owner.

4. Acid Dilution underground tanks shall not be used.

E. DEMOLITION
1. Prior to completion of final Review Documents, Owner shall identify material removed by demolition which is to remain on property.
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.
3. All asbestos materials shall be removed prior to general demolition.

F. WARRANTY
1. See Section III for information.

G. TRAINING
1. See Section III for information.

II. CIVIL
The following information is provided as a general guideline in establishing Civil Engineering project specific requirements.

A. GENERAL
1. See Section III for information.

B. SUBSURFACE INVESTIGATION
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:

a. Open Excavation
   (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) 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.

b. Pit and/or Trench Excavation
   (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.

c. Drilled Pier Excavation
   (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) 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. Backfill and subgrade compaction shall conform to Geotechnical Engineer’s recommendations. For projects without a geotechnical report, the following criteria shall be specified:
   a. 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.
   b. 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.

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:
   
a. 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.

C. **SITE SURVEY**
   1. See Section III for information.

D. **LANDSCAPING**
   1. **General**
      a. 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).
      b. Owner shall be notified prior to applying top soil or growing medium for turf or plants for the purpose of establishing the finish grade.
      c. Soil or growing medium for turf or plants shall be examined and approved by Owner.
   2. **Plants**
      a. Contractor shall stake all plant locations. The Owner shall approve all staked locations prior to planting.
      b. All baskets, burlap, containers, wires, twine, etc. shall be completely removed from all plant material prior to planting.
      c. Proper planting depth requires the root flare above finished grade. Specifications shall incorporate language and details to insure proper planting depth.
      d. Planters shall be filled with specific soil mixtures and checked for adequate drainage by the Owner before filling.
      e. Landscape plant materials shall be in accordance with the American Association of Nurseriesmen’s Standards.
      f. Landscape plants shall be maintained by the Contractor for a thirty (30) day period following planting.
g. Landscape installer shall provide typewritten instructions to the Owner for the maintenance of plant materials for one (1) year period. Instructions shall be submitted upon completion of planting.

h. Spring Planting Schedule
   (1) Trees (Deciduous and Coniferous Evergreen) and Shrubs
       (a) Shall be planted between March 15 and June 15.
       (b) Oak varieties shall only be planted in the spring.
   (2) Ground covers and herbaceous perennials shall be same schedule as trees.
   (3) Turf shall be seeded (sodded) between April 1 and May 31

i. Fall Planting Schedule
   (1) Trees (Deciduous, except Oak varieties) shall be planted between October 1 and November 30.
   (2) Trees (Coniferous Evergreen) shall be planted between September 1 and October 30.
   (3) Shrubs shall be planted between September 15 and November 30.
   (4) Ground covers and Herbaceous Perennials shall be planted between September 15 and October 15.
   (5) Turf shall be:
       (a) Seeded between August 25 and October 1
       (b) Sodded between September 1 and November 15.

3. Landscape Furniture and Fixtures
   a. All site furniture shall be surface-mounted on concrete.
   b. Bicycles
      (1) Bicycle racks shall be the Bike Rib Linear Rack as manufactured by Function First, Inc. Preferred color is black. Preferred finish is thermoplastic.
      (2) Bicycle racks shall be surface-mounted, installed on 24 to 30 inch centers from perpendicular wall, object or parallel object and on 24 to 30 inch centers apart.
      (3) Bicycle rack layouts with an aisle shall have a minimum 48 inch aisle. Allow 72 inches of depth for each row of parked bicycles.
   c. Benches
      (1) Stone and concrete benches shall not be used.
      (2) Acceptable Pallet
          (a) Scarborough
          (b) Plainwell
          (c) Plexus
   d. Trash Receptacle
      (1) Acceptable Pallet
          (a) Scarborough
          (b) Plexus
4. Exterior Building Signage
   a. See Section III for information.

E. ROADWAYS, PARKING LOTS AND WALKWAYS
1. General
   a. See Section III for information.
2. Roadways
   a. Asphalt and Portland Cement Concrete Paving
      (1) Asphalt/Portland cement concrete pavement shall be designed according to the following guidelines:
         (a) Roadways, rigid and flexible shall follow AASHTO Guidelines for the Design of Pavement Structures.
         (b) Parking Lots
            i. Rigid - Portland Cement Association
            ii. Flexible - The Asphalt Institute
         (c) Walkways shall have a minimum compressive strength of 4000 psi for twenty-eight (28) days.
         (d) Exposed concrete, including precast concrete, shall be air entrained.
      (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.
      (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.
      (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) Fibers (non-asbestos) can be used in addition to steel to control shrinkage cracking.
      (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.
         (a) 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 s sent directly to the Contractor, Architect, and the Owner, as specified.

(b) 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.

(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.

(8) Sand shall be from local sources meeting ASTM C-144 for mortar and ASTM C-33 Size 67 for concrete.

(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.

(10) Joints and Concrete Flatwork

(a) 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.

(b) Portland cement concrete flatwork shall be isolated from manholes, existing walls, etc., by use of expansion joints.

(c) Contraction joints shall be tooled during finishing or saw cut within 18 hours of concrete placement.

(d) Construction joints shall be located at expansion joint locations wherever possible. Construction joints at other locations shall be keyed.

(e) All expansion joints on Institutional Roads shall be sealed with traffic grade, non-asphalt, non-extruding sealant.

(f) Joint spacing and joint detail shall be shown on the drawings.

(11) Parking Lot Striping
b. 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.

3. Parking Lots
   a. See Section III for information.

4. Walkways
   a. The detectable warning plate shall be Neenah Foundry in cast iron and unpainted.

F. TEMPORARY TRAFFIC CONTROL
1. General
   a. See Section III for information.

2. Vehicular Traffic
   a. See Section III for information.

3. Pedestrian Traffic
   a. See Section III for information.

G. SANITARY SEWER
1. General
   a. 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.

   b. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

   c. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

   d. 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.

   e. Install warning tape 12 inches to 18 inches above piping.

2. Piping
   a. The minimum service line size shall be 6 inches.

   b. The minimum sewer line shall be 8 inches.

   c. Piping shall be either
      (1) PVC cement filled truss pipe.
      (2) Ductile iron pipe with restrained joints, Class 53.
      (3) Reinforced Concrete sewer pipe, with prior approval.

   d. Owner preference is push-joint PVC sewer pipe.

3. Accessories
   a. Manholes and Lids
(1) Manholes shall be precast concrete, minimum 4 feet inside diameter, unless otherwise noted.
(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”.
(3) Rings and lids for grated openings shall also use the 1045 ring, with the appropriate grated lid.
(4) Lid extension ring height shall not exceed 12 inches.
(5) Drop piping into manholes may be required.
(6) Bases shall be poured into the bottom of manholes and a formed invert from pipe to pipe installed to create flow path.

b. Cleanouts
(1) Cleanouts are required on service lines outside building footprint and at horizontal or vertical bends in a service line.
(2) The deflection shall utilize a wye with the cleanout as an upstream extension of the downstream line’s alignment.
(3) Cleanout material shall be ductile iron.
(4) Frame and casting shall be Neenah R-1976, Deeter 1830. Casting shall be anchored by a 2 foot x 2 foot x 8 inch thick concrete pad, 6 inches below finished grade. Separate concrete from pipe with two (2) layers of building paper.
(5) Cleanouts may be used at the end of a sewer line where the distance to the downstream manhole is 150 feet or less.
(6) End-of-line cleanouts shall use long radius bends and include a concrete cradle under the bends.
(7) PVC shall not extend above grade.

H. STORM SEWER
1. General
   a. Joints shall conform to ASTM D3212. Flexible elastomeric seals shall conform to ASTM F477.
   b. Backfill material shall be crushed stone or other granular material meeting the requirements of Class-2 material as defined in ASTM D2321.
   c. 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.
   d. 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.
e. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

f. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.

g. 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.

h. Install warning tape 12 inches to 18 inches above piping.

2. Piping
   a. Pipe shall be
      (1) Up to 12 inch
         (a) 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.
         (b) Polyvinyl chloride (PVC) conforming to ASTM D2241, PVC 1120, DR 21, PR 200 (SDR-21).
      (2) 12 inch and larger
         (a) Reinforced Concrete Pipe (RCP) conforming to ASTM C76 or AASHTO M170, Class 3 Minimum
         (b) HDPE conforming to ASTM F-2648 or F-2306.
   b. The minimum pipe size for storm drains, except roof drains, is 15 inches.
   c. Perforated pipe for subgrade drains shall be SDR-35 or Schedule 40 PVC.
      (1) Pipe shall be installed in a geotextile envelope with clean rock.
      (2) Perforated pipe in a 'sock' is not acceptable.

3. Accessories
   a. 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.
   b. Inlets and junction boxes may be cast-in-place or precast conforming to ASTM C478.
   c. Storm manholes and junction boxes shall be East Jordon Model 1045 non-bolt down. Lid shall be lettered with the words ‘University of Iowa Storm Sewer’ or ‘University of Iowa Storm Drain’.
   d. 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.
   e. 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.
f. With Owner approval, Nyoplast, PVC sub-surface drainage inlets, inline drains and catch basins may be used in landscaped areas.

I. DOMESTIC WATER

1. General
   a. 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.
   b. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.
   c. Backfill material shall be placed in continuous layers not exceeding 8 inches in compacted depth.
   d. Maintain -2 percent to +4 percent optimum content for cohesive soils. Cohesionless soils shall be pre-wetted to within $\pm$ 3 percent of optimum moisture content before delivery to the project site.
   e. Install warning tape 12 inches to 18 inches above piping.
   f. 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.
   g. Provide 1 inch insulation and vapor barrier on all domestic water piping that is not direct buried.
   h. Operation of all valves, both new and existing, shall be by the Owner.
   i. Coordinate post indicator valve locations with Owner.

2. Piping
   a. Use of plain EUD fittings is not allowed.
   b. Pipe shall be cement lined.
   c. Changes in direction shall be made with 45-degree, 22½-degree, or 11¼-degree bends. 90-degree elbows shall be used only with Owner’s approval.
   d. Approved manufacturers include Griffin-SnapLok, U.S. Pipe – TR Flex, Clow – TR Flex, or American Pipe - Flex Ring.
   e. Water pipe shall be encased in minimum 8 mils polyethylene sheathing.
   f. Field cut joints shall be mechanical, with Megalug series 1100 restraint. Manufacturer’s field kit shall not be used.
   g. Seal wall penetrations with Link-Seals.
   h. Anchor piping to wall or floor at penetrations.

3. Accessories
   a. 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.
b. All water meters shall be located inside buildings with a ¾ inch raceway to the Utility Ethernet connection.

c. Valves
   (1) Valves 14 inches and smaller shall be Clow F-6100 resilient wedge gate valve.
   (2) Valves 16 inches and larger shall be gear-operated butterfly valves.
   (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.
   (4) Connections
      (a) 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.
      (b) Mechanical joint end connections shall fully conform to ANSI/AWWA C111/A21.11.
      (c) Wafer end connection shall be designed for installation between ANSI B16.1 Class 125 Iron flanges or ISO 7005-2 PN10 or PN16 flanges.
   (5) Design
      (a) 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.
      (b) 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.
      (c) Resilient seats shall be field adjustable and replaceable and shall not require hypodermic needles or pressure vessels to replace or adjust.
      (d) Sleeve bearings shall be provided in the valve hubs and shall be Nylatron or woven Teflon, fiberglass backed, self-lubricating.
      (e) Thrust bearings shall be provided and shall be adjustable on valves 30 inches and larger.
      (f) Shaft seals shall be of the V-type and shall be replaceable without removal of the valve or shaft.
   (6) Materials
      (a) Body
         i. 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.

ii. Optional body material is ASTM A536, Grade 65-45-12 ductile iron.

(b) Valve disc shall be ASTM A536 Grade 65-45-12 ductile iron.

(c) Shafts
   i. Shafts shall be ASTM A276 type 304, or ASTM A564, Type 630 stainless steel.
   ii. Optional shaft material is ASTM A276, Type 316 stainless steel.

(d) Resilient seat shall be Buna-N and mate to a Type 316 stainless steel body seat ring.

(e) All seat-retaining hardware shall be Type 316 stainless steel.

(f) Valve exteriors for above ground service shall be coated with a universal, alkyd primer.

(g) Valve exteriors for buried service shall be coated with fusion bonded epoxy coating.

(h) Valve interiors shall be coated with an ANSI/NSF 61 fusion bonded epoxy coating approved for potable water.

(i) Provide manual, electric or cylinder actuation.

(j) 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”.

(k) T-bolts shall be fluorocarbon coated by Birmingham Fasteners.

(l) 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.

4. Testing
   a. Disinfection - Domestic Water
      (1) Disinfections shall be performed Monday through Thursday, starting between 8:00 AM and 9:00 AM.
      (2) Pipes shall be disinfected according to AWWA standards.
      (3) Disinfection shall take place over a period of twenty-four (24) hours (no longer or shorter).
      (4) 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
      (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.
(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.

(3) Take Chlorine residue tests at each sampling point after the twenty-four
(24) hour period. Report results to Owner.

(4) Owner shall provide 5-g calcium hypochlorite required for dose of 50
mg/L.

c. Flush - Domestic Water

(1) Remove air relief vents after testing. Provide GPS locations for each
vent.

(2) Contractor shall supply all equipment and personnel required to
perform flush.

(3) Contractor shall contact the Owner for water source.

(4) Flushing shall be started between 8:00 AM and 9:00 AM, Monday
through Thursday.

(5) Systems shall be flushed two (2) times, with two (2) samples per flush.

(6) Flushing shall take place for approximately four (4) hours.

(7) Contractor shall install a temporary hydrant at the end of the water
main for flushing purposes. The temporary hydrant shall be full-sized.

(8) 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.

d. Notify the Owner of de-chlorination plan prior to disposal of heavily chlorinated
water.

e. Neutralizing chemical shall be applied to the waste water to neutralize
thoroughly the residual chlorine.

f. Contact Federal, State, provincial, and local regulatory agencies to determine
provisions for disposal of heavily chlorinated water.

g. Cleaning

(1) Piping shall be free of all foreign materials. Joint surfaces shall be free
of lumps and blisters.

(2) Piping shall be power-washed clean inside and out. Owner shall witness
cleaning.

h. Water Sampling - domestic water only

(1) 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.

(2) The Contractor shall supply equipment and personnel required to
perform the tests.

(3) Water sampling shall take place at approximately 11:30 AM.

(4) Following the sampling, the Contractor shall allow three (3) days for
laboratory processing before hydro test.
(5) Testing shall be completed and passed prior to connecting to any existing lines.

i. Hydro test
(1) Hydro test all piping.
(2) Testing shall not begin until satisfactory biological test results have been received from the Owner.
(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.
(4) Owner shall witness all hydro tests.
(5) Test shall be for four (4) hours. No tests started after 12:00 PM.
(6) Test may only lose 5 psig.
(7) Gauges shall be Owner provided.

j. Final Connections to Existing Domestic Water Main
(1) Water mains and appurtenances shall be flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connection to the active distribution system.
(2) Follow sanitary construction practices during final connection so that no foreign material or groundwater contamination enters the adjacent piping.

J. NATURAL GAS
1. Gas Mains and services shall have a minimum of 24 inches of cover.
2. Piping downstream of meter shall be above grade.

K. CHILLED WATER
1. General
   a. Piping shall have sand pipe bedding and envelope. Piping shall be laid in a sand bed with a minimum 12 inch sand envelope.
   b. 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.
   c. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.
   d. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.
   e. 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.
   f. Install warning tape 12 inches to 18 inches above piping.
   g. Operation of all valves, both new and existing, shall be by the Owner.
   h. Chiller Plant PLC to be GE RX3i.
2. Piping
   a. Ductile iron piping shall be class 53 restrained joint piping for all sizes.
   b. Pipe shall be cement lined.
   c. Approved manufacturers include Griffin - Snap Lok, U.S. Pipe – TR Flex, Clow – 
      TR Flex, or American Pipe-Flex Ring.
   d. Field cut joints shall be mechanical, with Megalug series 1100 restraint. 
      Manufacturer’s field kit shall not be used.
   e. Piping shall be encased in minimum 8 mils polyethylene sheathing.
   f. Piping wall penetrations:
      (1) Seal wall penetrations with Link-seals.
      (2) Anchor piping to wall or floor at penetrations.

3. Accessories
   a. Valves
      (1) Valves 14 inch and smaller shall be Clow F-6100 resilient wedge gate 
          valve or approved equal.
      (2) Valves 16 inches and larger shall be gear-operated butterfly valves.
      (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”.
   b. Elbows:
      (1) Changes in direction shall be made with 45-degree, 22 ½-degree, or 11 
          ⅛-degree bends. 90-degree elbows are not allowed.
   c. Building service piping shall have a strainer and chilled water meter installed at 
      the point of entry into the building.
   d. Owner shall provide water meter specifications.

4. Testing
   a. All piping shall be cleaned prior to testing. Disinfection is not required. Cleaning 
      shall be as follows:
      (1) Piping shall be free of all foreign materials. Joint surfaces shall be free 
          of lumps and blisters.
      (2) Piping shall be power-washed clean inside and out. Owner shall witness 
          cleaning.
      (3) Video installed pipe to verify cleanliness. Submit video to Owner for 
          review.
   b. Hydro Test Requirements
      (1) Hydro test all piping.
      (2) Test pressure shall be 150 pounds.
      (3) Owner shall witness all hydro tests.
      (4) Test shall be for four (4) hours.
      (5) Test may only lose 5 psig.
      (6) Gauges shall be provided by Owner.
   c. Videotaping shall be required check cleanliness of chilled water piping.
L. STEAM AND CONDENSATE DISTRIBUTION

1. General
   a. 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.
   b. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.
   c. Backfill material shall be placed in continuous layers not exceeding 8 inch in compacted depth.
   d. 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.
   e. Install warning tape 12 inches to 18 inches above piping.
   f. Weld requirements:
      (1) Contractor shall submit welder certifications.
      (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.
   g. Pipe material requirements:
      (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.
      (2) Provide the Owner with the identification code.
      (3) Any fabrication off the jobsite shall have the identification color coded the entire length of fabrication.
      (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.

2. Piping
   a. Carrying piping material shall be as follows:
      (1) Steam - All Locations
         (a) 2 inches and Smaller Schedule 80 A106 Gr B seamless, threaded.
         (b) 2 ½ inches and Larger STW A106 Gr B seamless, butt-weld.
      (2) Condensate in Tunnels and Tank Rooms
         (a) 2 inches and Smaller Schedule 80 A106 Gr B seamless, threaded
         (b) 2 ½ inches and Larger, Schedule 10S A312 Type 304L stainless steel.
      (3) Condensate in Direct Bury Systems
         (a) 2 inches and Smaller Schedule 40S A312 Type 304L stainless steel socket weld - no threaded piping.
(b) 2 ½ inches and Larger Schedule 10S A312 Type 304L stainless steel.

b. 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.

c. Welds shall be visually inspected.

d. Flanges on screwed piping shall be back-welded.

e. 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.

f. 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.

g. Unions shall be Nicholson Uniflex Steel/Stainless. Pipe unions shall have replaceable gaskets.

h. Elbows shall be long radius.

i. Pre-insulated Piping (direct-bury)

(1) Perma-Pipe Multi-Therm 500.

(2) Steam and condensate shall be installed in separate casing pipes. Steam is schedule 40 seamless piping and condensate is schedule 10 stainless steel.

(3) Provide for pipe expansion in vaults.

(4) Casing pipe shall be air pressure tested and soaped at field joints.

(5) Provide DriTherm piping envelope. DriTherm shall assist the design professional with design.

(6) The pipe system and supports shall be designed by DriTherm.

(7) Trapping vaults on the system shall be no more than 250 feet apart.

(8) Engineering supervision is required during installation, as faulty installation cannot be detected by any post-construction test methods.

j. Piping Penetrations

(1) Penetrations of foundation walls shall be leak proofed. Approved manufacturers include Thunderline and Link-Seal.

(2) Penetrations, except steam tunnels, shall be individual pipes or conduits. Groups of pipes or conduits in a common penetration shall not be allowed.

(3) Minimum strength of pipe penetrating foundation walls shall be equal to Schedule 40.

(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. Water-stopping material shall be equal to Volclay RX-102.

(5) Individual penetrations of steam and condensate lines shall be installed as follows
(a) Sleeve penetration with a steel sleeve at least 6 inches beyond the penetration.
(b) 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.

3. Accessories
   a. Supports and Anchors
      (1) Portions of pipe stanchions within 12 inches of concrete shall be 304L stainless steel.
      (2) Anchoring devices shall be stainless steel.
   b. Meters
      (1) Meters are McCrometer V-Cone
      (2) 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.
      (3) Meters shall have flow direction arrows that need to be observed. The meters shall have 150 pound, raised face, flanged bodies.
      (4) Meter shall be provided by the Contractor.
      (5) Provide a ¾ inch raceway to the Utility Ethernet connection.
      (6) All conduit and conductors shall be provided and installed by the Contractor.
   c. Pressure Reducing Valves (PRV)
      (1) PRVs shall be installed with isolation valves.
      (2) PRVs shall be Cashco Ranger
      (3) PRVs in the distribution system shall not contain a bypass.
      (4) Locate pressure gauges on both sides of PRV.
      (5) All PRVs shall be located and configured to allow for maintenance access. Provide a minimum clearance of 24 inches in all directions.
      (6) Mount PRV below 8 feet AFF.
   d. Valves
      (1) All valves on a project shall be by the same manufacturer and the same model.
      (2) Valves 2 ½ inches and larger
         (a) Manufacturers shall be Powell, NEWCO, Velan, or Crane.
         (b) 155 psig Steam shall be 300 pound class cast steel, butt-weld.
         (c) 20 psig Steam shall be 150 pound class cast steel, butt weld.
         (d) Hard-faced seat rings.
         (e) Direct-operated valves are preferred over gear-operated valves.
         (f) All valves shall be equipped with operating devices to allow operation from the ground.
(g) Valves may be butterfly, lug-style, carbon steel body, and stainless steel disk, complete with gear operator and locking device and manual hand wheel.

(3) Valves 2 inches and smaller
   (a) Manufacturer shall be NIBCO Model T-174-SS
   (b) 155 psig Steam shall be 300 pound class screwed bronze.
   (c) 20 psig Steam shall be 300 pound class screwed bronze.
   (d) Rolled in stainless steel seat rings.

(4) Safety Valves
   (a) 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.
   (b) Multiple valves may be used in lieu of a single, larger valve.
   (c) Valves 2 ½ inch outlet or smaller shall be Kunkle Figure 6010. Valves 3 inch outlet or larger shall be Kunkle Figure 300.
   (d) The use of PRVs in series instead of a relief valve shall not be allowed.
   (e) Each safety valve shall have an individual vent pipe to outside. Consult with the Owner for vent routing.
   (f) Safety valve shall not be hard piped to vent line.
   (g) 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.
   (h) Vent lines from pressure powered pumps or condensate pumps shall not be connected to a relief vent pipe.

(5) Check Valves
   (a) Check valves shall bronze or stainless steel seats and flappers.
   (b) Bodies shall be bronze, cast steel or forged steel. Cast iron bodies are not acceptable.
   (c) Valves on steam shall be 300 pound class.

e. Strainers
   (1) Strainers shall have bronze, cast steel or forged steel bodies. Cast iron is not acceptable.
   (2) Strainers shall have 1/32 inch screens.
   (3) The blow down port of each strainer shall have a pipe nipple with a full port-sized gate valve and no cap.
   (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.
   (5) Manufacturers shall be Armstrong, Spirax Sarco, or Hoffman.
   (6) Strainers shall be Y-pattern, rated for steam, with stainless steel baskets.

f. Expansion Joints
(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 50 degrees F, weld ends, steel body, chromium plated steel slips, with no anchor foot, installed per manufacturer’s specifications. Comply with ASTM F 1007.

(2) Joints shall have internal and external guides, integral with joint gland and body. Joints shall be equipped with limit stop.

(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.

(4) Base joint travel on 550 degrees F operating temperature. Joints shall be pre-pressed to allow shrinkage down to 0 degrees F.

(5) Drain plugs shall be seal welded shut.

g. Gauges

(1) Provide McDaniel Gauges or approved equal.

(2) Face Style shall be 4 inches or larger.

(3) Range Selection

(a) 20 psig system gauges shall be 0 to 30 (psig).

(b) Medium pressure (20 to 90 psig) gauges shall be 0 to 100 (psig).

(c) 155 psig system gauges shall be 0 to 200 (psig).

(4) Mounting shall be standard bottom connection.

h. Equipment

(1) General

(a) Install air vents and vacuum breakers on steam equipment.

(2) Condensate Pumps

(a) Pumps shall be electric, duplex-type.

(b) Manufacturers include Sterling, Johnson, ITT, Spirax Sarco or Clark Reliance.

(c) Pump shall be installed per manufacturer’s specifications.

(d) Condensate tanks shall be vented.

i. Condensate pumps shall have two (2) full size vents, one (1) of which shall discharge into the equipment room or basement.

ii. Vent discharge location shall be coordinated with Owner.

(3) Heat Exchangers

(a) Exchangers shall be ASME approved, with relief valves, rated for the service, on both steam and hot water systems.

(b) Locate heat exchangers to allow removal of the bundle.

(c) Install gauges and thermometers to indicate the following:

i. Pressure of entering steam

ii. Pressure and temperature of entering water
iii. Pressure and temperature of leaving water

(d) Install expansion tanks on the water side of all heat exchangers. Provide sight glass and provisions for draining and venting.

(4) Coils
(a) Coils shall be tube-in-tube, non-freezing type with a minimum 1 inch O.D. tubing.
(b) Use integral face and bypass coils for outside air preheat coils.
(c) Provide two (2) steam traps with bypass for all pre-heat coils.

(5) Pressure Powered Pump
(a) Pump shall be a pressure powered design, using 60 psig steam to pump low pressure steam condensate.
(b) 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.
(c) Pump shall contain a float operated snap acting mechanism to actuate fill and discharge cycles.
(d) Connections shall be threaded or flanged.
(e) Pump shall be equipped with a gauge glass with brass cocks and manufacturer-furnished insulating jacket.

(6) Pressure Powered Pump/Receiver
(a) 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.
(b) Condensate receiving tank shall have a drain installed.

i. Steam Trapping Stations
(1) Steam traps on mechanical distribution piping shall be Armstrong 2011 Series, modular stainless steel inverted bucket traps.
(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.
(3) There shall be no trap bypasses.
(4) 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.
(5) 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.
(6) 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.

j. Insulation
(1) Closed cell foam insulation shall not be used.
(2) Insulation shall not be installed on steam traps and condensate return pumps.
(3) All exterior piping insulation systems shall have aluminum jacket.
(4) All piping exposed in occupied areas within 6 feet AFF shall have an aluminum jacket installed.
(5) Jacket
(a) Jackets shall be 0.019 inch stainless steel or aluminum.
(b) All seams shall face downward.
(c) PVC shall not be used for this jacket.
(6) Steam Tunnel Insulation
(a) Steam piping in tunnels shall have the following insulation:
   i. 850 CertainTeed fiberglass insulation, $\frac{3}{8}$ inches thick on high pressure steam and 2 $\frac{1}{2}$ inches thick on low pressure steam.
   ii. Insulation shall be installed in two (2) layers, using staggered joints and seams.
(b) Condensate piping in tunnels shall have the following insulation:
   i. 1 inch of 850 CertainTeed fiberglass insulation.
   ii. In addition to the fiberglass insulation with the vapor barrier jacket, the insulation shall be covered with aluminum jacket with bands.
(c) 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</td>
<td>Over 20 pounds</td>
<td>2 Inches first layer, (1 \frac{1}{2}) inches second layer</td>
<td>3 $\frac{3}{8}$ inches</td>
</tr>
<tr>
<td>Steam Steam</td>
<td>All Sizes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Pressure</td>
<td>Under 20 pounds</td>
<td>1 $\frac{1}{2}$ inches first layer, 1 inch second layer</td>
<td>2 $\frac{3}{8}$ Inches</td>
</tr>
<tr>
<td>Steam Steam</td>
<td>All Sizes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(d) Insulation shall be covered with aluminum jacket with bands.
(e) Where pipe is held in place with a spider guide that does not allow at least \(\frac{1}{4}\) inch clearance between the insulation and the outer ring, the following procedures shall be used:
i. The insulation shall neck down to a single layer approximately 6 inches before and after the guide.

ii. The top layer of insulation shall be beveled at a 45-degree angle to allow for a smooth transition to a single layer.

iii. 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.

(7) Steam Vault Insulation

(a) Steam Piping in vaults shall have the following insulation:
   i. Non-asbestos containing calcium silicate insulation.
   ii. Insulation shall be installed in two (2) layers, using staggered joints and seams.

(b) All condensate lines in vaults shall have non-asbestos containing calcium silicate insulation.

(c) Insulation shall be covered with aluminum jacket with bands.

(d) The Non-asbestos containing insulation shall be
   i. Johns Manville - Kaylo T-12
   ii. Pabco-Caltemp
   iii. Manson-CALMAX
   iv. Temperlite 1200
   v. Owens-Corning Pink

(8) Expansion Joint Insulation

(a) Expansion joints shall have removable/reusable insulation covers from weld to weld.

(b) The outer jacket shall be Steam Guard 1 Teflon-coated Nomex cloth 7 ounces per square yard x 0.010 inch thick.

(c) The gusset shall be Steam Guard 1 Teflon-coated Nomex cloth 7 ounces per square yard x 0.010 inch thick.

(d) The inter jacket shall be stainless steel crimped mesh.

(e) The insulation shall be 2 inches thick, minimum of 6-pound density, ceramic wool.

(f) The sewing thread shall be 3-ply 304 stainless steel and pure Nomex thread.

(g) The seam fasteners shall be stainless steel lacing “D” hooks with Velcro.

(h) ID tags shall be 304 stainless steel, embossed lettering.

(i) All remaining hardware shall be 304 stainless steel.

(j) Hog ring construction shall not be used.
(k) Provisions shall be made for the packing cylinders to ensure a snug fit along the entire expansion joint.

k. Steam Vaults

(1) Design vaults large enough to allow maintenance access.

(2) Provide with lighting, GFCI maintenance receptacle, and 30 amp receptacle.

(3) Ventilation

(a)Vaults shall have a single speed fan with thermostat control, freeze stat, and On-Off-Auto switch. Fans shall draw air into vault.

(b) All vault air ducts to louvered penthouses shall be ductile iron (push joint).

(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.

(5) Vaults shall be cast-in-place concrete.

(6) Vaults shall have a Q-door when not in drivable area.

(7) Vaults shall have an H-20 J-door when in drivable area. No openings in roadways.

(8) Vault doors shall be sized to allow largest equipment in and out.

(9) All vaults shall have a painted or galvanized ladder.

(10) Drainage

(a) Vaults shall have a gravity drain wherever possible.

(b) Vaults shall have a sump hole at low point. Sump hole shall be 24 inches in diameter and 24 inches deep.

(c) PVC fittings shall not be allowed.

(d) Surface drainage shall be routed away from all openings.

(11) Wall piping penetrations shall be sealed with link seals.

(12) Walls and ceilings shall be waterproofed.

(13) Supports for process piping and equipment shall be stainless steel.

(14) Supports for maintainable items shall be galvanized or painted.

4. Testing

a. Pressure pipe welding requirements:

(1) Pressure piping shall be examined and tested in accordance with ASME B31.1 and AWS B1.11.

(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.

b. Steam Blow:

(1) Provisions shall be made for a steam-blow of new steam piping to clean out debris.
(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.

(3) Owner shall furnish a steam muffler for the purpose of a steam-blow.

(4) The Contractor shall pick up, transport, and return muffler.

(5) Connections to the muffler shall be the responsibility of the Contractor.

(6) The steam-blow shall be coordinated by the Owner. Valve operation shall be by the Owner.

(7) Minimum of two (2) blows shall be required. The Contractor and Engineer shall be required to be on site.

(8) At the completion of the steam blow the Contractor shall disconnect the temporary piping and make all permanent connections.

M. UTILITY TUNNELS

1. Tunnel floors shall be positively sloped towards a drain and sumps with sump pumps and discharge piping installed.

2. Tunnels shall be ventilated with supply fan with thermostat control, freeze stat, and On-Off-Auto switch. Fans shall draw air into vault.

3. Tunnel entrances shall be hinged, spring-assisted Bilco doors. Tunnel entrances shall not be placed within roadways.

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.

5. At tunnel locations where serviceable items are located, tunnel chambers shall be installed with surface access.

6. Surface access shall allow hands-free upright entrance wherever possible.

7. Power and Lighting
   a. 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.
   b. Emergency lighting is not required.
   c. Provide 30 amp receptacle at each light fixture.

8. No plastic expansion anchors shall be used in the tunnel, including conduit.

9. PVC, plastic pipe, or conduit is prohibited in tunnels and vaults.

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.

N. ELECTRIC DISTRIBUTION

1. General
   a. 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.

b. Trench backfill shall comply with jurisdictional authority requirements when installed outside of University of Iowa property.

c. Backfill material shall be placed in continuous layers not exceeding 8 inches in compacted depth.

d. 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.

e. Install warning tape 12 inches to 18 inches above piping.

2. High Voltage Equipment
a. Primary transformer/switchgear installations shall be designed using concrete equipment vault.

3. Ductbank
a. Duct Banks shall be installed by qualified electrical Contractors.

b. Provide type-EB PVC 5 inch duct equal to Carlon number 68716 and EB PVC 2 inch duct equal to Carlon number 68711.

c. Conduits shall terminate 2 inches Inside walls with end bells equivalent to O-Z Gedney Type TNS.

d. Each ductbank shall contain a minimum of one (1) 2-inch conduit for telemetry.

e. All duct bank shall be concrete encased. Provide concrete base, minimum 4 inch, reinforced.

f. Steel conduits are required as follows:
   (1) Within 10 feet of manholes and building.
   (2) At construction joints where concrete pours are interrupted.

g. Base and intermediate spacers shall be Carlon catalog numbers S288PL and S289PL. Spacers shall be provided on maximum 5 foot centers, minimum.

h. Duct and conduit couplings shall be water-tight. Duct shall be installed in such a manner to prevent accumulation of water.

i. Duct run shall pitch a minimum of 3 inches per 100 feet with no more than 350 feet between manholes.

j. Changes in direction shall be long-sweep.

k. All conduits shall be evenly spaced and aligned with each other.

l. Minimum reinforcing of the concrete shall be as follows:
   (1) Minimum size # 4.
   (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.
   (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.
m. 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.

n. The top of the concrete encasement shall be a minimum of 24 inches below final grade.

o. Concrete
   (1) Concrete shall cover the duct a minimum of 3 inches in all directions, and a maximum of 6 inches.
   (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.
   (3) Maximum aggregate size shall be ¾ inch.
   (4) Concrete shall not be placed with the aid of a mechanical vibrator.

p. After duct encasement is placed, and before backfill is installed, pull a mandrel or leather wipe through the ducts ¾ 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.

q. 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.

r. Install #10 copper wire in all unused duct cells for future use.

s. Duct bank penetrations of foundation wall shall comply with the following:
   (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.
   (2) Duct banks shall be attached to the foundation wall in one (1) of two (2) manners.
      (a) 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.
      (b) In existing construction, drill and extend reinforcing using Hilti epoxy capsules.

t. The conduit shall penetrate the foundation wall in the following manner:
   (1) In new construction, install steel sleeve.
   (2) In existing construction, core drill. Sufficient space shall remain between the penetrations to maintain the structural integrity of the foundation wall.
   (3) Size sleeve or core opening per seal manufacturer’s recommendations.
(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.

O. COMMUNICATIONS DISTRIBUTION

1. General
   a. Number and type of fiber shall be specified by ITS EI - Physical Infrastructure.
   b. Fiber shall be installed in inner-duct within conduits.
   c. Multiple fibers shall be pulled in the same inner-duct whenever possible.
   d. Fiber shall be installed in one (1) continuous piece, unless prior approval is given by ITS EI - Physical Infrastructure.
   e. 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.

2. Underground Pathways
   a. All exterior underground conduits used for communications applications shall be 4 inch NEMA TC-6 type EB PVC plastic duct encased in concrete.
   b. Install a minimum of six (6) 4 inch ducts between manholes and a minimum of three (3) 4 inch ducts into a building.
   c. Encase all conduits in a 3 inch concrete envelope.
   d. Install conduit 30 inches (minimum) below grade to the top of the structure.
   e. Install conduit 36 inches (minimum) below grade under roadways.
   f. Concrete encasement shall contain \( \frac{1}{2} \) inch deformed steel reinforcing bars.
   g. Conduit joints shall be solvent-weld per manufacturer’s recommendations. Joints shall be staggered.
   h. Conduits shall be spaced 2 inches apart both vertically and horizontally.
   i. Test all conduits by drawing an appropriately sized slug or mandrel through each duct to assure the integrity. Testing to be witnessed by Owner.
   j. 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.

3. Building Entrance Pathway
   a. 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.
   b. HDPE conduit must meet ASTM 3035 specification. SDR ratings to be 11 for 2-inch and 13.5 for 4-inch. All joints to be electro-fusion welded and witnessed by ITS EI - Physical Infrastructure.
   c. 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.

d. The 4 inch conduits shall terminate inside the room equipped with bell-end fitting.

e. The 4 inch conduit entering the building beyond the point of penetration shall be installed in compliance with the National Electrical Code (NEC).

f. All conduits shall be sealed with rubber conduit plugs, Jackmoon U.S.A. Inc., part number 50D535U, Carlon Telecom Systems, part number MAEPG8, General Machine Products Co. Inc., part number 66638.

4. Communication Manholes

a. Precast Manholes

(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 El - Physical Infrastructure.

(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.

b. Cast in place Manholes

(1) All cast in place manholes shall meet the American Association of State Highway and Transportation Officials (AASHTO) specifications.

(2) All conduits entering or exiting manholes shall be placed the same elevation to permit pull-through cable placement.

(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.

(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.

c. Communication Manhole Equipment

(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.

(2) Cast-in-place and nonstandard manholes shall have inserts cast in the walls.

(3) Provide pulling in irons cast in the walls directly opposite the various duct entrances.

d. Frame and Cover Adjustments

(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).
(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.

5. Termination, Splicing and Testing
   a. Fiber shall be terminated in a Corning Closet Connector Housing (CCH) at each end to facilitate cross-connections.
   b. Fiber shall be terminated with the following type connectors:
      (1) Corning CCH Pigtail Cassette CCH-CS12-59-POORE.
      (2) Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-59-POORE cassette loaded with SC connectors.
   c. Contractor shall provide Owner with the following documentation:
      (1) OTDR trace from each end at 850 nm or 1300 nm 1310 nm 1550 nm.
      (2) Power meter loss measurements in both directions at a wavelength of 850 nm or 1300 nm 1310nm 1550 nm.
      (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.

A. GENERAL
   1. Building Elevations
      a. See Section III for information.
   2. Standard Floor and Room Numbering
      a. See Section III for information.

B. BUILDING ENVELOPE
   1. General
      a. Exterior wall insulation may be semi rigid, blanket batt type, glass fiber, unfaced, complying with ASTM C665 and the following ASTM E84 values:
         (1) Flame spread less than 25.
         (2) Smoke development and fuel contributed less than 50.
      b. Use closed cell extruded polystyrene insulation below grade on exterior walls or insulate on the interior face.
      c. All foundation walls with accessible or occupied space on one (1) side and soil on the other shall be waterproofed below grade.
      d. Drain tiles are to be installed at footings and tied to storm sewer system as allowed by local municipalities.
      e. Down spouts shall be tied into storm sewers (in lieu of foundation drain tiles) and shall not discharge on grade.
      f. Crawl spaces shall have concrete floor slabs, floor drains, ventilation and lighting.
2. Exterior Building Materials
   a. See Section III for information.
3. Exterior Enclosure Performance Requirements
   a. See Section III for information.

C. ROOFING

1. General
   a. 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.
   b. 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.
   c. Abandoned or unused equipment and materials shall be removed on re-roofing
      projects. Verify specifics with Owner.
   d. Approved manufacturers as follows:
      (1) EPDM – Black Membrane
          (a) Carlisle Corporation
          (b) Firestone Building Products Company
      (2) PVC – White Membrane
          (a) Sarnafil Corporation
      (3) KEE – White Membrane
          (a) Seaman Corporation
      (4) Metal Roofing Systems
          (a) ATAS Aluminum Corporation - Monarch
          (b) Butler Manufacturing Company - VSR
          (c) Centria - SRS
          (d) MBCI - LokSeam
          (e) Steelox Systems, Inc. - CF/SD
          (f) Vincent Metals - System 1
   e. Roof Installation
      (1) Roofing Contractor shall have the following qualifications:
          (a) A minimum of five (5) years of experience in installation of the
              specified roofing system.
          (b) Roof Manufacturer Certification as installer for specified roofing
              systems.
          (c) Roof Foreman and 50 percent of installing crew are trained and
              certified in the installation of specified roofing system.
          (d) Foreman shall be full-time, at project site, through roof
              completion.
   f. Roof Warranties and Certification
      (1) Roof manufacturer and roof installer shall provide the following items:
(a) Roofing Contractor (installer) shall guaranty 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:
   i. Roofing membrane (built-up felts or single-ply), slate, shingles, or metal roofs
   ii. Flashing and counter-flashing
   iii. Insulation
   iv. Vapor barrier
   v. Fasteners and adhesives
   vi. Sealants and caulking
   vii. Ballast and ballast stops
   viii. Walkway mats and pavers
   ix. Roof hatches, pitch pans and equipment curbs
   x. Gutters, downspouts, and fascia panels
   xi. Roofing accessories, as required, making a complete roofing system
   xii. Coping

(b) Warranted roof system components shall be identified in the Construction Documents. Roof materials and accessories shall be part of the approved system.

   (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. Warranty shall run concurrently with the roofing installer warranty. Warranty shall cover labor and materials for the complete roofing system. 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. Warranty shall not exclude coverage as a result of winds less than the velocity coordinated with the Owner.

2. Roofing Systems
   a. Green Roof Systems
      (1) Basis of design shall be LiveRoof LLC.
      (2) Systems shall have irrigation water sources spaced no more than 100 feet apart.

   b. Metal Roofing-Structural Standing Seam (SSR)
      (1) Roofing shall be pre-engineered metal running perpendicular to purlins supports. Provide glass batt insulation directly beneath the roofing and over the purlins.
      (2) Sheets shall have a steel or aluminum core, minimum 22-gauge, and corrosion protection provided by a Kynar-coated finish.
c. Slate
(1) Use copper nails and ridge caps.
(2) Ice guards are required on eaves over sidewalks.

d. Asphalt Shingles
(1) Provide a pre-finished metal sheet steel drip edge at eaves and gable rakes.
(2) Shingles shall be nailed, not stapled.

3. Roofing Components
a. Roof Membrane and Insulation Assemblies
(1) SBS Type Modified Bitumen Sheet System
   (a) Membranes to consist of a base sheet, interply sheet and cap sheet of SBS type sheets bonded with cold-process adhesive.
   (b) Fire-rated sheet may be necessary to meet Class A requirements.
   (c) Polyester or fiberglass reinforcement is allowable, per manufacturer’s roof systems.
   (d) Standard test methods for sampling and testing Modified Bitumen material shall comply with ASTM D-5147, D-6162, D-6163, and D-6164.
   (e) 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.
   (f) The specified Insulation shall be compatible with the system and shall be included in the total system warranty.
   (g) 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.
   (h) Substrate Board
      i. 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.
      ii. Substrate board shall be installed with staggered joints.
   (i) Surfacing shall be white, ceramic granule surfaced cap sheet.
   (j) Base Flashings
      i. SBS-type with polyester reinforcement only.
      ii. APP-type at non-nailable substrates shall not be used.
      iii. SBS-type with granule surfacing and polyester reinforcement as walkways.
   (k) 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.

(2) EPDM (non-reinforced) - Fully Adhered
(a) Membrane
   i. Minimum 60 mil thick EPDM non-reinforced sheet.
   ii. Seam products shall be pre-manufactured as supplied and approved by manufacturer. Minimum field seam width shall be 5 ½ inches.
(b) Insulation shall be selected per current ASHRAE 90.1 guidelines, rigid polyisocyanurate as part of roof manufacturer’s approved system and included in the total system warranty.
(c) Polyisocyanurate shall have facers designed for EPDM adhesion and shall be approved or manufactured by primary membrane manufacturer.
(d) Mechanical insulation fasteners, with locking caps, shall be used metal and wood decks.
(e) Adhere with polyurethane adhesive over concrete substrate and vapor barriers.
(f) 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.
(g) Install insulation in more than one (1) layer with staggered joints. Use of a recovery board is not considered a layer.
(h) Surfacing shall not be required. Use fire rated Class-A system for exterior fire resistance.
(i) Base Flashings shall be 60 mil EPDM.
   i. Continue field membrane up walls and curbs using non-penetrating attachment methods.
   ii. Use details that minimize uncured rubber.
   iii. Termination bars shall be covered with a reglet and counter flashing.
(j) Substrate Board shall be ½ inch thick siliconized gypsum core panel.

(3) PVC (reinforced) - Fully Adhered
(a) Membrane shall be minimum 60 mil thick fabric reinforced sheet with heat weld seaming.
(b) Insulation shall be selected per current ASHRAE 90.1 guidelines, rigid polyisocyanurate or high-density fiberboard (as part of roof manufacturer’s approved system and included in the total system warranty).
(c) The insulation specified shall be compatible with the application method required as well as with the other materials of the

SECTION IV – OUTLINE SPECIFICATIONS AND DETAILS
roofing system and shall be included in the total system warranty.

(d) Install insulation in more than one (1) layer with staggered joints. Use of a recovery board is not considered a layer.

(e) Substrate Board shall be ⅜ inch thick siliconized gypsum core panel.

(f) Surfacing shall not be required.

(g) Base Flashings shall be membrane coated metal or reinforced sheet and accessories provided by primary manufacturer.

(h) 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.

b. Roof Deck
   (1) Roof deck material shall be a minimum 20-gauge metal deck or a cast in place concrete deck.
   (2) Lightweight concrete shall not be used.
   (3) All wood curbs, blocking, subfascias, etc. shall be preservative-treated material.

c. Vapor Retarders
   (1) See Section III for information.

4. Accessories

a. Parapet wall coping shall be constructed with metal selected from one (1) of the following materials
   (1) Sheet metal, 22-or 24-gauge, galvanized, factory finished with Kynar 500.
   (2) Copper, ASTM B370, 16 to 20 ounces.
   (3) Aluminum, .032 inch or .040 inch, factory finished with Kynar 500.
   (4) Stainless steel, .018 soft buff.

b. Gravel stop and fascia shall be 22-or 24-gauge, galvanized, factory finished with Kynar 500.

c. 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.

d. Sheet metal roof accessories shall be constructed with metal selected from one (1) of the following materials:
   (1) Sheet metal, 20-gauge, galvanized, factory finished with Kynar 500.
   (2) Copper, ASTM B370, 16 to 20 ounce.
   (3) Aluminum, ASTM B209, alloy 3003, AA-C22A41 clear anodized finish, minimum 20-gauge.
   (4) Solder, 50/50 ASTM B32.

D. DOORS, HARDWARE, WINDOWS, CURTAIN WALLS AND GLASS
1. Doors
   a. General
      (1) Doors and hardware shall be installed by the supplier furnishing the
          doors and frames.
      (2) Supplier shall have been in business at least five (5) years specializing in
          sales and installation of Contract Grade doors and hardware.
      (3) On-site supervising installer shall have at least five (5) years of
          experience installing doors and hardware.
      (4) One (1) additional member of the supplier’s installation crew shall have
          at least two (2) years of door and hardware installation experience.
      (5) Installer to follow Manufacturer instructions for templating and
          installation.
   b. Pairs of doors shall have a Von Duprin keyed removable center mullion Kawneer
      560 Insulclad and Kawneer 500 Tuffline shall be used as a standard of quality.
   c. Hollow-metal Frames
      (1) All wood and hollow-metal doors shall be installed in hollow-metal
          frames.
      (2) Hollow-metal frames in new construction shall be welded, ground and
          finished smooth.
      (3) Frames shall be factory mortised and prepped for all mortised hardware
      (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).
      (5) Frames and anchors in wash-down spaces shall be stainless steel.
      (6) Frames in masonry walls shall be grouted as the masonry units are laid.
          Use mortar, maximum 4 inch slump, hand trowel method.
      (7) Grouted frames shall be A60 galvannealed.
      (8) Install polystyrene rigid insulation fillers, cut to profile, to keep grout
          out of bottom 6 inches of frame.
      (9) Grouted frames shall include conduit for electrified hardware
          components.
      (10) Brace frames so that pressure of grout before setting does not deform
          frames.
      (11) Frames in stud walls shall be filled with fiberglass insulation.
      (12) Materials and installation shall comply with Steel Door Institute
          standards ANSI/SDI-100 A250.8-2003.
      (13) Exterior frames shall be 12-gauge. Interior high-frequency frames shall
          be 14-gauge. Interior low-frequency frames shall be 16-gauge.
      (14) Frames shall be reinforced with 12-gauge steel for all surface-mounted
          hardware.
   d. Wood Doors
(1) Wood doors shall be 5-ply solid-core and comply with WDMA IS 1A-11 Window and Door Manufacturers Association standards.

(2) Performance standard to meet WDMA IS 1A-11, Extra Heavy Duty.

(3) Aesthetic grade to meet WDMA IS 1A-11, Custom Grade.

(4) 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.

(5) Doors shall be factory prefinished, System TR-6, per WDMA IS.1A-11. Color to-be-determined.

(6) All doors shall be factory pre-machined for all mortise hardware, including face holes and race ways, as required for specified hardware.

(7) Crossbands shall be wood-based composites of a minimum thickness of 1/16 inch and extend the full width of the door.

(8) Crossbands and face veneers shall be laminated to the core with Type 2 interior use glue using the Hot Press process.

(9) Non fire-rated
   (a) Non fire-rated wood doors shall be Custom Grade and constructed using WDMA 5-ply hot press method for laminating door materials.
   (b) Core-type shall be Structural Composite Lumber Core (SCLC-5).
   (c) Stiles and rails shall be securely bonded to the core and then abrasively planed prior to veneering.
   (d) Stiles shall be hardwood, one (1) piece, laminated or veneered.
   (e) 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).
   (f) Top Rails shall be minimum 5 inches.
   (g) Constructions with laminated edges may use structural composite lumber, as an inner stile component.

(10) Fire-rated
    (a) Fire-rated wood doors shall be WDMA 5-ply construction, using Hot Press method for laminating door materials.
    (b) Core materials shall be Structural Composite Lumber Core for 1/3 hour rated doors and mineral core.
    (c) Stiles shall consist of manufacturer’s standard laminated edge construction with improved screw-holding capability and split resistance.
    (d) Inner and outer stiles shall not contain salt treating.
    (e) Rails shall be solid wood or other material contained in manufacturer’s fire door approvals.
(f) Minimum 5 inch top rails and 5 1/2 inch bottom rails. Minimum lock block size shall be 4 1/2 inches x 10 inches.

(g) Doors with exit devices shall also have hinge-edge blocking and top and bottom latch blocking to match specified exit devices.

(h) Fire ratings shall comply with positive pressure requirements UL 10C/UBC7-2-97, with concealed intumescent.

e. Glass doors
   (1) Exterior glass doors shall have wide rails and stiles. Narrow rails and stiles or full glass doors are not allowed.
   (2) Bottom rail shall be 10 inches high. Top rail shall be 5 inches high. Stiles shall be 5 inches wide.

f. Aluminum doors
   (1) Aluminum doors shall have wide stiles, weather-stripping, and be insulated.
   (2) Bottom rail shall be 10 inches high, top rail shall be 5 inches high, intermediate rail shall be 6 inches and stiles shall be 5 inches wide.
   (3) All rails shall be welded to stiles at top and bottom.

g. Hollow-metal doors
   (1) Hollow-metal doors are required to have steel stiffened cores. Steel ribs shall be 22-gauge and welded together at both ends of ribs.
   (2) Exterior and high moisture areas require A60 galvannealed material.
   (3) High humidity areas require stainless steel material.
   (4) Full lite doors require tubular stile and rail construction.
   (5) The top edge of exterior doors shall have inverted steel channel closures, installed flush, tack welded in place, filled and finished smooth.
   (6) Exterior door faces shall consist of 14-gauge steel and meet Level 4/Model 2 standards.
   (7) Interior door faces shall consist of 16-gauge material and meet Level 3/Model 2 standards.
   (8) All doors shall be 1 3/4 inch thick.
   (9) All door seams shall be continuous weld, ground and finished smooth. Door edges shall be fabricated utilizing beveled edges on hinge and lock stiles.
   (10) Doors shall be reinforced with 14-gauge steel for surface-mounted hardware.
   (11) Materials, storage and installation shall comply with Steel Door Institute standards ANSI/SDI-100 A250.8-2003 (R2008).
   (12) Doors shall be factory prime painted per ANSI/SDI A250.10-1998 (R2011).

h. Rolling fire doors and fire shutters activated by fusible link or a local smoke/fire detector or a central smoke/fire alarm system.
1. Doors shall not require a releasing device when activated by an alarm signal.

2. Doors shall maintain an average closing speed of not more than 9 inches (229 mm) per second during automatic closing.

3. When automatic closure is activated, electric sensing edge and push button are inoperable.

4. Doors shall be fail-safe and close upon power failure.

5. Resetting of spring tension or mechanical dropouts shall not be required. Upon restoration of power, replacement of fusible link or clearing of the alarm signal, doors shall immediately reset by opening with the push button.

2. Hardware
   a. General
      (1) Doors and hardware shall be installed by the supplier furnishing the doors and frames.
      (2) Supplier shall have been in business at least five (5) years specializing in sales and installation of Contract Grade doors and hardware.
      (3) On-site supervising installer shall have at least five (5) years of experience installing doors and hardware.
      (4) One (1) additional member of the supplier’s installation crew shall have at least two (2) years of door and hardware installation experience.
      (5) Installer to follow Manufacturer instructions for templating and installation.
      (6) Installer, supplier, Contractor, Design Professional and Owner shall convene for a pre-installation meeting prior to commencement of installation of doors and hardware.
   b. Hardware finish shall be either US32D or US26D.
   c. Keying
      (1) Keying and installation of the permanent cores and cylinders shall be provided by the Owner.
      (2) Construction keying and cylinders shall be provided by the Contractor and two (2) construction and control keys shall be provided to Key & Access Services.
      (3) Cutting of all final keys shall be by Owner.
      (4) All permanent cores shall be provided by the Contractor.
      (5) All cylinder jackets and construction cores shall be provided and installed by the Contractor.
      (6) Ten (10) keys for each non-electronic cylinder shall be provided by the Contractor. Provide one (1) key for each electronic cylinder.
      (7) Key system for new buildings shall be Schlage Small Format Interchangeable Core, B Series restricted keyway.
      (8) Key systems for existing buildings shall be verified with Owner.
(9) Lock cylinders used in ITS telecommunication rooms and doors receiving access control hardware shall accept Schlage small format interchangeable core.

(10) Lock cylinders utilized as a key override on access control doors shall accept Schlage small format interchangeable core.

(11) Lock cylinders used in Facilities Management electrical, mechanical, elevator, and custodial rooms shall be Schlage B Series, restricted keyway, interchangeable core.

d. Hardware Requirements

(1) Hardware schedule submittals shall be in vertical format.

e. Hinges

(1) Stanley model numbers shall be used as a standard of quality. Approved manufacturers include Stanley and McKinney.

(2) All hinges shall be ball bearing.

(3) All exterior doors and all mineral core fire doors, including 7 foot 0 inches tall doors, shall be hung with four (4) hinges.

f. Door Closers

(1) Door closers shall be LCN 4040XP.

(2) Closers shall be surface-mounted parallel arms, mounted on the interior of the opening.

(3) Large classrooms or auditoriums shall require LCN 4410MExB80 with scan II motion detector.

(4) All LCN 4410 ME door closers require the use of a 4040SE-3210 transformer.

(5) All labeled doors with LCN 4410 ME closers shall be connected to the building fire alarm system.

(6) All door closers shall be through bolted.

g. Power Operators

(1) Approved manufacturer and model is Record 8100 series.

(2) Actuators shall be located 36 inches AFF.

(3) Automatic operators on exterior doors and their corresponding vestibule door shall be wired for sequential operation.

h. Door Stops

(1) Door stops and holders shall be LCN 7800 series 24 volt wall-mount magnetic, LCN 4040SE 24 volt Sentronic, or Glynn-Johnson 90 series manual.

(2) Overhead stops/holders shall be surface-mounted.

(3) Use Ives WS401/WS402 wall stops.

(4) When wall mounting is not possible, use LCN 4040SE electric hold-open.

(5) All exterior doors that have overhead stops shall have floor stops. Floor stops shall be Rockwood 466 or 467 or Ives FS18S and FS18L.

(6) Use wall bumpers whenever possible.
i. Flushbolts
   (1) Flushbolts shall be Ives manual FB458 or FB30 automatic on metal doors or Rockwood 1960 on wood doors.
   (2) Constant latching flushbolts shall be Ives FB50.
   (3) Dust-proof strikes shall be provided for flushbolts.

j. Coordinators
   (1) Coordinators shall be Timco 3092.

k. Pulls
   (1) Pulls shall be straight pulls with no offset, 1 ¾ inch in diameter with 3/8 inch diameter through bolts.
   (2) Pulls on restroom doors shall have 4 inch x 16 inch backup plate.
   (3) Push plates shall be 6 inches x 20 inches.

l. Locksets and Latchsets
   (1) Locksets and latchsets shall be mortise type.
   (2) Approved manufacturers for new buildings are Yale 8800 CRCN, Sargent 8200 LW1J, or Schlage L series 03N. See Appendices for manufacturer and models to match existing buildings.
   (3) Electronic locksets shall have request to exit and latch bolt monitoring switches.
   (4) Quick-connect plug connections are required.
   (5) Electromagnetic locks are not allowed.
   (6) In multiple-door entries, only one (1) doorway shall be keyed from the exterior.

m. Exit Devices
   (1) Exit devices shall be Von Duprin 98 series.
   (2) 94 Series Impact device may be used on fire-rated, cross-corridor doors, non-locking and held open at all times.
   (3) Use cylinder dogging on all non-rated devices.
   (4) On interior pairs of doors with vertical rod exit devices
      (a) Surface devices shall be used on wood doors.
      (b) Concealed devices shall be used on hollow metal and aluminum doors.
      (c) Vertical rod devices shall not have bottom rod.
   (5) Electronic non-rated exit devices
      (a) Electronic, non-rated exit devices with latch retraction shall have special center case “SD” dogging.
      (b) Electronic non-rated exit devices with electric trim shall have cylinder dogging.
      (c) Entrance doors requiring a power operator, exit device, and access control shall use Von Duprin LX RX-LC-SD-ELx996L-XP99L (FSE) exit device.
      (d) Quick connect plug connections are required.
n. Power Supplies
(1) Power supplies for electronic latch retraction panic devices shall have battery backup and be supplied by the door hardware provider.
(2) Power supply shall be Von Duprin PS914 900-2RS 900-BBK.
(3) 900 KL key-lock shall be used for installation on walls in public areas.
(4) Access control system power supplies shall be provided by the access control Contractor.

o. Protection Plates
(1) Bottom of protection plates shall be mounted 1 inch from the bottom of the door.
(2) Typical protection plate height shall be 10 inches.
(3) Custodial rooms and other rooms with cart traffic to have 34 inch high armor plates.
(4) Protection and armor plate width shall be door width less 1½ inch.
(5) If cart traffic could hit lever handles or exit devices, use protection bars, Rockwood R115LPB for lever handles and HD2230 for exit devices.

p. Power Transfers
(1) Power transfers shall be Securitron CEP T Series.
(2) Electric hinges may only be used with existing frames.
(3) Power transfers and electric hinges shall have two (2) 18-gauge wires and six (6) or eight (8) 22- or 28-gauge wires.

q. Weather-strip
(1) Weather-strip shall be Reese 769C with TEK screws and polyurethane rubber.
(2) Contractor shall install a screw 1 inch or less from the ends of the weather strip.

r. Sweeps
(1) Sweeps shall be Reese 772C with TEK screws and polyurethane rubber. A screw shall be installed 1 inch or less from the ends of the sweep.

s. Gasketing
(1) Gasketing shall be Reese 797, white or black to match color of frame.

t. Thresholds
(1) Thresholds shall be Reese S471A with thermal break. Furnish threshold 4 inches longer than door opening and cope around frame face.

3. Windows
a. All operating mechanisms shall be heavy-duty and institutional-grade.
b. Window units shall comply with ASTM E283, E331, and E547.
c. 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. Glass and Glazing
a. Glazing in new windows, doors, storefronts, etc. shall carry a ten (10) year manufacturer’s warranty.

5. Joint Sealants
   a. All exterior sealants require the use of a sealant primer.
   b. Multi-part pourable urethane sealant shall be used in the following:
      (1) Exterior and interior joints in horizontal concrete surfaces.
      (2) Between metal and concrete, mortar, stone or masonry.
   c. Neutral-curing silicone sealant shall be used at exterior, exposed applications. Neutral-curing silicone sealant requires twenty (20) year warranty.
   d. One-Part mildew-resistant silicone shall be used at interior joints in vertical surfaces of toilet room, shower, and kitchen ceramic tile.
   e. 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.

E. FINISHES

1. Wall Systems
   a. Use 5/8 inch Type X fire code drywall construction
   b. Mold resistant drywall shall be used in intermittently wet areas (restrooms, wash rooms, custodial closets, etc.)
   c. 20-gauge (0.0329 inch) minimum studs shall be used. Specify both gauge and thickness. Wood studs shall not be used.
   d. 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.
   e. Demountable panel systems require Owner approval.
   f. Wall Finishes
      (1) Restroom tile shall be minimum height of 54 inches and extend above top of fixtures.
      (2) Chair rail height shall be determined by chair selection (when required).

2. Ceiling Systems
   a. Gypsum Board Ceilings
      (1) Textured finishes shall not be used on drywall ceilings.
   b. Acoustical Tile Ceilings
      (1) Use ceiling tiles with non-sag warranties in high humidity or unconditioned spaces.
      (2) Ceiling grid shall be an intermediate duty exposed system conforming to ASTM C635 (1 inch wide grid). Basis of design shall be Chicago Metallic 200 Snap Grid.
      (3) Suspend ceiling grid directly from the building structure.
(4) Ceiling tile basis of design shall be Armstrong Minaboard, fissured, 2 foot x 4 foot and/or 2 foot x 2 foot.
(5) Reveal edge tiles may be used in selected areas with Owner approval.
c. Concealed spline or tongue and groove ceiling systems shall not be used.
d. Means of access shall be maintained to the plenum space and above ceiling devices.

3. Paint Finishes
   a. Wall
      (1) Wall finish shall be two (2) coats, plus primer, of latex eggshell or satin paint.
      (2) Flat paint shall not be used.
      (3) Semi-gloss paint shall be used in public areas on veneer plaster or concrete masonry units.
   b. Ceiling finish shall be two (2) coats, plus primer, of latex flat paint.
   c. Painted door, window, and miscellaneous trim finish shall be two (2) coats, plus primer, of latex or alkyd enamel semi-gloss paint.
   d. Stained door, window, and miscellaneous wood trim finish shall be high sheen / gloss, oil based with a urethane topcoat.
   e. Epoxy paints shall be 2-part systems.

4. Floor Finishes
   a. Entry Mats
      (1) Basis of design shall be linked tread, 3M Nomad floor mats.
   b. Vinyl composition tile shall be a minimum 1/8 inch thick.
   c. Slip resistant tile shall be used on slopes and inclines.
   d. Epoxy resin floor color shall be integral to flooring material. Surface coloring shall not be used.
   e. 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.
   f. Ceramic tile base/cove shall be curved rather than a 90-degree angle.
   g. Carpet and Base
      (1) Submit carpet seaming diagram for approval prior to ordering material.
      (2) Carpet
         (a) Fiber: nylon type 6 or 6.6.
         (b) Construction: Tufted loop pile.
         (c) Color: Multi-color yarn system.
         (d) Carpet tile face weight: minimum 16 ounces.
         (e) Broadloom face weight: minimum 22 ounces.
      (3) Resilient base shall be 1/8 inch thick vinyl or rubber.
      (4) Base joints shall be at inside corners and no closer than 24 inches to an external corner.
      (5) Continuous, rolled base shall be used. 4 foot sections are not acceptable.
(6) Wood Base shall be hardwood species only.

F. FURNISHINGS
1. Window Treatments
   a. Basis of design shall be MechoShade.
   b. Exterior shades are not allowed.

G. INTERIOR SIGNAGE
1. General
   a. Modular inserts shall be adhered with tamper-proof fastener system.
   b. Signage Installation
      (1) Verify with Owner prior to specifying mounting systems which will permanently impact architectural finishes.
      (2) Wall Mounted Signage
          (a) Typical wall-mounted sign installation shall be double-sided foam tape and silicone adhesive.
          (b) Signs exceeding the adhesive strength of double-sided foam tape shall have additional threaded studs attached to wall surface.
          (c) Projecting flag identification shall be mechanically fastened to wall.
      (3) Signs mounted to glass shall have a backer panel of matching size on the second surface of the glass.
      (4) Signage mounted on stone
          (a) Architectural lettering shall be securely mounted with vandal and tamper resistant method appropriate to wall surface.
          (b) Threaded studs, set in non-shrinking grout, shall be used wherever possible.
          (c) Signs and lettering mounted to limestone or similar natural stone surfaces shall not use silicone adhesive or double-sided tape.
      (5) Ceiling Mounted Signage
          (a) Signs hanging from ceiling or projecting from wall shall be mounted away from sprinklers and shall not obscure site lines to fire exit signage.
          (b) Bottom of sign shall be above door swing.
          (c) Sign shall be attached to structure, fastened to drywall, plaster, or suspended by cable. Cable shall be stainless steel and aircraft quality or equal.
          (d) Signs shall not be attached to suspended ceiling grid systems.
             i. If structure is inaccessible, review alternatives with Owner.
             ii. Hole where cable passes through ceiling tile shall match dimension of suspension system.

2. Sign Types
   a. See Section III for information.
H. SPECIALTIES

1. Visual Display and Bulletin Boards
   a. See Section III for information.

2. Projection Screens
   a. See Section III for information.

3. Restrooms and Restroom Accessories
   a. Restrooms
      (1) Hand-operated flush controls within accessible toilet stalls shall be located on the open side of the water closet.
   b. Toilet Partitions
      (1) Wall Hung Urinal Screens shall have integral wall-mounting flange or continuous wall-mounting bracket specified as a “Government Screen”.
      (2) Blocking shall be installed for all wall-mounted partitions.
      (3) Partitions shall have Trimco 3071-1 x 32D hook with through bolts and security Torx head screws.
      (4) Ceiling-supported partitions shall have a flip-over latch for closure.
   c. Restroom Accessories
      (1) Owner shall provide one (1) triple-roll Renown toilet tissue dispenser per water closet. Contractor to mount dispenser on the left wall (when sitting on the water closet) of each stall.
      (2) Toilet tissue dispenser locking mechanism shall not be blocked by ADA handrails.
      (3) Provide one (1) through-bolted double-hook inside of each stall door.
      (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.
      (5) Hand Dryers
         (a) Contractor 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.
         (b) 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.
         (c) 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.

4. Lactation Rooms
   a. Soap dispenser and paper towel dispenser shall be wall-mounted next to the sink.
b. Minimum of three (3) single or two (2) double coat hooks shall be installed on wall.

c. Mount bulletin board and clock so visible from the seated position.

5. Recycling and Trash Receptacles
a. See Section III for information.

6. Vending Spaces
a. See Section III for information.

7. Custodial Work Spaces
a. Custodial Work Control Center
   (1) Light fixture(s) shall have safety guards.
   (2) Provide smooth floor transition from hall to room.

b. Supply Storage and Delivery Room
   (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.
   (2) Light fixture(s) shall have safety guards.
   (3) Door shall have closer and armor plate.
   (4) Provide smooth floor transition from hall to room.

c. Equipment Storage Room
   (1) Chemical dispensing unit shall be hard piped with cold water feed.
   (2) Emergency eye wash to be Guardian model G5026BP.
   (3) Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker. Install minimum 6 inches above the expected point of use.
   (4) Light fixture(s) shall have safety guards.
   (5) Door shall have closer and armor plate.
   (6) Provide smooth floor transition from hall to room.

d. Custodial Service Room
   (1) Protect all hose connected equipment with Watts 289 spill-proof vacuum breaker. Install minimum 60 inches AFF.
   (2) Emergency eye wash to be Guardian model G5026BP.
   (3) Light fixture(s) shall have safety guards.
   (4) Door shall have closer and armor plate.
   (5) Provide smooth floor transition from hall to room.

e. Heavy Equipment Room
   (1) Emergency eye wash to be Guardian model G5026BP.
   (2) Light fixture(s) shall have safety guards.
   (3) Door shall have closer and armor plate.
   (4) Provide smooth floor transition from hall to room.

f. Light Bulb Storage Room
   (1) Door shall have closer and armor plate.
   (2) Provide smooth floor transition from hall to room.

8. Maintenance Rooms
9. Telecommunication Rooms (TR)
   a. Walls shall extend to structure.
   b. Walls and plywood shall be painted extra white, Sherwin Williams B24W02651, minimum two (2) coats.
   c. Overhead structure to be painted Sherwin Williams B24W02651.
   d. Floor finish shall be vinyl composition tile, Armstrong VCT51911 Classic White.
   e. Secure Room door(s) with AMAG access control.
   f. Provide cages on all fire suppression sprinklers.

10. Classrooms - General Assignment
    a. See Section III for information.

11. Offices
    a. See Section III for information.

12. Loading Dock Facilities
    a. See Section III for information.

13. Animal Rooms
    a. See Section III for information.

I. CONVEYING SYSTEMS

1. Elevators
   a. The elevator control equipment shall be non-proprietary. Elevator control systems shall be maintainable, repairable, and adjustable by any elevator repair company without the use of proprietary software or proprietary tools.
   b. Ramtel hands-free style telephone model number R733M. Shielded wires for telephone shall be included in the compartment and connected to the car traveling cable. Telephone shall be provided by Owner.
   c. Elevator cars shall be provided with wall protection pads and installation hooks for these pads.
   d. All spare parts, manuals, adjusting information, drawings, safety upgrades and software upgrades shall be provided to the Owner.
   e. Contractor shall provide to the Owner the manufacturer’s
      (1) Electronic tools
      (2) Adjusting Information
(3) Wiring Diagrams
(4) Full List of Fault Codes with definitions
(5) Product Data
  (a) Signal and operating fixtures, operating panels and indicators.
  (b) Electrical characteristics and connection requirements.
  (c) Expected heat dissipation of elevator equipment in machine room.

f. Provide the following Submittals
(1) Buffers and other components in hoistway.
(2) Maximum rail bracket spacing.
(3) Maximum loads imposed on guide rails requiring load transfer to building structure.
(4) Loads on hoisting beams.
(5) Clearances and travel of car.
(6) Clear inside hoistway and pit dimensions.
(7) Location and sizes of access doors, hoistway entrances and frames.
(8) Rail attachment.
(9) Cab design, dimensions and layout.
(10) Hoistway-door and frame details.

g. Operations and Maintenance Manuals shall include
(1) wiring diagrams
(2) adjusting information
(3) fault code information

h. 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.

i. Maintenance and Repair Service
(1) Provide monthly examinations, adjustments, repairs and lubrication of the elevator equipment for a period of twelve (12) months after the elevator has been accepted as substantially complete.
(2) Provide 24-hour callback service, including travel time and mileage, during this period at no charge to the Owner.
(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.
(4) All parts and supplies shall be same as originally used in manufacture and installation.
(5) Emergency Call-Back Response Time
  (a) Maximum response time for emergency call-backs shall be limited to fifteen (15) minutes by telephone and sixty (60) minutes to arrive on site.
(b) 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.

(6) Elevator Contractor 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.

(7) Coordinate removal of elevator from service with Owner.

j. Elevator shall have an electronic door screen reopening device.

k. Controls shall be vandal proof.

l. Perform complete elevator performance check, with Owner present, prior to final State Elevator Inspection.

m. 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.

n. Spill-containment shall meet SPCC standards (40 CFR 112).

2. Lifts
   a. See Section III for information.

3. Escalators
   a. See Section III for information.

IV. STRUCTURAL

The following information is provided as a general guideline in establishing Structural Engineering project specific requirements.

A. GENERAL
   1. All load criteria shall be in accordance with the latest edition of the applicable codes.

B. FOUNDATIONS
   1. Attach concrete duct banks, tunnels, and other concrete masses to foundation walls with steel pins in epoxy capsules.

C. CONCRETE
   1. Mix Design and Materials
      a. Accessories touching the exposed surface of the concrete or in contact with soil shall be coated with plastic or epoxy to prevent rust.

   2. Exposed Concrete
      a. 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. Precast Concrete
a. Fabricator shall submit design to the Design Professional for review.
b. Fabricator shall have a minimum of three (3) years of experience in the fabrication of similar precast units.
c. Erector shall have a minimum of two (2) years of experience erecting similar precast units.
d. Shop drawings shall be prepared by a Registered Professional Engineer licensed to practice in the State of Iowa.

4. Placement
a. Joints
(1) Contraction joints shall be tooled during finishing or sawed within 18 hours of concrete placement.
(2) Contraction joints shall have a minimum depth of $\frac{3}{4}$ of the pavement thickness and a minimum width of $\frac{1}{8}$ inch.
(3) Transverse contraction joints shall be provided at a maximum of 2 $\frac{1}{2}$ times the pavement thickness for street pavements and 2 times for all other pavements.
(4) Longitudinal joints shall have a maximum separation of 12 feet for streets and 9 feet for sidewalks.
(5) Construction joints shall be located at expansion joint locations wherever possible. Construction joints at other locations shall be keyed.
(6) Concrete flatwork shall be isolated from columns, existing walls, etc., by non-extruding expansion joint material.

5. Testing
a. The Owner shall retain services of the testing firm. Contractor shall be responsible for scheduling tests.
b. Contractor shall notify the Owner a minimum of 48 hours prior to placement of concrete.
c. Testing requirements
(1) Strength, air entrainment, temperature, and slump tests.
(2) Strength tests shall require four (4) cylinders, three (3) broken and one (1) spare.
(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.
d. Test data from concrete cylinder breaks shall be evaluated using the current edition of American Concrete Institute 214.
e. Test results shall be sent directly to the Contractor, Design Professional, and the Owner.

D. MASONRY
1. General
a. See Section III for information.
2. Brick and Block Masonry  
   a. See Section III for information.
3. Stone Masonry  
   a. Coping stones shall be secured with stainless steel anchors and pins.  
   b. 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.  
   c. Head joints of coping stones shall be set with joint sealant in lieu of mortar or grout.
4. Accessories  
   a. Shelf angles and other metal objects incorporated into masonry walls shall be hot dipped galvanized. Fasteners shall be stainless steel.
   b. Flashing  
      (1) Flashings shall extend ¾ inch beyond the face of wall.  
      (2) In-wall flashings shall be composite copper asphal tic felt.  
      (3) Through-wall flashings shall be stainless steel.  
      (4) Weeps shall be installed above each flashing.
   c. Wall ties shall be hot dipped galvanized steel, equal to Hohmann & Barnard, Inc., DW10 Box Wall Tie.
   d. 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.

E. METALS  
1. Structural Steel  
   a. Certified (AWS D1.1) welders shall be required on structural work.
2. Testing  
   a. The Owner shall retain services of the testing firm. Contractor shall be responsible for scheduling tests.  
   b. Contractor shall notify the Owner a minimum of 48 hours prior to erection.  
   c. Test results shall be sent directly to the Contractor, Design Professional, and the Owner.
3. Miscellaneous Metals  
   a. Guardrails and Handrails  
      (1) Non-Architectural, exterior guardrails and handrails shall be fully welded, hot dipped, galvanized steel pipe.
      (2) Infill panels shall be vertical balusters.  
      (3) Support posts shall be installed in sleeves cast into walk. Size sleeve 1 inch larger than post.  
      (4) Railings shall be painted black with high gloss enamel paint.  
      (5) Non-shrink non-metallic grout shall be used.  
   b. All exterior fasteners shall be stainless steel.
c. Mock up panel is required for all welded railings, grilles and similar architectural metal elements.

F. WOOD AND PLASTICS
1. Rough Carpentry
   a. Chromated Copper Arsenate (CCA) treated lumber shall not be used.

2. Architectural Millwork and Cabinetry
   a. Millwork finish shall be free of lead bearing substances.
   b. Durable solid surfacing materials shall be used for windowsills.
      (1) Plastic laminate on solid wood or exterior grade plywood.
      (2) Standard particleboard shall not be used.

3. Countertops
   (1) Seams shall be kept to a minimum.
   (2) Plastic laminate countertops shall have a plywood substrate.
   (3) Sprayed-on glue application for plastic laminate shall not be used.
   (4) Countertops in wet areas shall not be constructed with substrate susceptible to moisture.

V. MECHANICAL
The following information is provided as a general guideline in establishing Mechanical Engineering project specific requirements.

A. GENERAL
1. Hanger design, application, and installation shall comply with MSS SP-58 and SP-69 Standards.
2. Solder shall be lead free.
3. All piping shall be hydraulically tested. Air testing is not acceptable.
4. 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.
   a. Test all systems for a minimum of four (4) hours.
      (1) 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.
      (2) Natural gas shall be tested at twice the working pressure or a minimum of 3 psig.
      (3) Sanitary sewer shall be tested at 10 feet of head pressure for minimum of four (4) hours.

5. Identification
   a. Labeling shall conform to ANSI A13.1.
   b. Piping systems shall be labeled, color coded with the type of service and the direction of flow.
(1) 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.

(2) Lettering shall be visible from the floor.

c. Labeling for refrigerant piping shall indicate refrigerant type.

d. For pipe ¾ inch and smaller, permanent phenolic tags shall be used.

e. Valves shall be tagged with an engraved brass or plastic tag describing type of service and area controlled by the valve.

f. Provide valve list for all valves located in the mechanical rooms.

6. Insulation

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.

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.

c. Exposed, insulated interior piping in mechanical rooms is within 6 feet of the finished floor shall have an aluminum jacket installed.

7. Wall and Ceiling Access Doors

a. Mechanical and architectural drawings shall identify access doors, number of doors needed, and general locations.

b. Size to allow maintenance access all concealed valves and equipment.

B. FIRE PROTECTION AND SUPPRESSION

1. General

a. Fire protection systems shall be installed per NFPA IFC, IBC.

b. Materials and equipment shall be specifically approved, listed, and labeled for fire protection service by UL or FM Global.

c. Sprinkler shop drawings shall include hydraulic calculations, pipe drawings all drains, isometric drawings, all sprinkler piping, and material/product cut sheets.

2. Piping and Pumps

a. Piping

(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) 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.

(3) Minimum FM Global approved Schedule 40 steel sprinkler pipe shall be used for all water-based fire protection piping.

(4) Other piping

(a) Wet systems – Use schedule 40 black iron piping
(b) Dry systems and Preaction systems – Use schedule 40 galvanized sprinkler piping

(c) MRI/Magnet affected areas – Use copper piping with metal fusible link heads

(d) Piping before backflow preventer – Use cement lined ductile

b. Pumps

(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.

(2) Fire pumps shall be horizontal split-case with electric motor.

(3) Pump shall be sized to eliminate the need for pressure relief valves.

3. Accessories

a. Valves

(1) Valves shall be located to allow access without requiring additional equipment.

(2) Zone valves shall be located in a fire protected enclosure (stairwell) at a maximum 7 feet AFF.

(3) Zone valve shall be located on the floor being served. Check valves and zone main drains shall accompany zone valve.

(4) A pressure gauge shall be installed on the main supply of each sprinkler system, upstream from the main test valve, and in each zone.

b. Drains

(1) Drains that are piped to floor drains shall be at minimum 6 inch floor drains that can handle full flow discharge of a fully pressurized sprinkler system.

(2) 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.

c. Sprinklers

(1) Flexible sprinkler piping or heads shall not be allowed.

(2) Sprinkler piping containing ethylene glycol shall be drained to a sanitary sewer.

d. Fire Extinguishers

(1) The Contractor shall provide and install all fire extinguishers.

(2) Fire extinguishers shall be as follows:

(a) Public areas and laboratories shall be Amarex B402 – 5 pound multi-purpose (ABC) dry chemical fire extinguisher.

(b) Laboratories shall be Amarex 322 – 5 pound carbon dioxide (CO2) fire extinguisher.

(c) Electrical rooms (where required) shall be Amarex 330 - 10 pound carbon dioxide (CO2) fire extinguisher.
(d) Mechanical rooms and high hazard rooms shall be Amarex B456-10 pound multi-purpose (ABC) dry chemical fire extinguisher.

(3) Fire Extinguisher Cabinets
   (a) Cabinet shall be Larson 2409-R2 with full acrylic view. 24 inches H X 9 inches W X 6 inches D to hold a 5 or 10 pound ABC extinguisher or 5 pound CO2 extinguisher.
   (b) Extinguishers may be hung if renovation project in laboratories, electrical rooms, and mechanical rooms do not allow enough space for cabinet installation.

C. PLUMBING SYSTEMS
1. General
   a. See Section III for information.

2. Insulation
   a. The following plumbing systems shall be insulated:
      (1) Domestic cold and hot water supply
      (2) Domestic hot water return or recirculating lines
      (3) Horizontal storm drain lines and roof drain sumps
      (4) Exposed waste lines

3. Instrumentation
   a. General
      (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.
      (2) Thermometers shall be of the dry-well type and installed with thermal conductive material in the dry wells.
      (3) Thermometers and gauges shall be selected with expected operating conditions in the middle of the device’s range.
      (4) Thermometers and pressure gauges shall be accurate to 1 percent of full scale.
      (5) Gauges shall be installed with gauge cocks.
   b. Provide pressure gauges immediately upstream and downstream of skid mounted, domestic booster pump assemblies.

4. Piping and Pumps
   a. General
      (1) Dielectric unions shall not be allowed in piping systems. Use dielectric couplings or flanges to connect dissimilar piping materials.
   b. Domestic Water
      (1) Materials
         (a) PVC piping shall not be used for domestic water systems.
(b) Pipe and fittings shall be copper, Type L, hard or soft drawn for solder joint connections, ASTM B88.

(c) Unions 2 ½ inches and larger shall have flange joints.

2. Valves

(a) 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.

(b) 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.

(c) Ball valves, 3 inches and smaller, shall be soldered, bronze 125 pound, full port, Nibco S-580 or equal.

(d) Butterfly valves, 6 inches and larger, shall be gear operated.

(e) Globe valves shall be maximum 2 inches.

(f) 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.

(g) Low point drain valves shall be equipped with a hose adaptor fitting.

c. Sanitary Waste and Vent

(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.

(2) Gate valves shall be installed upstream of strainer for backflow devices and shall be epoxy coated.

(3) Cleanouts shall be located in the wall or on the floor, not above the ceilings.

(4) Pipe and fittings may be cast iron, DWV copper, or DWV Schedule 40 PVC. Copper and PVC may be used above grade only. Cast iron may be hubbed below grade, no hubbed above grade.

d. Storm Sewer Systems

(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.

(2) Provide cast iron cleanouts at grade with a concrete pad.

(3) Foam core or cell core PVC not permitted.

e. Special Systems

(1) Acid waste
(a) Pipe and fittings may be either glass or CPVC. All materials must be rated and approved for acid waste use.

(2) Distilled and deionized water
(a) Pipe and fittings shall be Schedule 80 PVC or other plastic piping systems designed specifically for this type of service.

(3) Natural gas
(a) Pipe and fittings shall be carbon steel, A53 Gr. B or A106 Gr. B, Schedule 40.

(4) Valves 1 inch and smaller shall be ball valves, rated for the type of service.

(5) Compressed air and vacuum
(a) Pipe and fittings shall be Type L.

f. Pumps
(1) Recirculating pumps in hot water systems shall be constructed of non-ferrous material.

5. Equipment
a. Water Heaters
   (1) See Section III for information.

b. Expansion tanks
   (1) All expansion tanks shall be installed with provisions for draining and venting.

c. Water Softeners
   (1) All water softening equipment shall be installed with a test port immediately downstream from the softening equipment.
   (2) Equipment basis of design shall be Water Rite.

d. Backflow Preventers
   (1) Domestic water backflow prevention devices shall be Watts 909.
   (2) 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) Backflow preventers located more than 4 feet AFF shall have an access platform.
   (4) Pit installations of backflow preventers shall not be allowed.
   (5) Drainage from backflow preventers shall be air-gapped and gravity only, to a floor drain or floor.
   (6) Potable water systems shall have two (2) backflow preventers in parallel, each at 100 percent capacity.
   (7) Dedicated fire suppression water system shall have one (1) FM Global approved double-check assembly.

6. Fixtures
a. General
   (1) Fixtures and related equipment shall be of commercial grade or better.
(2) Fixtures (sinks, urinals, water closets, etc.) shall be white in color.
(3) Fixture hardware (faucets, flush valves, etc.) shall be chrome color.
(4) Strainers shall be specified for sinks. Pop-up drain stoppers shall not be used with the exception of residence halls.
(5) Water closets shall have check hinges.
(6) Automatic faucets shall be infrared, proximity sensor type.
(7) Water closets shall have an automatic flush valve, be wall-mounted, 500 pound minimum load with floor mounted heavy-duty rated carrier.
(8) Lavatory faucets shall be hands free, automatic.
(9) Spring return valves on faucets shall not be used.
(10) Urinal flush valves shall be side mount, automatic. Flush valves shall have a manual override function. Approved manufacturers include Sloan, Zurn and Delaney.
(11) Sensor valves shall be battery operated.
(12) Showers shall have anti-scald mixing valves.
(13) Note locations of electric water coolers and fixtures with automatic flush valves (battery), with courtesy flush button, on electrical and plumbing plans.
(14) Note all plumbing fixtures on the architectural drawings.

b. Water Coolers
(1) Water cooler shall be located a maximum of 36 inches from cooling unit.

c. Hose Bibbs and Wall Hydrants
(1) Provide isolation valves on interior feed to deactivate outdoor hose bibbs during winter.
(2) Exterior hose connections shall be recessed socket type.

d. Floor Drains
(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.

e. Emergency Showers and Eyewash Stations
(1) See Section III for information.

D. HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)
1. General
   a. All penetrations through firewalls, floor or roof decks shall have firestopping material installed at the penetrations and shall be shown on the drawings.
   b. Manual-type air vents shall be installed at high points in water systems.
2. Piping
   a. General
      (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.

(2) Triple-duty valves shall not be used.

b. Hot Water Piping
(1) Hose bibbs shall be installed for manual air vents at all high points of the hot water systems.
(2) Automatic air vents shall not be used.

c. Chilled Water Piping
(1) Provide thermometers and pressure gauges on both the inlet and discharge sides of any device connected to the chilled water system.
(2) Material
(a) PVC shall not be used for chilled water systems.
(b) Welded steel systems shall use black steel piping and fittings, ASTM A53, Schedule 40. Minimum pipe size shall be ¾ inch.
(c) Copper systems shall use a minimum of Type L copper.
(d) Any threaded black steel pipe shall be schedule 80.
(3) Valves
(a) 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.
(b) 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.
(c) Balancing valves 2 ½ inches and smaller shall be plug valves. For pipe sizes larger than 2 ½ inches, butterfly valves shall be used.
(d) All sizes shall have external stem packing.
(e) 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) Mechanical Couplings and Valves
(a) Mechanical Couplings, 2 inch through 12 inch
   i. Manufactured in two (2) segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12.
   ii. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000.
   iii. Mechanical Coupling bolts shall be zinc-plated, heat-treated carbon steel track head.
(b) Rigid Type
   i. Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and
support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.

(c) Flexible Type
   i. Use in locations where vibration attenuation and stress relief are required.
   ii. Flexible couplings may be used in lieu of flexible connectors at equipment connections.
   iii. Three (3) couplings, for each connector, shall be placed in close proximity to the vibration source.

(d) Flange Adapters
   i. Use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges.
   ii. Basis of design shall be Victaulic style 741.
   iii. For direct connection to ANSI Class 300 flanges, basis of design shall be Victaulic Style 743.

(5) 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.

3. Insulation
   a. Insulation shall not have gaps.
   b. Piping insulation passing through partitions shall be continuous.
   c. Provide pipe hangers sized properly to allow for continuous insulation.
   d. Insulation blankets
      (1) Custom fabricated, removable insulation blankets shall be provided for equipment that operates above or below ambient conditions and that needs regular maintenance such as steam valves, bonnets, condensate chests / tanks, and steam meters.
      (2) Custom fabricated, removable insulation blankets shall be provided for equipment and appurtenances that operate in the following temperature ranges:
         (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
(d) The insulation blankets shall be attached via Velcro straps and d-ring buckles. Installation and removal by wires is not acceptable.

4. Air Distribution
   a. Ductwork
      (1) Maximum length of flexible ductwork shall be 6 feet 0 inches.
   b. Accessories
      (1) Access doors shall be located before and after all reheat coils.

5. Equipment
   a. General
      (1) Provide major equipment with pressure, temperature, and flow indicators at time of installation to establish unit performance.
      (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.
      (3) Provide access doors at all coils, filters, motors, belts etc.
      (4) 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.
      (5) All coils within air handling units shall be drainable.
      (6) Mechanical equipment/systems shall be installed on a 4 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.
      (7) Motors shall be premium-efficiency.
      (8) Motors shall not be designed to operate in the service factor.
      (9) 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.
      (10) Equipment shall have a hand/off/auto switch to allow manual override of the normal controls.
   b. Refrigerant Systems
      (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.
      (2) Pipe discharge from all relief valves to exterior of the building.
      (3) Insulate suction and hot gas bypass on refrigerant lines in all locations and discharge lines if exposed in occupied areas.
      (4) Piping and fittings shall be copper, except in an evaporative condenser, where steel piping is acceptable. Use long radius fittings.
(5) Solder shall be 15 percent silver solder.
(6) For units over 5 tons, use 1 inch fiberglass insulation. For smaller units, use ½ inch closed cell foam insulation, minimum.
(7) All insulation on exterior piping will be protected by an aluminum jacket.
(8) Compressors
   (a) Compressors shall have five (5) year manufacturer warranty.
   (b) Multiple units are preferred over larger single units.
   (c) All compressors shall be single speed.
   (d) All 3-phase units shall have adjustable voltage monitors for each phase, with manual reset.
   (e) Compressors shall have recycle timers and crankcase heaters.
   (f) Provide high and low pressure switches.
(9) Solenoid valves shall have a manual lift stem.
(10) Provide driers on all liquid lines with isolation valves on each side of the drier.
(11) Coils shall have copper tubes and aluminum fins.

c. Pumps
(1) Install all pumps in easily accessible locations. Install isolation valves on each side of the pump.
(2) Pumps shall have mechanical seals.
(3) Base mounted, centrifugal pumps shall be installed with a pressure gauge manifold and a suction diffuser/strainer.
(4) Pipe vibration isolators shall be stainless steel.
(5) Pumps 7 ½ HP and greater shall have Chesterton mechanical split seals, or approved equal.
(6) Bell and Gosset pumps shall be the standard of quality.
(7) 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.

d. Air Handling Equipment
(1) Units shall have a magnahelic filter pressure differential indicator installed with a manifold and valves to isolate lines on each side of the filter.
(2) Thermometers shall be installed to show temperatures of the mixed, discharge, outside, and return air.
(3) Thermometers shall be bi-metal type with a minimum 4 inch dial face.
(4) Oil and grease lines shall be extended to the exterior of the case.
(5) 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.
(6) Traps for drain systems shall be sized for the system served. Ensure adequate room for the size of trap required. Adjust the height of the housekeeping pad as required. A 6 inch minimum height housekeeping pad is preferred.

(7) Coils
(a) All coils shall have a minimum of 0.025 inch tube wall thickness and 5/8 inch O.D. minimum diameter.
(b) 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.
(c) Coils shall have copper coils, aluminum fins, and non-ferrous headers.
(d) Coils shall be drainable.
(e) Water coils shall be piped for counter flow.
(f) Balancing valves shall be installed at the coil.

(8) All dampers used in a fully closed position shall be low-leakage type. A standard of quality is Ruskin CD60.

e. Humidifiers
   (1) See Section III for information.

6. Lab Systems
a. Ductwork
   (1) Ductwork for fume hoods and laboratory exhaust systems shall be welded, 304 stainless steel. Specific programs may require alternate materials. Verify with Owner.
   (2) Plastic laboratory exhaust duct shall be FM Global approved for use without automatic sprinkler protection.

b. Fume Hoods
   (1) The standard for fume hoods is Mott Casework.

7. Steam Systems
a. Drip legs are required for all steam risers. Drawings shall indicated drip leg locations.

b. Piping and Pumps
   (1) Pumps
      (a) Main Campus condensate pumps shall be duplex electric pumps.
      (b) Install a pressure gauge on the system side of the condensate pump discharge check valve.
      (c) All condensate pumps shall be capable of handling high temperature condensate.

   (2) PRVs
      (a) Install Isolation valves at all PRVs.
      (b) Install pressure gauges on both sides of the PRV.
(c) 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.

(d) PRVs in the distribution system shall not contain a bypass.

(3) Medium and Low Pressure Steam - Above Grade

(a) Pipe and fittings
   i. Piping shall be seamless black steel.
      1. For supply, piping shall be Schedule 40.
      2. For condensate, piping shall be Schedule 80.
   ii. 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.
   iii. 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.
   iv. Globe valves shall be used only for throttling purposes. Globe valves shall be a minimum of 150 pound, and shall be rated for steam.
   v. 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.

(b) Strainers shall be Y-pattern, rated for steam, with stainless steel baskets. All strainers shall be installed with a blow down valve.

(c) Safety relief valves shall have piping equal to or larger than tappings of the valve. Pipe discharge to exterior of the building.

(d) Vent lines from pressure powered pumps or condensate pumps shall not be connected to a relief vent pipe.

(4) Install aluminum jacket on exposed piping in occupied areas within 6 feet AFF. PVC jacket shall not be used

c. Equipment
   (1) Air vent/vacuum breakers shall be installed on steam equipment as required.

E. INSTRUMENTATION
   1. Meters
      a. Domestic Water Meters
         (1) Contractor shall be responsible for installation of meter.

F. CONTROLS
1. General
   a. Contractor 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.
   b. Manufacturers shall be Johnson Controls or Schneider Continuum Controls.
   c. All components shall have been thoroughly tested and proven in actual use.
      (1) The DDC system shall possess a modular architecture, permitting future expansion through additional DDC panels, sensors, actuators and/or operator terminals.
      (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.
      (3) Existing DDC system shall be extended to meet the requirements, as indicated by the Drawings and Specifications associated with this project.
   d. BACnet Integration
      (1) All BACnet devices shall be BACnet Testing Lab certified.
      (2) Conduct on-site device testing using the BACnet Manufacturers Association / BACnet Testing Laboratories (BMA/BTL) Virtual Test Shell 3.5.0 (VTS) program.
      (3) BACnet instance numbers shall be coordinated with the Owner. Assigned numbers shall be physically entered by the equipment manufacturer at the BACnet device.
   e. Installing Contractor shall specialize in systems and products and have a minimum of five (5) years documented experience.
   f. 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.
   g. Warranty:
      (1) The control system shall be guaranteed free from material and workmanship defects for a period of two (2) years.
      (2) All Actuators shall be warrantied for two (2) years.

2. Scopes of Work
   a. Coordinate with UI Controls for projects using third party controls subcontractors.
   b. The following responsibilities shall apply when UI Controls is providing project programming:
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<th>ACTIVITY</th>
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<td>Provide Control Components per Plans &amp; Specifications</td>
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<td>Determine Sensor Locations</td>
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<td>Control System Startup</td>
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<td>Build/Install Graphics</td>
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<td>Record Drawings</td>
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|   |                                                                           |                   |
|   | c. DDC Contractor shall additionally                                      |                   |
|   | (1) Verify space requirements to insure proper service clearances.         |                   |
|   | (2) Provide all required information, material and direction to the        |                   |
|   | designated Contractor as required for device and accessory installation.   |                   |
|   | (3) Address controllers                                                   |                   |
|   | (4) Configure jumpers                                                     |                   |
|   | d. HVAC Contractor shall                                                   |                   |
|   | (1) Install automatic valves, separable wells, flow switches, airflow     |                   |
|   | monitoring stations, etc., supplied by the DDC Contractor.                 |                   |
|   | (2) Install all automatic control dampers.                                 |                   |
|   | (3) Assemble multiple section dampers with required inter connecting       |                   |
|   | linkages and extend required number of shafts through duct for external    |                   |
|   | mounting of damper motors.                                                |                   |
|   | (4) Coordinate installation of variable air terminal units with control    |                   |
|   | Contractor.                                                                |                   |
|   | (5) Install duct mounted reheat coils.                                     |                   |
|   | e. Electrical Contractor shall                                             |                   |
|   | (1) Provide all power wiring (120 volt or greater) to motors, electric    |                   |
|   | dampers, smoke detectors, and DDC panels.                                  |                   |
|   | (2) Assign and identify electrical circuits to control Contractor for      |                   |
|   | dedicated controller wiring.                                              |                   |
|   | (3) Electric wiring and wiring connections required for the installation  |                   |
|   | of the temperature control system shall be provided by the DDC Contractor,  |                   |
|   | unless specifically shown on the electrical drawings or called             |                   |
|   | for in the electrical specifications.                                     |                   |

3. User Interface
   a. Graphics
(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.

(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.

(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.

(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.

(5) Graphics Development Package: Provide graphic generation software to allow the user to add, modify, or delete system graphic displays.
   (a) DDC Contractor shall provide libraries of pre-engineered screens and symbols depicting:
       i. Standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.)
       ii. Complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.)
       iii. Electrical symbols
   (b) The graphic development packages shall allow user to perform the following:
       i. Define symbols.
       ii. Position and size symbols.
       iii. Define background screens.
       iv. Define connecting lines and curves.
       v. Locate, orient and size descriptive text.
       vi. Define and display color for all elements.
       vii. Establish correlation between symbols or text and associated system points or other displays.
   (c) Graphical displays can be created to represent any logical grouping of system points or calculated data based upon:
       i. Building function
       ii. Mechanical system
       iii. Building layout
       iv. Any other logical grouping of the facility
(d) 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) Control Contractor shall coordinate with Control Engineering for campus graphic standard.

b. Local Interface

(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:
   (a) Adjust application parameters.
   (b) Execute manual control of input and output points.
   (c) View dynamic data.

c. Alarms

(1) Route alarms directly from primary application nodes to specific workstations and servers.

(2) The alarm management portion of the master controller software shall, at the minimum, provide the following functions:
   (a) Log date and time of alarm occurrence.
   (b) Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
   (c) Allow user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
   (d) 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.
   (e) Provide the ability to direct alarms to an e-mail address or phone text message.
   (f) Any attribute of any object in the system may be designated to report an alarm.
   (g) The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

d. Reports

(1) Reports shall be capable of being directed to each of the following:
   (a) User interface displays
   (b) Printers
   (c) Archives

(2) The system shall provide the following reports:
   (a) All points in the BAS.
   (b) All points in each BAS application.
   (c) All points in a specific area network.
   (d) All points in a user-defined group of points.
(e) All points currently in alarm in BAS application.
(f) All points locked out in a BAS application.
(g) All BAS schedules.
(h) All user defined and adjustable variables, schedules, interlocks, etc.
(i) BAS diagnostic and system status reports.

E. Schedules

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:
   (a) Weekly schedules.
   (b) Temporary override schedules.
   (c) Holiday schedules.
   (d) Monthly schedules.

2. Schedules shall be provided for each system or sub-system.
   (a) Each schedule shall include all user commanded points residing within the system.
   (b) 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.
   (c) Scheduling and rescheduling of points shall be accomplished via the system schedule spreadsheets.

3. Monthly calendars for a twelve (12) month period shall be provided to allow for scheduling of holidays and special days in advance.

F. Historical Trending and Data Collection

1. Trend and store point history data for all BAS points and values as selected by the user.

2. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.

3. Provide the capability to perform the following statistical functions on the historical database:
   (a) Average
   (b) Arithmetic mean
   (c) Maximum/minimum values
   (d) Range – difference between minimum and maximum values
   (e) Standard deviation
   (f) Sum of all values
   (g) Variance

4. Coordinate with Controls Engineering on trend specifics as they apply to data collection for the Energy Control Center.

4. Sensors and Equipment

a. Nomenclature
(1) Label all system control points and devices.

(2) Control point identifiers, descriptions and object names shall be per the Owner’s equipment nomenclature standard.

(3) The Owner’s nomenclature standard shall apply to third-party BACnet controllers.

b. Sensors and equipment shall be of the electronic-type suitable for their intended purpose.

c. Inputs and Outputs

(1) The DDC System shall be capable of receiving the following input signals:

(a) Analog Inputs (AI) shall monitor temperature, humidity, voltages, or any type of input signal from a 4-20 mA or 0 to 10 volt DC as selected by software.

(b) Digital Inputs (DI) shall accept dry contact closures.

(c) 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.

(2) The DDC System shall be capable of outputting the following signals:

(a) 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.

(b) Analog Output (AO) shall provide variable outputs of 4-20 mA, 0 to 10 volt DC, or 0 to 20 volt DC, as selected by the software. Pulse Width Modulation (PWM) outputs are prohibited.

d. Accuracy shall be consistent with that specified below and as required to maintain end-to-end system accuracy.

(1) Temperature sensors shall be thermistor or RTD-type.

(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.

(3) Energy recovering units shall have averaging temperature sensors at the inlets and outlets at the wheels.

(4) Humidity sensors shall be electronic with no moving or other parts requiring periodic service. Accuracy will be ±3 percent of reading.

(5) Control relays shall be rated for the application with form C contacts with position indicator.

(6) Air flow status sensors for all supply, return, exhaust and relief applications shall be differential pressure type.
(a) Fan arrays (fan wall technology) shall be coordinated through control engineering.
(b) Where Fan Wall Technology is utilized, an adjustable differential pressure switch shall be installed across the fan wall.
(c) An additional current transducer at each motor shall be installed for alarming purposes.

(7) 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.

(8) Water Temperature Sensors shall be installed in separate immersion wells.

(9) 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.

(10) Current transducers shall be industrial type with separate zero and span adjustments.

e. Terminal Air Box (TAB) Controllers

(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.

(2) Each TAB controller shall be capable of controlling the following configurations of variable air volume types:
   (a) Single Duct, cooling only.
   (b) Single Duct with Reheat.
   (c) Double Duct.
   (d) Fan-Powered, Parallel or Series Flow.
   (e) Remote Heating.

(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.

(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.

(5) Valve actuators shall be proportional control 0 to 10 volt DC. No spring return actuators with zone control devices.

f. 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.
g. 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.

h. Building pressurization
   (1) Volume tracking shall be used for these applications.
   (2) Building pressure shall be a monitored point only.

i. Building steam pressure shall be monitored on the secondary side of all pressure reducing valves.

j. Humidity Control
   (1) Units that have humidity control require the following:
       (a) Zone humidity
       (b) Return air humidity
       (c) Discharge air humidity
   (2) Discharge high humidity limit switch shall be wired back as feedback to the DDC controls and hard wired to the humidity valve.

k. Air Handler Heating and Cooling Water Coils: Per control valve, provide supply and return temperature sensors on coil header piping.

l. Air Handler and Exhaust Fans Safety Static Pressure Sensors
   (1) Provide low static sensor on inlet side of all supply, return and exhaust fans. Mount sensor on unit.
   (2) Provide high static sensor on discharge side of supply fans before fire smoke dampers. Mount sensor on unit.

m. Automatic Control Valves
   (1) Provide factory fabricated electronic control valves of type, body material, and pressure class required for application.
   (2) Provide valve size in accordance with specified maximum pressure drop across control valve.
   (3) Equip control valves with heavy-duty electronic actuators, with proper shutoff ratings.
   (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.
   (5) Valve Trim and Stems shall have bronze trim with stainless steel stem
   (6) Packing shall be spring-loaded Teflon, self-adjusting.

n. Dampers
   (1) Automatic dampers shall be single or multiple blade and furnished by the DDC Subcontractor.
   (2) Dampers shall be installed by the HVAC Subcontractor under the supervision of the DDC Subcontractor.
   (3) Damper frames shall be constructed of 13-gauge galvanized sheet metal and shall have flanges for duct mounting.
(4) Damper blade 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.

(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) 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.

(7) Damper shaft shall be exposed and mechanically marked (indicating damper position) for enabling easy access for maintenance, repair and future replacement.

(8) Damper leakage shall be rated for a class 1A or better. Refer to AMCA 500-D-98.

o. Damper and Valve Motors

(1) Size each motor to operate dampers or valves with sufficient reserve power to provide smooth modulating action.

(2) Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator.

(3) Mechanical end switches to deactivate the actuator at the end of rotation are not acceptable.

(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.

(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) 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.

(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.

(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.

(9) Actuators shall be sized for proper speed of response at the velocity and pressure conditions to which the control damper is subject.
(10) Shall produce sufficient torque to close off against the maximum system pressures encountered.

(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.

(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.

(13) Approved manufacturers include Johnson Controls and Belimo.

p. Combination Air Flow and Temperature Measurement Station (AFMS)

(1) General

(a) CSC shall provide thermal dispersion-type, combination airflow and air temperature measurement devices where indicated on the drawings and/or control sequences.

(b) 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.

(c) 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.

(d) Design and installation shall use duct-mounted devices in filtered airstreams and adequate access shall be provided for maintenance.

(e) Fan inlet sensors shall not be substituted for duct or plenum sensor probes.

i. Fan inlet sensors may be used with Owner approval where conditions make duct/plenum installation impractical.

ii. 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.

(f) The device selected shall be capable of reading accurately throughout the full, intended range of airflow.

(2) Basis of design shall be EBTRON, Inc. Gold Series

(3) Transmitter

(a) Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature.
(b) Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units.
(c) Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.
(d) All integrated circuitry shall be industrial grade temperature rated.

q. Air Flow Monitoring Stations
   (1) Provide differential pressure-type measurement devices where indicated on the drawings and/or control sequences.
   (2) Device shall be capable of reading accurately throughout the full, intended range of airflow.
   (3) Basis of design shall be Air Monitor Corporation, VOLU-probe or VOLU-probe/FI.

r. Miscellaneous Devices
   (1) Provide all the necessary switches, relays, transformers, etc. to make a complete and operable system.
   (2) Locate devices in local interface panel, unless otherwise specified.
   (3) All buildings shall have a building static pressure sensor which has been field verified with Owner.

5. Installation
   a. Install all equipment in accordance with equipment manufacturer's published instructions. Furnish printed copies of these instructions to the Owner prior to installation.
   b. Identification
      (1) All equipment, including valves, dampers, etc., shall be identified by a unique equipment number and the equipment tagged after installation.
   c. DDC Panels
      (1) Neatly train wiring inside Panduit wire management system.
      (2) Mount relays and devices on din rail.
      (3) Control wiring cable sheath shall be stripped backed no more than 6 inches from control terminations.
      (4) Label electrical circuit number inside DDC panel door.
   d. Wiring
      (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.
      (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.
      (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.

(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.

(5) Label each field wire at each end. All relays and transformers in panels shall be labeled.

(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.

(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.

(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. Air Flow Matrix
   a. See Section III for information.

VI. ELECTRICAL
The following information is provided as a general guideline in establishing Electrical Engineering project specific requirements.

A. GENERAL
   1. General
      a. See Section IV for information.
   2. Identification
      a. All switching, protective devices and metering on main distribution panels shall be identified with labels.
      b. Equipment labels shall be adhesive-backed vinyl or plastic with ½ inch letters.
      c. Identification labels are required for all distribution equipment from the service through branch circuit panelboards and motor control centers.
      d. Label inside cover of all safety switches with fuse size, type, current limiting ability and devices controlled.
      e. Label all receptacles on the cover plate with self-adhesive labels. Label shall indicate panel name and circuit number.
      f. 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.
      g. All junction box covers shall be labeled with the panel number and circuit numbers contained in the junction box.
(1) Exposed boxes in finished areas shall be labeled on inside of cover.
(2) Exposed boxes in unfinished areas shall be labeled on outside of cover.
(3) Concealed boxes above accessible ceilings shall be labeled on outside of cover.

3. Arc Flash
   a. All new greater than 50 volt panel boards, switchboards, lighting controls, disconnects, motor control centers, local starters, vfds or other isolated equipment shall be clearly labeled.
   b. At a main circuit breaker where the arc flash study indicated different hazard levels, label as per the highest level arc flash hazard.
   c. Arc flash labels shall be a permanently attached, non-aging material with waterproof, abrasion resistant lettering. Required information shall include:
      (1) Flash Protection Boundary in feet and inches
      (2) Hazard Risk Category
      (3) Calculated incident energy in calories per square centimeter (Cal/cm²)
      (4) Working distance in inches of the calculated incident energy
      (5) Voltage of equipment
      (6) Equipment name of identification number
      (7) Issue date that matches completion of studies
      (8) Recommended PPE

4. Grounding
   a. 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.

B. MEDIUM-VOLTAGE (601 VOLTS – 69k VOLTS) ELECTRICAL DISTRIBUTION
1. Metering
   a. Additional electric kilowatt-hour meters may be needed to properly account for customer electric power usage within the building.
      (1) The meter sockets for these self-contained meter sites shall be provided by Owner and installed by the Contractor.
      (2) Meter shall be provided and installed by Owner.

2. Switchgear and Transformers
   a. Secondary service protector switchgear shall be furnished by Owner and installed by the Contractor.

3. Raceways
   a. Provide a ¾-inch minimum communications raceway to electrical meters to support data acquisition systems.

4. Wire and Cable
   a. See Section III for information.

C. LOW-VOLTAGE ELECTRICAL DISTRIBUTION
1. **Equipment**
   a. **Design**
      (1) Provide nominal 4 inch high housekeeping pads for floor mounted equipment. Pads shall extend 4 inches beyond the equipment.
      (2) Exterior and interior surfaces of electrical equipment enclosures shall be wiped or cleaned with a vacuum immediately prior to final acceptance.
      (3) Scratches on painted surfaces shall be touched up with equipment manufacturer’s standard paint of matching color.
      (4) Provide five (5) spare conduit stubs from flush panels into suspended ceiling space or other accessible space.
      (5) 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.
      (6) Provide a label on the inside of the panel door with panel ID and power origin.
      (7) Provide branch circuit electrical panels in General Education Buildings with Best 5E Series ¾” Utility Cylinder. Key to MK EB and EB1.
   b. **Transient Voltage Surge Suppression**
      (1) See Section III for information.
   c. **Switchboards**
      (1) Covers to consist of full-length hinge, door within a door.
      (2) Approved manufacturers include Square D, General Electric and Cutler-Hammer.
   d. **Panelboards**
      (1) Circuit breakers on branch circuit panelboards shall be bolt-on type.
      (2) Approved manufacturers include Square D I-Line, GE Spectra Series, and Cutler-Hammer.
   e. **Motor Control Center**
      (1) Approved manufacturers include Square D, General Electric and Cutler-Hammer.
   f. **Breakers, Fuses and Safety Switches**
      (1) Each project shall supply one (1) set of three (3) spare fuses for each type and size fuse installed.
      (2) Provide spare fuse storage cabinet of metal Construction. Cabinet shall be labeled and mounted as directed by Owner.
      (3) Safety switches shall be heavy duty.
      (4) Safety switches in mechanical rooms shall have minimum NEMA 3R enclosures.
      (5) All safety switches shall have a grounding bar.
      (6) Approved manufacturers include Square D, General Electric and Cutler-Hammer.
   g. **Variable Frequency Drive**

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**SECTION IV – OUTLINE SPECIFICATIONS AND DETAILS 202**
2. Devices

(1) Manufacturer shall provide harmonic analysis of the supplied VFD. Total harmonics are not to exceed 3 percent.

(2) Provide startup services by a Factory-Certified Service Representative

(3) Minimum training time shall be four (4) hours.

(4) Approved manufacturers include ABB, Toshiba and Square D Reliance.

(5) Drive Isolation Transformer

(a) Factory-assembled and tested, air-cooled dry-type transformer, having characteristics and ratings as indicated. Units shall be designed for 60 Hz service. Transformer shall be 3-phase, Delta-Wye or Delta-Delta.

(b) Delta-Delta secondary shall be corner grounded.

(c) Provide grain oriented, non-aging silicon steel core.

(d) Coils shall have continuous windings with splices at taps only.

(e) Insulation system shall be UL recognized 220 degrees C. Performance shall be obtained without exceeding 150 degrees C temperature rise while operating in 30 degrees C ambient for twenty-four (24) hour average.

(f) Enclosure shall be heavy gauge steel with electrostatic applied finish, ventilated, drip-proof, with lifting holes.

(g) Sound levels shall not exceed 55 db.

(h) Harmonic rating shall be equal to or greater than the harmonic distortion produced by the supplied VFD, as determined by the harmonic analysis supplied by the VFD manufacturer.

(6) See Appendices for VFD mounting installation detail.

2. Devices

a. Receptacles and switches shall be heavy-duty, minimum specification grade, minimum 20 amp rating.

b. Receptacles and switches shall be side and back wiring type. All wire connections shall be screw clamp or wire nut type.

c. Install switches at 48 inches AFF. Install receptacles at 18 inches AFF.

d. Install 120 volt receptacles with the ground up.

e. Approved manufacturers include:

1. Switches shall be Hubbell, Leviton 1221, or Pass and Seymour

2. Receptacles shall be Hubbell 5362, Leviton 5362A, or Pass and Seymour.

3. Isolated Ground Duplex Receptacles shall be Hubbell, Leviton, or Pass and Seymour IG5362.

4. Plugmold shall be Wiremold V24GB306.

5. Plugmold Pigtail shall be Pass and Seymour S266-X 12/3 type SJOW cord.

3. Raceways, Boxes, and Supports

a. Raceway and Boxes
(1) For Branch Circuits, the minimum conduit size shall be ¼ inch. The minimum size for flexible metal conduit shall be ½ inch.

(2) Conduit shall be supported from the building structure. Attachment to other pipes, conduits, ductwork, etc. shall not be allowed.

(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) All metallic fittings shall be compression-type rated for ground connection.

(5) All fittings shall be galvanized steel or malleable iron.

(6) EMT shall not be used outdoors, in wet locations, in floor crawl spaces, or within 5 feet of finished grade.

(7) The use of flexible metal conduit shall be limited to recessed lighting fixtures. Maximum length shall be 6 feet.

(8) Liquid-Tight flexible metal conduit shall be used to connect rotating, vibrating or moveable equipment.

(9) Empty conduits shall have nylon pull cords installed with temporary caps or plugs.

(10) Non-metallic conduit or boxes

   (a) Shall be used only in wet locations.

   (b) May be used for underground electric circuits less than 600 volts which are:

       i. Under paved areas and areas scheduled to be paved.

       ii. Next to permanent buildings, under formal planting beds and in extremely high areas that would be difficult to excavate due to regular heavy use.

   (c) 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.

   (d) Schedule 80 PVC conduit shall be utilized anywhere non-metallic conduit emerges from concrete or where conduit may receive physical abuse.

(11) Maintain a 6 inch minimum from top of ceiling tile support grid to any raceway.

(12) Raceways, boxes and their supports shall be compatible with the atmosphere of the area in which they are installed.

b. Hangers and Supports

   (1) Lead, fiber, wood and powder actuated anchors are prohibited.

   (2) Bolted conduit clamps are prohibited below 8 feet AFF in public areas.

4. Wire and Cable
a. Number 10 AWG shall be used when length of wire serving floor maintenance receptacles exceeds 100 feet.
b. Provide dedicated neutral and ground for each isolated ground device.
c. The minimum wire size for lighting and power branch circuits is #12 AWG.
d. The minimum wire size for Class 1 control circuits is #14 AWG.
e. Any conductors installed in flexible conduit at terminal connections of rotating, vibrating or moveable equipment shall be of stranded wire.
f. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

<table>
<thead>
<tr>
<th>208/120 VOLTS</th>
<th>PHASE</th>
<th>480/277 VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
<td>White or Gray</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

D. EMERGENCY AND BACKUP POWER SYSTEMS

1. Packaged Generator Assemblies
   a. Provide startup services and training for Owner’s personnel by a Factory-Certified Service Representative.
   b. All fuel piping from the outside of the building for day tank filling and venting shall be hard piped.
   c. A high liquid level device shall be provided for day tank overflow protection.
   d. Manufacturer shall have a service center within a 100 mile radius of The University of Iowa.
   e. 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.

2. Battery Equipment
   a. Batteries on racks or in cabinets shall be accessible for maintenance. Provide 6 inches minimum vertical access above batteries.

3. Transfer Switches
   a. See Section III for information.

E. INSTRUMENTATION

1. Metering
   a. Place a disconnecting means ahead of any low voltage watt-hour meter.
   b. Locate low voltage watt-hour metering (e.g. sidewalk, parking lot, and roadway lighting) near the primary building metering or provide a raceway (1 inch conduit minimum) from the low voltage meter to the primary metering location.
   c. All contactors shall be on the load side of low voltage watt-hour meters.

F. LIGHTING
1. General
   a. See Section III for information.

2. Interior Lighting
   a. Design
      (1) See Section III for information.
   b. Classroom Design
      (1) See Section III for information.
   c. Daylighting
      (1) See Section III for information.
   d. Ballasts
      (1) All ballast cases shall be bonded to the equipment grounding conductor.
      (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.
      (3) Utilize parallel-wired ballasts where possible so that if one (1) lamp fails remaining lamps stay on.
      (4) All ballasts shall have a sound rating “A” and total THD of 10 percent or less.
      (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) Select lighting fixtures with tool-less access to ballasts for ease of maintenance.
      (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.
      (8) Utilize parallel-wired ballasts where possible so that if one (1) lamp fails the remaining lamps stay on.
      (9) Clearly label all specialty ballasts (dimming, stepped dim, high or low ballast factors, etc.) to prevent incorrect replacements.
      (10) Coordinate with Environmental Health and Safety for disposal of existing ballasts.
   e. Lamps
      (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.
      (2) Coordinate with Environmental Health and Safety for disposal of existing lamps.
   f. Lighting Fixtures (luminaries)
      (1) Provide all lighting fixtures with a specific means for grounding their metallic wire-ways and housings to an equipment grounding conductor.
(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).

(3) Fixture finish shall be free of stains or evidence of rusting, blistering or flaking.

g. LED Lamps and Fixtures

(1) LED fixture submittals shall include photometric reports per IES LM-79 guidelines.
   (a) 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.
   (b) Provide manufacturer of origin for the LED chipset included in the fixture.

(2) 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.

(3) All LED fixtures, modules, or arrays, per type, shall be provided with the same date code of manufacture.

(4) 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.

(5) 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) LED fixtures shall be provided with a driver and light source as a modular system.

(7) All LED drivers shall carry a minimum life expectancy of 50,000 hours.

(8) 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.

h. Emergency Lighting and Exit Signs

(1) Emergency lighting and exit sign units shall not be mounted higher than 10 feet AFF.

(2) Center exit signs on building elements, such as corridors and doorways.

(3) Exit Signs
   (a) 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.
(b) Lamps shall be red LED, mounted in center of letters on red color-stable plastic or fiberglass.

(c) LED shall be rated minimum twenty-five (25) year life.
   i. LED exit light fixtures without diffuser panels shall be maximum of 3.5 watts for single-faced and 7 watts for double-faced.
   ii. LED exit light fixtures with diffuser panels shall use 1 watt maximum per fixture for single-or double-faced.

(d) Fixtures shall be wired for universal 120 to 277-volt.

(e) EXIT signs shall comply with UL 924 and EPA Energy Star Specifications at the end of five (5) years of continual use.

(f) 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.

(g) There shall be no radioactive material used in the fixtures.

(4) Emergency Fixtures

(a) System shall consist of an automatic power failure device and fully automatic solid-state charger in a self-contained power pack.

(b) Charger shall be trickle, float, constant-current or constant-potential type, or a combination of these.

(c) Battery shall operate unattended and require no maintenance, including no additional water, for a minimum of five (5) years.

(5) Exit signs and emergency lighting equipment shall include self-testing module to perform the following functions:

(a) 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.

(b) 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.

(c) Multi-color LED on-board indicators shall provide visible fault detection and charging status.

(d) Manual test switch to simulate a discharge test cycle.

(e) Module shall have low voltage battery disconnect and brown-out protection circuit.

i. Fixture Installation

(1) Luminaires located in suspended ceilings shall be connected with a maximum 6 foot length of flexible metal conduit.
(2) Use number 12 AWG (min) light fixture whips.
(3) Luminaire shall be fitted with swivels or otherwise adjusted so they hang plumb and true.
(4) Fixtures in finished spaces shall not be chain hung.
(5) Housing, trim, and lens frame shall be true, straight and parallel to each adjacent fixtures and features.
(6) Fixtures shall not be supported by ceiling acoustical panels.
(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.
(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.
(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.

j. Quality Control
(1) Foot candle measurements shall be taken after lamps have been in service for one-hundred (100) hours.
(a) Obtain measurements during periods of darkness at a sufficient number of locations to demonstrate that the design criteria have been met.
(b) Results shall be submitted to Owner.
(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.
(3) Test all emergency fixtures and exit signs under power failure conditions.
(4) Lighting Designer shall observe and direct Contractor in the field for final aiming of each adjustable fixture.
(a) Aiming shall occur after sunset, at a time designated by the Owner.
(b) All materials and labor necessary for the final aiming and adjusting shall be included in the Contractor’s base bid.
(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) 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.

(7) The Owner reserves the right to videotape each training session for use in future training programs.

(8) Training shall include:
   (a) A combination of classroom and field venues (all typical room types).
   (b) Complete overview of the entire system identifying specific features and operating descriptions.
   (c) Provide specific instructions on how to turn lights on, off, dim lights, etc. allowing for hands-on participation.
   (d) 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 shall bring minimum one (1) of each component to the training event so participants can “touch and hold” each device.
   (e) If the system includes daylight-harvesting functionality, provide a complete description of how the daylight-harvesting system works.
   (f) Provide detailed instructions and demonstrations on how to adjust, calibrate, program, troubleshoot, repair, and replace each sensor and major system component.
   (g) Provide detailed instructions and demonstrations on how to repair and troubleshoot individual luminaires.
   (h) For computerized systems, provide detailed system login, programming, reporting, and troubleshooting instructions.

3. Exterior Lighting
   a. Wiring for exterior light fixtures shall be installed in Schedule 40 PVC conduit, 2 inch minimum.
   b. Temporary lighting around the perimeter of the project shall be provided during major construction projects which have displaced exterior lighting.

4. Lighting Controls
   a. Design
      (1) Provide Sequence of Operation for manufacturer and Commissioning Agent use in verifying building operates as intended and designed.
      (2) Include provisions for post-occupancy retesting or verification by the Manufacturer for one (1) year after occupancy to ensure that all controls are still operating as intended.
      (3) All occupancy sensors shall be factory pre-set to vacancy sensor mode.
(4) Where dual-level or multi-level switching is provided, switches shall control the same lamp sets at each fixture.

(5) Project specific control layouts shall be included in the submittals. Include manufacturer’s layout demonstrating proper coverage areas and sensor types for the application.

(6) 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.

(7) Control Scenarios
(a) The following table provides examples of space control requirements. Review space types and verify control methods with Owner.

<table>
<thead>
<tr>
<th>SPACE TYPE</th>
<th>CONTROL TYPE</th>
<th>DURATION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>vacancy sensor (dt)</td>
<td>20 minutes</td>
<td>Teacher over-ride off, test mode on (1 hr.), dimming</td>
</tr>
<tr>
<td>Restroom</td>
<td>occupancy sensor (dt)</td>
<td>20 minutes</td>
<td>Ceiling only. No manual over-ride.</td>
</tr>
<tr>
<td>Office</td>
<td>vacancy sensor (dt)</td>
<td>10 minutes</td>
<td>Manual on. Potential for dual-level. Integrate w/ hvac</td>
</tr>
<tr>
<td>Mechanical</td>
<td>manual</td>
<td>n/a</td>
<td>Manual on/off only in mechanical areas</td>
</tr>
<tr>
<td>Conference</td>
<td>pre-set dimming</td>
<td>varies</td>
<td>Multi-zone, preset control. Possible a/v Interface.</td>
</tr>
<tr>
<td>Open Office</td>
<td>occupancy sensor</td>
<td>20 minutes</td>
<td>Provide adequate sf coverage pattern for area.</td>
</tr>
<tr>
<td>Corridor</td>
<td>occupancy sensor</td>
<td>20 minutes</td>
<td>Provide sensor at entry door 0001 aimed at door.</td>
</tr>
<tr>
<td>Lounge</td>
<td>programmable relay</td>
<td>varies</td>
<td>Time-clock function as set by owner</td>
</tr>
<tr>
<td>Storage</td>
<td>occupancy sensor</td>
<td>10 minutes</td>
<td>Manual on/ auto-off</td>
</tr>
</tbody>
</table>

b. Central Dimming Controls
(1) Provide startup, demonstration, and training for Owner’s personnel by a manufacturer’s representative. Minimum training time shall be four (4) hours.

c. Sensors
(1) Ceiling sensors shall be located minimum of 4 feet from supply air vent in order to avoid false trips.

G. COMMUNICATIONS
1. General
   a. Use removable fire-stopping pillows for cable tray penetrations.
   b. Telephone and miscellaneous signals shall be in conduit. Conduit systems may consist of rigid galvanized steel, IMC, EMT, or a combination of these as required by applicable codes and standards.

2. Telecommunication Pathways
   a. 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.
(1) Inside bending radius shall be at least six (6) times the inside conduit diameter for conduit 2 inches or less and at least ten (10) times the conduit diameter for conduit greater than 2 inches.

(2) Pull boxes shall be placed directly after a bend or sized accordingly if the pull box is located at the bend.

b. 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.

c. 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.

d. Rough-in box at secondary pathway destination shall be Randle Industries, Inc. 5 Square Telecommunications box, part number T-55017.

e. Fire rated pathways shall be:
   (1) Specified Technologies Inc. EZ-Path Fire Rated Pathways or approved equal.
   (2) Coordinate with Owner size of EZ-Path.
   (3) Utilize five (5) ganged pathway bracket in all telecommunications rooms. Part number EZP544W. Provide five (5) EXD44S Pathways at each bracket
   (4) Utilized for all interior Telecommunication Room primary cable pathways.
   (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 6A 40% FILL CABLES DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; caddy clip</td>
<td>35</td>
<td>24</td>
</tr>
<tr>
<td>1&quot; EMT conduit</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1 1/4&quot; EMT conduit</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>2&quot; EMT conduit</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>2 1/2&quot; EMT conduit</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>3&quot; EMT conduit</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>3 1/2&quot; EMT conduit</td>
<td>45</td>
<td>65</td>
</tr>
<tr>
<td>4&quot; EMT conduit</td>
<td>60</td>
<td>83</td>
</tr>
<tr>
<td>EZD44</td>
<td>45</td>
<td>156</td>
</tr>
<tr>
<td>2400 Wiremold</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4000 Wiremold</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>6000 Wiremold</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>6&quot; x 6&quot; Wireway</td>
<td>110</td>
<td></td>
</tr>
</tbody>
</table>
### 3. Grounding and Bonding

a. **Telecommunication Main Ground Busbar (TMGB)**
   - (1) Shall be Chatsworth Products Inc. ¾ inch x 4 inch x 20 inch, part number 40153-020

b. **Telecommunication Grounding Busbar (TGB) or approved equal.**
   - (1) Shall be Chatsworth Product Inc. ¾ inch x 4 inch x 12 inch, part number 40153-012

c. **Telecommunication Horizontal Rack Busbar**
   - (1) Chatsworth Product Inc. 3/16 inch x ¾ inch, part number 10610-019

d. **Bonding Conductors shall be insulated copper.**

e. **Flat, braided, aluminum ground straps shall be utilized for bonding sections of aluminum cable tray.**

f. **Bonding Conductor size shall be determined by NEC.**

g. **Interconnecting Bonding Conductor (IC)**
   - (1) Shall be insulated, copper, number 3/0 AWG referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications.

h. **Telecommunication Bonding Backbone (TBB)**
   - (1) Shall be insulated, copper, number 3/0 AWG.

i. **Equipment Bonding Conductor (EK)**
   - (1) Shall be green colored insulation, copper, number 6 AWG.

j. **Bonding Conductor Terminations**
   - (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.

   - (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.

### 4. Data and Voice Horizontal Infrastructure

a. **Horizontal station cable shall be one (1) of the following:**
(1) TE Connectivity TrueNet Category SE (CSeT) Plenum, Siamese cable. Manufacturer’s part number TN5ETPX2-WT01-A.
   (a) Construction shall be 24 AWG copper, FEP Teflon insulated solid copper conductors, Siamese-type (two [2] 4-pair groups), twisted pairs, unshielded, ripcord, with Natural colored, plenum rated, jacket, TIA/EIA category 5E, communications cable.

(2) TE Connectivity TrueNet Category SE Plenum cable, manufacturer’s part number TN5ESPN-BLII.
   (a) Construction shall be 24-4P UTP CMP SOL BC CAT 5E IP1 FEP/SRPVC Blue JKT AIRES TRUENET.

b. 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.

c. Support all cable such that they will not be damaged by normal building use.

d. Communications may share support superstructures with multiple utilities. Design superstructures to support the entire connected load.

e. Provide metallic conduit sleeves and nylon bushings for all floor and wall penetrations.

f. Horizontal cabling shall be continuous from the work area communication outlet to the distribution frame.

g. Cables shall not be installed or routed in any manner that violates the manufacturer’s specifications.

h. The following minimum bend radius and pulling tension shall be applied, unless the manufacturer’s requirements are more stringent:
   (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.
   (2) Maximum pulling tension is 50 pounds.

i. 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.

5. Fiber Optic and Copper Backbone and Riser Cable

   a. Premise Fiber Optic Cable Risers

   (1) Fiber Risers
   (a) Optical fiber riser cable must be Corning FREEDM Loose Tube Gel-Free Riser Cable. Strand count will be specified per project.
   i. Single mode application use OS2 SM
   ii. All fiber shall be installed as a home-run. No mid-span splices are allowed.
   iii. Provide a service loop of 10 feet (minimum) at both ends of the cable.
(2) Accepted Single Mode OS2 connector installation
   (a) Corning CCH Pigtail Cassette CCH-CS12-59-POORE.
   (b) Single-mode fiber shall be fusion spliced to the pre-assembled pigtail within the CCH-CS12-59-POORE cassette loaded with SC connectors.

(3) Accepted Single mode connectors for non-building riser fibers.
   (a) Corning UniCam SC High-Performance Connectors

(4) Accepted Fiber housings are
   (a) Corning Closet Connector Housing CCH
       i. The CCH is a one (1) piece enclosure.
   (b) Clearfield xPAK
       i. The xPAK Part Number 6PAK-SC fiber demarcation housing for fire panels and other similar applications.
   (c) Accepted Closet Connector Housing CCH Panels
       i. CCH-CP12-59

(5) Closet Connector Housing Panel Polarity Orientation
   (a) 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.

6. Outdoor Plant Fiber Optic Cable
   a. Single-mode fiber shall have a core diameter of 8.3 microns and cladding diameter of 125 microns. Maximum attenuation shall be:
      (1) 0.44 dB/Km @ 1310 nm
      (2) 0.35 dB/Km @ 1550 nm
      (3) Zero-dispersion wave length of 1310 nm + or - 10 nm
b. **Loose-tube Fiber Cable**
   1. Provide Corning ALTOS Loose-tube, gel-free cable, 24 F, Single mode (OS2), part number 024EU4-T4101D20.
   2. Suitable for underground (in conduit) and aerial installation.
   3. Cable sheath rated and marked OFNR for riser applications per NEC.
   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.
   5. Six (6) or twelve (12) fibers per buffer tube.
   6. Use standard color codes on sub-buffers per current EIA/TIA 598.

7. **Copper**
   a. Copper riser cable shall be specified per project by Owner.
   b. 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.
   c. Copper riser will be rated for the environment in which installed.
   d. Accepted copper splice connecting hardware shall be 3M or AT&T.
   e. Splice connecting hardware shall be 25 pair modular connectors specifically designed for straight splicing applications.
   f. Splice modules shall be designed to accommodate splicing of 22 - 26 AWG solid copper conductors having Polyvinyl Chloride (PVC) or Polyethylene (PE) insulation.
   g. 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.
   h. Accepted copper splice closures shall be 3M. Coordinate size with Owner.

8. **CATV Distribution and Horizontal Infrastructure**
   a. Horizontal drop cable shall be plenum-rated 75Ω Series 6. Horizontal drop lengths shall not exceed 295 feet over Series 6 (see note below under Cable Type).
   b. Horizontal cabling between Telecommunications Rooms and outlet/drop locations shall be made as individual home runs. Intermediate splices or couplings are not allowed.
   c. 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.
   d. Label all horizontal drops with outlet location and run length.
   e. Distribution feeds less than 500 feet shall be plenum rated, 75Ω Series 11.
   f. 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.
   g. All F-Connectors and will be hand tightened and then torqued to 20 pounds/inch.
h. The Contractor shall ensure that the CATV System meets or exceeds the following system design criteria at any and all CATV System drops:

1. Minimal Signal level range at required.
2. Analog marker channels 2, 78 and 120 will be 6dBmV+/- 4 dBmV.
3. Carrier to noise ratio shall be 43 dB (minimum).
4. Humidity shall be 1 percent.

i. Cable Type

1. Horizontal Non-Plenum <=295 feet Series 6 – Commscope 5727 Belden – Snap-n-Seal SNS1P6 (Compression Connector).
2. Horizontal Plenum <=295 feet Series 6 – Commscope 2276V WHRL Belden – Snap-n-Seal SNS6PLA.
3. Closet Risers <=500 feet – Non-Plenum – Series 11 Belden 1617A Belden Snap-n-Seal SNS11AS.
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.

H. ELECTRONIC SAFETY AND SECURITY

1. Electronic Access Control and Security (AMAG)

a. Electronic Access

1. Emergency locking push-button switches shall be manufactured by Safety Technology International, series 2000 and custom labeled ‘PUSH TO LOCK DOOR’.
2. Vendor identification information is permitted only on access control system panels.
3. UL or WH fire-rated doors or frames shall not be modified as to void the label or fire-rating.
4. 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.
5. System startup and training
   (a) Contractor shall conduct a 100 percent device check-out prior to Owner’s demonstration and training.
   (b) Record drawings shall be provided to the Owner prior to Owner’s demonstration and training.
   (c) Contractor and Owner shall review the project for the following
      i. Security Management System room layout and installations
      ii. Hardware and programming set-up and installation
iii. System overview
iv. Owner training requirements
v. Provide a minimum two (2) eight (8) hour sessions.

(6) The Security Management System (SMS) equipment room shall have ¾ inch sanded walls, one (1) side fire-rated plywood with a painted finish.

(a) Owner provided Ethernet port shall be located on the wall adjacent to the Database Unit cabinet.

(7) Equipment shall be installed in location and manner to allow convenient access for maintenance and inspection.

(8) SMS Equipment and Devices

(a) AMAG panels shall be model 2150
(b) All SMS power supplies require 120 volt power from dedicated circuits.
(c) Communication cables shall be in a yellow jacket when used for openings requiring card readers, plenum-rated, and continuously labeled ‘Access Control Cable’, similar to CSC model number 112115. Cabling for openings requiring only door monitoring shall be labeled at all entry and exit points of cable trays and shall be similar to CSC model number 110200.
(d) If conduit capacity is filled to more than 60 percent, installation of a same-sized conduit is required.
(e) When cable trays are not available or have inadequate capacity, J-hooks (spaced at a maximum of 4 feet) or conduit may be used. When cable is in occupied visible space it shall be in conduit.
(f) Exposed conduit in occupied spaces shall be painted to match adjacent surfaces.
(g) If existing pull strings are used they shall be replaced or retied as necessary.
(h) Conduit shall be minimum ¾ inch with pull boxes every 50 feet at minimum.
(i) J-hook route shall be used to route around the ITS closet if door is not scheduled for AMAG installation.
(j) All building access control points, excluding elevators, shall have a storeroom/night latch function lock with key override, which shall be keyed under the Owner access control override master key system.
(k) All component hardware shall be 24 volt.
(l) Electronic mortise locks and panic devices shall have a keyed cylinder and be fail-secure on all exterior doors.
(m) Panic devices shall utilize electronic trim, and when required to integrate with power door operators, shall have electronic latch retraction.

(n) When integral hardware request to exit switches are not feasible, motion detectors similar to Bosch DS160 series shall be utilized.

(o) Door position switches for steel doors shall be 1 inch diameter recessed, similar to GRI model number 184-12.

(p) 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.

(q) Power transfers shall be Securitron CEPT-10, unless existing conditions make it unfeasible or cost-prohibitive and electric hinges or door loops are required.

(r) Card readers shall be HID RP40 proximity type wall-mount or HID RP15 micro-proximity frame-mount.
   i. Color shall be charcoal gray.
   ii. Mounting height shall be 36 inches AFF to centerline.
   iii. WIMs shall be provided.

(s) The green and red LEDs on the prox 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.

(t) Devices shall be wired such that the system can differentiate between a trouble signal and a cut wire.

(u) Hand geometry readers shall be Schlage Recognition Systems HKCR Handkey with enrollment stations as necessary.

(v) Elevator readers shall be located in the cab instead of the lobby.

(w) Elevator nodes shall be located in the elevator equipment room.

(x) Door position switches for wood doors shall be 3/8 inch diameter recessed, similar to GRI model 2020-12.

(y) Power supplies for electric latch retraction panic devices shall have battery backup, provided and installed by the Contractor.

(z) Maintenance access to power supply shall not interfere with door operation.

(aa) Power supplies other than for electric latch retraction panic devices shall be manufactured by Securitron BPSM-24-10 with B-24-4 battery backup and shall be Contractor provided.

(bb) Plug-in transformers shall be located at the security control panels. Secure all low-voltage plug-in transformers to outlet with screw or strap.

(9) Renovations and additions shall use the Owner's existing software license.
b. Video Surveillance Systems
(1) Cameras/video equipment shall be furnished and installed by ITS. Responsibilities shall be clearly defined on the Project Documents – the scope of work by the Contractor and the scope of work by ITS.
   (a) Conduit work shall be by Contractor.
   (b) Cabling and installation of cameras shall be by ITS.
(2) Cameras shall be IP cameras manufactured by Axis.
(3) Cameras shall be compatible with the current edition of the Milestone software.
(4) Cameras shall be fixed or Pan, Tilt and Zoom (PTZ), depending on the application.
(5) A data jack, Cat 5E or greater, shall be provided for each IP camera installed back to an ITS closet.
c. Security alarm/intrusion alarm systems
(1) See Section III for information.

2. Fire Alarm and Detection Systems
a. General
(1) Finished back boxes shall be provided by equipment supplier for any surface-mounted pull stations or signaling devices.
(2) All detection devices shall be placed in easily accessible locations. Smoke, heat, audio visual devices, etc. shall be mounted on solid surfaces.
(3) Contractor 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. The Contractor shall coordinate with Department of Public Safety if off-site reporting is required. The Contractor shall follow the Fire Safety acceptance testing procedures noted in the Fire Alarm and Detection Specification.
(4) The building shall be 100 percent tested with Fire Safety prior to project completion.
b. Fire Alarm Control Panels (FACP)
(1) Coordinate FACP location with local authority having jurisdiction and Owner.
(2) All new FACP shall be Simplex 4100ES. University Housing projects shall use Notifier 3030. No other substitutions shall be allowed.
(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.
(4) Panel door locks shall be front mounted.
(5) Fire alarm panel shall be an intelligent analog system with voice.
(6) Top of FACP shall be 6 feet AFF and shall have minimum 2 feet clearance on each side.
(7) When multiple FACP are required, set panels 6 inches apart while maintaining 2 feet clearance on each side.

(8) Provide Owner all hardware devices and software for off-line programming, complete with manuals and software files.

(9) Provide locking breaker on 120 volt AC power source and label “Fire Alarm”.

(10) Fire alarm control panel power shall be supplied dedicated circuit(s).

(11) Single pole, 120/277V switch shall be installed within the fire alarm control panel to disconnect all battery power.

(12) A duplex receptacle, on a circuit separate from the fire alarm panel, shall be installed under the main fire alarm control panel.

(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.

(14) Coordinate location with Sprinkler System Fire Department Connection.

c. Releasing Panels

(1) Releasing panel shall be Simplex 4100ES.

(2) Separate Simplex 4100ES releasing panel is required for releasing other than sprinkler systems, such as Novec 1230.

d. Initiation Devices

(1) Pull Stations

(a) Pull stations shall be Simplex 4099-9020.

(2) Smoke Detectors

(a) Smoke detectors shall not be located within 3 feet of an air vent.

(3) Duct Detectors

(a) 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.

e. Annunciation Devices

(1) General

(a) Contractor shall not mount a separate visual device and separate speaker side-by-side.

(2) Strobe Devices

(a) 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.

(3) Fire Department Connection Horn Strobe

(a) Provide Potter Sash 24 number 1000055 Sprinkler / Siren Strobe

(b) Locate directly above the fire department sprinkler connection on the exterior of the building.

f. Other Devices
(1) See Section III for information.

g. Raceways, Boxes and Cables
(1) Conventional wiring shall be solid, THHN.
(2) Insulate all grounding shields with 3M number 130C rubber tape.
(3) Junction and pull boxes shall be a minimum size of 4 11/16 inches square x 2 1/8 inches deep.
(4) Fire alarm and detection conduits shall be red.
(5) Line voltage (120 volt AC) shall be run in separate conduit.
(6) Spare conductors shall not be allowed in conduit or junction boxes.
(7) Surface wireway is prohibited.
(8) Box extensions shall not be permitted on new systems.
(9) Splicing shall not be allowed in device mounting boxes.
(10) Wiring size and color shall be per the Owner’s specifications.

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 1/2" PLUS TOTAL STATIC PRESSURE

**DRAIN PAN TRAP DETAIL FOR BLOW-THRU UNIT**

"H" DIMENSION TO BE MINIMUM OF 1/2" PLUS TOTAL STATIC PRESSURE
**BUILDING FIRE ALARM SYSTEM DETAILS**

<table>
<thead>
<tr>
<th>Building Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SIMPLEX 4100 U</strong></td>
</tr>
<tr>
<td>Adler Journalism and Mass Communication Building</td>
</tr>
<tr>
<td>Art Building West</td>
</tr>
<tr>
<td>Beckwith Boat House</td>
</tr>
<tr>
<td>Boyd Law Building</td>
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<tr>
<td>Cambus Maintenance Facility</td>
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<tr>
<td>Campus Recreation and Wellness Center</td>
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<tr>
<td>Carver-Hawkeye Arena</td>
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<tr>
<td>Chemistry Building</td>
</tr>
<tr>
<td>Chilled Water Plant 2 (West)</td>
</tr>
<tr>
<td>111 Church St</td>
</tr>
<tr>
<td>700 S. Clinton St.</td>
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<tr>
<td>College of Public Health Building</td>
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<tr>
<td>Communications Center</td>
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<tr>
<td>Dental Science Building (West Wing)</td>
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<td>Eckstein Medical Research Building</td>
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<tr>
<td>Engineering Research Facility</td>
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<tr>
<td>English Philosophy Building</td>
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<tr>
<td>Gilmore Hall</td>
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<tr>
<td>Hancher, Voxman, Clapp</td>
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<tr>
<td>Hardin Library for Health Sciences</td>
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<tr>
<td>Pappajohn Biomedical Discovery Building</td>
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<tr>
<td>Hydraulics Wave Basin Facility</td>
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<td>Iowa Memorial Union</td>
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<tr>
<td>Jefferson Building</td>
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<td>Jessup Hall</td>
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<td>Kinnick Stadium</td>
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<td>Library (Main)</td>
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<td>Lindquist Center South</td>
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<tr>
<td>Lindquist Center North</td>
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<tr>
<td>Maclean Hall</td>
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<tr>
<td>Madison Street Services Building</td>
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<tr>
<td>Medical Laboratories</td>
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<tr>
<td>Music West - Interim Building</td>
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<tr>
<td>Nursing Building</td>
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<tr>
<td>Information Technology Facility</td>
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<tr>
<td>Oakdale Environmental Management Facility</td>
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<tr>
<td>Oakdale Power Plant</td>
</tr>
<tr>
<td>Multi Tenant Facility (Pod A-B)</td>
</tr>
</tbody>
</table>
# Building Fire Alarm System Details

## Simplex 4100 U
- State Hygienic Laboratory
- Stuit Hall
- Phillips Hall
- Pomerantz Center
- Power Plant
- Recreation Building
- Riverside Recital Hall (St. Thomas Moore)
- Studio-Arts
- Seashore Hall
- Spence Labs
- Theatre Building
- University Capitol Center
- University Services Building
- Van Allen Hall

## Simplex Zone Panels
- Medical Research Center
- North Campus Parking and Chilled Water Facility
- Oakdale Studio A
- Substation U
- Substation L

## Notifier AFP200's
- Art Building
- Becker Communication Studies Building
- Calvin Hall
- Carver River Research and Education Facility
- Dey House
- Halsey Hall
- Hospital Parking Ramp 1
- Hospital Parking Ramp 2
- Hospital Parking Ramp 3 will be changed to a Simplex 06/12
- Mossman Business Services Building
- Melrose Avenue Parking Facility
- Newton Road Ramp
- Oakdale Waste Storage Facility (at Oakdale Environmental Management Facility)
- Institute for Rural and Environmental Health
- Laundry
## BUILDING FIRE ALARM SYSTEM DETAILS

<table>
<thead>
<tr>
<th>NOTIFIER AFP200’S</th>
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<tbody>
<tr>
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<td>MULTI TENANT FACILITY (POD D)</td>
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<tr>
<td>MULTI TENANT FACILITY (POD E)</td>
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<tr>
<td>2556 CROSSPARK ROAD</td>
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<tr>
<td>2660 CROSSPARK ROAD</td>
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<tr>
<td>PHYSIOLOGY RESEARCH LABORATORY</td>
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<tr>
<td>TECHNOLOGY INNOVATION CENTER</td>
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<tr>
<td>109 RIVER STREET</td>
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<td>SHAMBAUGH HOUSE</td>
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<tr>
<td>SOUTH QUAD</td>
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<tr>
<td>WATER PLANT</td>
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<tr>
<th>NOTIFIER ZONE PANELS</th>
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<tr>
<td>WOMEN’ RESOURCE AND ACTION CENTER</td>
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<tr>
<th>NOTIFIER AFP400’S</th>
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<tbody>
<tr>
<td>OAKDALE NATIONAL ADVANCED DRIVING SIMULATOR</td>
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<tr>
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<tr>
<td>OLD CAPITOL</td>
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<tr>
<th>NOTIFIER AFP1010</th>
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<tbody>
<tr>
<td>Gerdin Athletic Learning Center</td>
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<tr>
<td>Blank Honors Center</td>
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<tr>
<td>Karro Athletic Hall of Fame</td>
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<tr>
<td>MacBride Hall</td>
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<tr>
<td>Medical Research Facility</td>
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<tr>
<td>Hawkeye Tennis and Recreation Complex</td>
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<td>Trowbridge Hall</td>
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<tr>
<td>Wendell Johnson Speech and Hearing Center</td>
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<tr>
<th>NOTIFIER AFP2020</th>
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<tbody>
<tr>
<td>Sciences Library</td>
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<tr>
<td>Biology Building East</td>
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<tr>
<td>Biology Building (Old)</td>
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<tr>
<td>Bowen Science Building</td>
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<tr>
<td>Carver Biomedical Research Building</td>
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<tr>
<td>Dental Science Building</td>
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<tr>
<td>Field House</td>
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<tr>
<td>Hydraulics Laboratory</td>
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<td>Iowa Advanced Technology Laboratories</td>
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<tr>
<td>Medical Education Building</td>
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## BUILDING FIRE ALARM SYSTEM DETAILS

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<th>NOTIFIER AFP2020</th>
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<tbody>
<tr>
<td>NORTH HALL</td>
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<tr>
<td>PAPPAYN BUSINESS BUILDING</td>
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<td>PHARMACY BUILDING</td>
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<td>SCHAEFFER HALL</td>
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<th>EDWARDS EST-3</th>
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<tbody>
<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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</tbody>
</table>
CHILLED WATER COIL (CC) PIPING DETAIL

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.
NOTE: NO WELDING OF SS THREADED RODS OR ROD COUPLINGS IS ALLOWED.
CHILLED, DOMESTIC AND FIRE PROTECTION WATER
FLOOR PENETRATION AND ANCHOR DETAIL

3/4" 304 STAINLESS STEEL RODS
ANCHORED THROUGH WALL
(4 REQ'D FOR 8" PIPE OF LARGER)

One PIECE CONSTRUCTION FACTORY
INSTALLED 125# FLANGE X PLAIN END PIPE.

DIP - ONE PIECE CONSTRUCTION
FACTORY INSTALLED 125# FLANGE

LINK SEAL
CONCRETE

CORE DRILLED OR
SLEEVED HOLE

CONCRETE FLOOR
MEGA LUG W/ THRUST BLOCK
DESIGNED BY: ENGINEER

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

APPENDICES
Automatic air vent model #813 Watson-McDaniel Air Eliminator, ¾" NPT and ball valve. Install at high point inside building.

Isolation valve.

Pressure gauge, ¼" NPT and ball valve.

Pressure transmitter, Foxboro Model IGP10-A22DIF ⅜" NPT and ⅜" NPT ball valve.

Stainless steel temperature gauge to be ⅜" NPT, 5" Face, Everyangle, 30°F – 130°F ASHCROFT or equivalent. ¼" NPT stainless steel well to penetrate halfway through pipe.

Temperature transmitter with ⅜" NPT stainless steel well, ABB controls, model TTH30 transmitter, with Pyromation 4 wire, 100 OHM Platinum RTD. Well to penetrate halfway through pipe.

⅜" NPT vent ball valve and cap

⅜" NPT drain valve, ball valve and cap

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 readout in 100’s. Mount strainer inverted, with bottom insertion.

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.

Pipe bridge size to match control valve, minimum length to be 7 pipe diameters.

Chilled water building pump (to be approved by the Owner.)

Provide one Veris Industries H908 current switch for each chilled water pump to provide monitoring by the PLC.

This pipe section is to match larger diameter of meter or valve. Add reducer/increaser if necessary to match smaller device.

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.)
Automatic air vent model #813 Watson-McDaniel Air Eliminator, ¾” NPT and ball valve. Install at high point inside building.

Isolation valve.

Pressure gauge, ¾” NPT and ball valve.

Pressure transmitter, Foxboro Model IGP10-A22DIF ½” NPT and ¾” NPT ball valve.

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.

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.

¾” NPT vent ball valve and cap

¾” NPT drain valve, ball valve and cap

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.

Normally open, ___” diameter control valve, V notchtype with electric motor operator, 4-20mA signal with position feedback. Valve to be KTM with EPI2 Keystone actuator with mounting bracket.

Pipe bridge size to match control valve, minimum length to be 7 pipe diameters.

Chilled water building pump (to be approved by the Owner.)

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.
# 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>
</tr>
</thead>
<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>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>Leviton</td>
</tr>
<tr>
<td>Wall Switch</td>
<td>PASSIVE INFRARED</td>
<td>SM. Private Office, SM. Conference Room, Break Room, Storage Closet</td>
<td>900</td>
<td>Wattstopper</td>
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<td></td>
<td></td>
<td>625</td>
<td>Leviton</td>
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<tr>
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<td>900</td>
<td>Hubbell</td>
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<tr>
<td>Wall Switch</td>
<td>PASSIVE INFRARED</td>
<td>LG. Private Office, Conference Room, Break Room, Storage Closet</td>
<td>1000</td>
<td>Wattstopper</td>
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<td></td>
<td></td>
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<td>2100</td>
<td>Leviton</td>
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<td>1200</td>
<td>Hubbell</td>
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<td>Ceiling or Wall Mounted</td>
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<td>LG. Office, Conference Room, Computer Room, Open Office</td>
<td>2000</td>
<td>Wattstopper</td>
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<td>Hubbell</td>
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<td>120 L.F.</td>
<td>Hubbell</td>
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<td>Ceiling or Wall Mounted</td>
<td>PASSIVE INFRARED</td>
<td>Gymnasium, Open Offices</td>
<td>500</td>
<td>Wattstopper</td>
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<tr>
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<td>450</td>
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<td>600</td>
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<td>Wall Mounted</td>
<td>PASSIVE INFRARED</td>
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<td>2500</td>
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<td>3100</td>
<td>Hubbell</td>
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DIFFERENTIAL PRESSURE TRANSDUCER
(ACROSS CHILLED WATER DELTA P VALUE) DETAIL

- BALL VALVE (TYP)
- PETE'S PLUG (TYP)
- DELTA P VALVE
- MUST BE INSTALLED HORIZONTALLY TO VALVE NETWORK

FLOW

P-1, P-2, P-3
(PETE'S PLUG)
DIFFERENTIAL PRESSURE TRANSDUCER
(ACROSS SUPPLY AND RETURN MAINS) DETAIL

- Ball Valve (Typ)
- Pete's Plug (Typ)
- Union (Typ)

DPT MUST BE INSTALLED HORIZONTAL TO VALVE NETWORK

Supply Main

Return Main
DU PLEX BACKFLOW PREVENTER STATION DETAIL

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
END OF MAIN DRIP STATION PIPING (BUILDING) DETAIL

- Last Branch Take Off
- Main Steam Supply Line
- Condensate Return Line
- Concentric Reducer
- 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
## ENERGY IMPACT STATEMENT

### Building Energy Summary:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SD</th>
<th>DD</th>
<th>CD</th>
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</thead>
<tbody>
<tr>
<td>Project Affected Gross Area (GSF)</td>
<td></td>
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</tr>
<tr>
<td>Annual Total Building Energy Use (MMBtu/year)</td>
<td></td>
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</tr>
<tr>
<td>Annual Total Building Energy Use per GSF (Btu/year/GSF)</td>
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### Energy Statistics:

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<tr>
<th>Parameter</th>
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<td>Maximum Demand (kW)</td>
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<td>Annual Consumption (kWh)</td>
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<td>Lighting (kWh)</td>
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<td>HVAC (kWh)</td>
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<td>Misc. Equipment (kWh)</td>
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<td>Engine Size (bhp or kW)</td>
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<td><strong>Low Pressure Steam</strong></td>
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<td>Summer Peak Load (lbs/hr)</td>
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<td>Winter Peak Load (lbs/hr)</td>
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<tr>
<td>Annual Consumption (MMBtu/yr)</td>
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<td>Heating (MMBtu/yr)</td>
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<td>Humidification (MMBtu/yr)</td>
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<td>Air Conditioning (MMBtu/yr)</td>
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<tr>
<td>Domestic Water Heating (MMBtu/yr)</td>
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<td>Not req'd</td>
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<tr>
<td>Process (MMBtu/yr)</td>
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<tr>
<td><strong>High Pressure Steam</strong></td>
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<tr>
<td>Summer Peak Load (lbs/hr)</td>
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<td>Not req'd</td>
</tr>
<tr>
<td>Winter Peak Load (lbs/hr)</td>
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<td>Not req'd</td>
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<tr>
<td>Annual Consumption (MMBtu/yr)</td>
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<td><strong>Chilled Water</strong></td>
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<td>Summer Peak Load (tons/hr)</td>
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<tr>
<td>Winter Peak Load (tons/hr)</td>
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<td>Annual Consumption (MMBtu/hr)</td>
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<td><strong>Domestic Cold Water</strong></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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<td>Sanitary Sewer (Mil gal/yr)</td>
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<td>Cooling Tower Evap. (Mil gal/yr)</td>
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<tr>
<td>Cooling Tower Blowdown (Mil gal/yr)</td>
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<td><strong>Domestic Hot Water</strong></td>
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<td>Peak Demand (GPM)</td>
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<tr>
<td>Annual Consumption (Mil gal/yr)</td>
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<td>Peak Demand (Therms/hr)</td>
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<td>Annual Consumption (Therms/yr)</td>
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<td><strong>Storm Drainage System</strong></td>
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<td>Design Storm Peak Volume (GPM)</td>
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</table>
FUMEHOOD INSTALLATION DETAIL

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 FUME HOOD 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.

APPENDICES 241
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. 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.
PRESSURE GAUGE ASSEMBLY (TYP.)

VENT TO OUTSIDE

RELIEF VALVE
SET PRESSURE BELOW MAXIMUM ALLOWABLE WORKING PRESSURE OF HX.

TO FLOOR DRAIN

HOT WATER RETURN

HOT WATER SUPPLY

STEAM SUPPLY

GATE VALVE

STRAINER ASSEMBLY (TYP.)

ECCENTRIC REDUCER (TYP.)

UNION (TYP.)

CONTROL VALVE (N.C.)

VACUUM BREAKER

CONDENSATE RETURN LINE

CHECK VALVE

1/2" TEST STATION ASSEMBLY

STEAM TRAP

BALL VALVE

DRIP LEG

APPENDICES 243
HOT WATER PREHEAT 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.
HYDRANT DETAIL

HYDRANT (MUELLER SUPER CENTURION 250, FEDERAL SAFETY YELLOW, MODEL A-423 OPEN RIGHT, 6" D 150 SHOE)

COVER GRAVEL WITH 4 MIL PLASTIC SHEETING

SIDEWALK WORD "WATER"

CONFORM TO MANUFACTURER'S SPECIFICATIONS AS REQUIRED

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

TRENCH BACKFILL

DEEP AS SPECIFIED

5'-4" MINIMUM

TO CONFORM TO MANUFACTURER'S SPECIFICATIONS

FACE PUMPER NOZZLE TOWARDS STREET OR MAIN SIDEWALK

ADJUSTABLE CAST IRON VALVE BOX

3' RADIAL CLEAR SPACE

MAIN TRENCH

THRUST BLOCK

WATER MAIN

AS REQ'D 6'-0"

5" GATE VALVE

12" SAND ENVELOPE

245
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.

\[
\text{Riser Height \over 2.31} + 5 \text{ psi} = \text{Expansion tank bladder charge pressure}
\]

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 shall also be the pressure set for the automatic fill valve on the system.
FIGURE 1 – SIGN LOCATION PLAN
## INTERIOR SIGNAGE DETAILS

<table>
<thead>
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<th>Sign Type</th>
<th>Message</th>
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<td>To Front Row</td>
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<td>Wheelchair Seating</td>
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<td>N130</td>
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</table>

**FIGURE 2 – SIGN SCHEDULE**
INTERIOR SIGNAGE DETAILS

EXHIBIT 1 — SIGN TYPE DIRECTORY

EXHIBIT 2 — SIGN TYPE ELEVATOR DIRECTORY
INTERIOR SIGNAGE DETAILS

Biomedical Research Group
David Smith, Professor
Robert Jones, Research Assistant, W304
Susan Miller, Research Assistant, W315
David Smith, Professor, W304

EXHIBIT 3 – SIGN TYPE DEPARTMENT DIRECTORY

W 302-323
Professor
David Smith's Research Group

David Smith W304
Robert Jones W306
Susan Miller W315

EXHIBIT 4 – SIGN TYPE DEPARTMENT DIRECTORY
INTERIOR SIGNAGE DETAILS

EXHIBIT 5 – SIGN TYPE OVERHEAD DIRECTIONAL

EXHIBIT 6 – SIGN TYPE WALL MOUNT DIRECTIONAL

LEVEL 4

← Oral & Maxillofacial Surgery
← Periodontic Dentistry
← Prosthodontic Dentistry
↑ Clinic Administration
↑ Restroom

(single changeable insert)

APPENDICES

251
INTERIOR SIGNAGE DETAILS

Level 4

- Oral & Maxillofacial Surgery
- Periodontic Dentistry
- Prosthodontic Dentistry
- Clinic Administration
- Restroom

Individual modular inserts

Exhibit 7 - Sign Type Wall Mount Directional

Level 4

Map on single changeable insert

Exhibit 8 - Sign Type Wall Mount Directional

APPENDICES 252
INTERIOR SIGNAGE DETAILS

EXHIBIT 9 – SIGN TYPE PROJECTING FLAG IDENTIFICATION

EXHIBIT 10 – SIGN TYPE DEPARTMENT IDENTIFICATION PLAQUE
INTERIOR SIGNAGE DETAILS

EXHIBIT 11 – SIGN TYPE ROOM NUMBER

EXHIBIT 12 – SIGN TYPE ROOM IDENTIFICATION
INTERIOR SIGNAGE DETAILS

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

EXHIBIT 16A – SIGN TYPE MULTIPLE SYMBOL IDENTIFICATION
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
# 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>Classrooms, meeting rooms</td>
<td>Finelite, Focal Point, Linear Lighting, A-Light</td>
</tr>
<tr>
<td>Linear white board light</td>
<td>Corridors, lobbies, 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>
</tr>
<tr>
<td>Indirect cove lighting (strip w/ reflector)</td>
<td>Corridors, lobbies, restrooms</td>
<td>Nu-lite, Williams, Birchwood</td>
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<tr>
<td>Industrial turret</td>
<td>Mechanical/ Utility areas</td>
<td>Columbia, Lithonia, Williams</td>
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<tr>
<td>Fluorescent high bay</td>
<td>Mechanical, storage, sports areas</td>
<td>ILP, Holophane, Lithonia, Williams</td>
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<tr>
<td>Industrial, harsh environment</td>
<td>Mechanical/ Utility areas</td>
<td>Kurtzon, Rig-a-Lite, Paramount</td>
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<td>Linear indirect, indirect/ direct, direct (steel)</td>
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<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>
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</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>
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<tr>
<td>Lensed wall wash (LED)</td>
<td>Corridor, lobbies, conference rooms</td>
<td>USAI, Kurt Versen, Lightolier, Pathway</td>
</tr>
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Fixtures no longer allowed:
- Compact fluorescent downlights
- Halogen (MR16) accent or downlights

## EXIT SIGNS AND EMERGENCY LIGHTING

<table>
<thead>
<tr>
<th>GENERIC FIXTURE DESCRIPTION</th>
<th>TYPICAL LOCATION</th>
<th>RECOMMENDED MANUFACTURERS</th>
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<tbody>
<tr>
<td>Thermoplastic exit sign (universal mounting)</td>
<td></td>
<td>Dual-lite, Emergilight, Lithonia</td>
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<tr>
<td>Cast aluminum exit sign (universal mounting)</td>
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<tr>
<td>Edge lit exit sign (ceiling or wall)</td>
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<td>Dual-lite, Emergilight, Lithonia</td>
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<tr>
<td>Emergency lighting (LED only)</td>
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<td>Dual-lite, Lithonia</td>
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<td>Emergency lighting (LED only)</td>
<td>Harsh environments</td>
<td>Kenall, Emergilight</td>
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<tr>
<td>Small inverters (lighting loads)</td>
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<td>Dual-lite, Perfect Power Systems</td>
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APPENDICES 260
## Lockset Types by Building Details

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<thead>
<tr>
<th>Building</th>
<th>Lockset-Type</th>
<th>Trim</th>
<th>Finish</th>
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<td>Art Building West</td>
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## LOCKSET TYPES BY BUILDING DETAILS

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POST AND CHAIN FENCE DETAILS

**Single Chain**

NOTE: POST HEIGHT & CHAIN SAG TEMPLATES TO BE USED

**Double Chain**
PRESSURE GAUGE INSTALLATION DETAIL

INSULATION

PIECE

PRESSURE SNUBBER

SYPHON STEAM ONLY

GAUGE COCK

NIPPLE LENGTH TO ALLOW FOR INSULATION

1/4" HALF COUPLING
1. Control valve to be wafer style Cashco Ranger.
2. Block valves to be gate valves:
   a. 2” and smaller – Powell Model #2377;
   b. Larger than 2” – Welded steel.
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..
STEAM PREHEAT COIL WITH INTERNAL FACE
AND BY-PASS DAMPERS DETAIL

UNIT S 3,000 CFM AND ABOVE
MUST USE A 1/2 - 3/4
STEAM VALVE ARRANGEMENT

1/2" VACUUM BREAKER
HOFFMAN #62
(ON OR NEAR COIL)

1/2" VACUUM BREAKER
HOFFMAN #62

INTERNAL FACE &
BY-PASS DAMPERS

PITCH LINE
DOWN FROM
CONTROL
VALVE

PRESSURE
GAUGE

PRESSURE
SENSOR

CONTROL
VALVE
N.O.

STRAINER
WITH
BLOW DOWN
VALVE & CAP.

STEAM TRAP
ASSEMBLY WITH
BY-PASS LINE.

STEAM SUPPLY

PROVIDE END OF
MAIN Drip
ASSEMBLY.

NOTE:
STRAINER WITH
SLOW DOWN VALVE & CAP.
STEAM TRAP ASSEMBLY WITH
BY-PASS LINE.

16" MIN.

6" MIN.

CONDENSATE LINE FROM
COIL TO TRAP INLET TO
BE FULL SIZE OF CONNECTION.

1/2" TEST STATION

CONDENSATE RETURN
GRAVITY FEED TO
CONDENSATE RECEIVER

Notes:
1. Install piping to allow for ease of coil removal.
STEAM PRESSURE TAPS DETAIL

3/4 Inch Thread-O-Let

4 Pipe Diameters

3 Pipe Diameters

Flow

Steam Service
Notes:
1. All fittings shall be 3000#.
2. Refer to standards for drip-leg specifications
3. No welded fittings allowed on trapping stations.
4. No bypass around steam traps.
5. No welded fittings.
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.

To primary cable tray or pull box

Install pull strings

J-hooks or cable tray in corridor ceiling space

To primary cable tray or pull box

Install pull strings

Floor
NOTE:
Mount bracket to wall vertically.
VAV TERMINAL CLEARANCE INSTALLATION DETAIL

- 3 STRAIGHT DIA. OR VAV INLET SIZE
- 18" MIN CLEAR SPACE
- SLIP AND DRIVE CLEAT CONNECTION
- REHEAT COIL
- ACCESS DOOR WITH CAM LOCKS SIZE TO BE 2" LESS THAN DUCT WIDTH SQUARE (MAX 18 x 18)

SIDE VIEW

- (S/E) VAV TERMINAL CONTROL ENCLOSURE
- SHAFT
- 18" MIN CLEAR SPACE

TOP VIEW

- SLIP AND DRIVE CLEAT CONNECTION
- REHEAT COIL
- ACCESS DOOR WITH CAM LOCKS SIZE TO BE 2" LESS THAN DUCT WIDTH SQUARE (MAX 18 x 18)
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.
NOTES
1 ACTUATOR
2 DAMPER
3 HVAC DUCT
4 SLEEVE, 16 GAUGE
5 CAULKING MATERIAL
   (MAY BE ON EITHER SIDE OF DAMPER FRAME.)
6 MOUNTING ANGLES
   1-1/2" X 1-1/2" X 20 GAUGE (MINIMUM)
7 S-JOINT/DUCT MATE, SLEEVE TO DUCT CONNECTION (BREAK-AWAY)
8 PROVIDE ACCESS DOOR(S) TO ALL INTERNAL COMPONENTS
   AND TO PROVIDE VISUAL INSPECTION.
CHANGE REQUEST FORM

This form shall be used to request a change to the UI Design Standards & Procedures manual. Please complete and return via e-mail for further consideration:

Facilities Management – Design Standards & Procedures
Attn: Mary Rue
200 USB
Iowa City, IA 52242
mary-rue@uiowa.edu

First and Last Name: ___________________________ Date: ____________

Company Name: ____________________________________________________________________________

Email address: _____________________________ Phone: ____________________________

Section and Page #: ________________________________

Change suggested: 

Please use additional paper or the back of this form in order to provide as much detail as possible.

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Justification:

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DEVIATION REQUEST FORM

The Design Professionals shall use this form to request a deviation from the UI Design Standards & Procedures prior to bidding the project. Please complete and return via e-mail to UI PM in .pdf format.

First and Last Name: ___________________________ Date: __________

Company Name: ________________________________________________

Email address: __________________________________________ Phone: ______________

Project Name: __________________________________________________

UI Project #: ______________________ UI Project Manager Name: ______________________

Description of Deviation, Section, and Page #:

________________________________________________________________________
________________________________________________________________________
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Justification:

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Attachment List:

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PD&C PM Approval  B&LS Approval  U&EM Approval  Other Approval

Recommended  Recommended  Recommended  Recommended
Recommended as Noted  Recommended as Noted  Recommended as Noted  Recommended as Noted
Not Recommended  Not Recommended  Not Recommended  Not Recommended
Received Too Late  Received Too Late  Received Too Late  Received Too Late

Signed by: _______________ Signed by: _______________ Signed by: _______________ Signed by: _______________

Date: _______________ Date: _______________ Date: _______________ Date: _______________