GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Programming Standards” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated March 15, 2006, is the basis for programming services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with additional programming requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:
The purpose of this standard is to set forth the requirements for facility programming services for DFCM and the University of Utah.

ADDED:
Programming services shall define and provide a cost estimate for the project within the constraints of the “Agreement between DFCM and the Programming Consultant.” or the agreement between the Programming Consultant and the University of Utah.

ADDED:
REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>Specific University of Utah programming needs were removed from the former Design Standards Chapter 1. Text was extensively revised and updated. University programming standards were formatted to match the layout of the DFCM Manual, and issued as a supplement to the Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>Campus Design &amp; Construction. CD&amp;C has changed to Construction Project Delivery</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>Facilities Planning. Facilities Planning has changed to Campus Planning</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>Business Services. Business Services has changed to Facilities Business Services</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>Plant Operations. Plant Operations has changed to Facility Operations</td>
</tr>
</tbody>
</table>
1.0 GENERAL

1.1 General

A. Purpose and Scope

1. Programs shall comply…

*ADDED:*

Programs shall comply with the project budget as identified in the approved CBE. It shall also include a proposed schedule for design and construction.

2. The intent of the Program Standards…

*ADDED:*

b. The expectation is for professional quality work in terms of content and presentation. The program document will be used by individuals with and without technical backgrounds and should be easily understood by both.

   (1) The executive summary must be presented in clear and concise language that effectively communicates purpose, objective, results, recommendations, and explains assumptions.

   (2) A well-organized document that facilitates finding specific information is essential. Page numbers are required.

   (3) The responsibility for the quality of the program document rests entirely with the Consultant. The Consultant may seek general advice from members of the steering committee, but should not expect them to be active participants in the writing or mechanical editing.

   (a) Mechanical editing refers to consistency in capitalization, spelling, hyphenation, table format, use of abbreviations, and so forth; correctness of punctuation, including ellipsis points, parentheses, and quotation marks; the way numbers are treated; consistency between text, tables, and illustrations; and citation format.

   (4) Editing should be completed prior to presenting the document for review. It is difficult to read for content if the material is presented in an error-laden package.
(5) Use the most effective format and style for the program document.

(a) The overall design, illustrations, graphics, charts, and other artwork used should facilitate the inevitable need to copy, duplicate, or print all or part of the document later on.

(b) Use standard page sizes. Documents that use 8½” x 11” paper with a portrait layout are the easiest to file. For this size of document, use foldout pages for oversize illustrations only. Foldouts must be sized to require unfolding in one direction only with the folds being parallel to the binding. The foldout page should not exceed 11” x 17” when the page is unfolded. Each foldout page should be assigned a page number and caption that are immediately visible to the reader when opening the book, without unfolding the page. Printing on the back of a foldout page is permitted, but should be avoided.

(c) Double sided printing is encouraged; however, only on pages other than foldout pages where appropriate.

ADDED:

4. A “Scope” is defined as the basic requirements, goals, design objectives, etc. of the project. The University Project Manager may prepare a scope statement or assign this task to the Consultant. The scope of a project defines the design and construction limits for the intended work.

a. Typically, the purpose of the programming phase is to analyze the requirements of a proposed program of specific activities with respect to the area and other facility related needs required for the building to accommodate the identified activities. This typically includes a parking plan coordinated with Commuter Services, a detailed site analysis, an estimate of circulation space, identifying limitations or requirements, such as congruence with the Campus Master Plan. The program does not address the specific design, it calculates but does not dimension space; and it does not lay out each and every contingency that could be encountered at some future time. It addresses each item in a programmatic way, such as: adjacency, type, and quality of a space to meet a specific need. While there are details that need to be documented and analyzed, such as utility requirements, multimedia or communication needs, or security issues, etc., the specific design, detailed dimensions, and specific layout will be determined in the design phase.
5. General statement regarding University meetings:
   a. There will be official University committees that will be organized as appropriate through University channels. For any committee formed through this process, meeting agendas are to be provided in advance of each of the meetings, and meetings minutes will be distributed to all committee members after each meeting. The University Project Manager will be copied on all project correspondence.

2.0 FACILITY PROGRAM

2.1 General.
   A “Program” is defined as…

   ADDED:
   A program can further be described as a scope document prepared for larger projects. It is nonspecific in design and layout, but specific in defining the requirements, scope, and expectations of each portion of the new or remodeled facility. It becomes the official guide and reference for all aspects of the project. The subsequent design must comply with the program.

A. Programming Process

1. Pre-Program Documents
   a. Furnished by the University, these documents inform the preliminary description, space list, square footage analysis, site analysis, and cost estimate/project budget. The following plans are considered basic source documents for the development of the program.

      (1) The University of Utah’s Strategic Academic Plan

         (a) The strategic academic plan guides and directs the physical and facilities planning on campus.

         (b) A strategic academic plan describes the present and future academic priorities of the college. Therefore, a current strategic academic plan for an academic University unit approved by the Cognizant Senior Vice President for Academic Affairs or the Cognizant Senior Vice President for Health Sciences is typically submitted to the Associate Vice President (“AVP”) for Facilities Management prior to the start of programming.

         (c) A strategic academic plan provides clear criteria to guide University decisions on which programs should grow, and which should be reorganized, redefined, or eliminated based on the University’s ability to discern,
and respond to, long-term fundamental trends in the field of practice and in society in general.

(d) A strategic academic plan enables the University to evaluate the mix and viability of academic and professional programs, recognizing that many fields of scholarship have enduring value that transcends current interest.

(e) Specific considerations in a strategic academic plan can include such considerations as the following:

(i) Size of programs, both academic and research.

(ii) Academic balance and diversity of disciplines that are primarily theoretical, and those that involve direct experience with tangible subjects in the studio, laboratory, or field.

(iii) Amount of interdisciplinary teaching and research programs.

(iv) Action plans to either improve, or to phase out and eliminate, programs that do not fully measure up to a standard of excellence.

(v) Development of ideas for new initiatives both within and across disciplines.

(vi) Identification of themes of exceptional promise.

(vii) Target key benchmarks of student engagement including level of academic challenge, active and collaborative learning, enriching experiences, student-faculty interaction, and institutional support.

(viii) Developing a mission balance between research, education, and public service.

(f) It is the purpose of the strategic academic plan to provide a framework for such decisions.

(2) Business Plan

(a) For a non-academic University unit, Facilities Management recommends that a current business plan approved by the Cognizant Senior Vice President for Academic Affairs or the Cognizant Senior Vice President for Health Sciences, if available, be submitted
to the AVP for Facilities Management prior to the start of programming.

(b) A business plan is a formal statement of a set of business goals, the reasons why they are believed attainable, and the plan for reaching these goals. It may also contain background information about the organization or team attempting to reach those goals.

(c) Business plans may also target changes in perception and branding by the customer, client, or larger community.

(d) When the existing business is to assume a major change or when planning a new venture – a 3 to 5 year business plan guides the programming process.

2. Program Preparation and Cost Estimate

The program architect adheres to applicable adopted construction and fire codes, these Design Standards (DFCM Design Manual, University of Utah Supplement), the Campus Master Plan, DFCM requirements; and, submits a draft estimate(s) to the program group to establish a firm project budget with itemized cost summary.

3. Program Document - First Review

The program architect submits the document for review to the program group. Comments are returned to the Consultant for implementation into the document.

4. Program Value Management Session

The revised document is reviewed for value enhancement by assignees of the program group. Selected action items are submitted to the program architect for document revision.

5. Final Program Document

Completed copies of the document are submitted to the program group for final endorsement by each group.

6. Funding for Construction

The need for accurate and complete programs and program cost estimates for construction projects is critical.

7. Cost Analysis

Include a “list of assumptions” about the program cost estimate. This “list of assumptions” is intended to help the design architect have greater understanding
of the program estimate. The “list of assumptions” is not intended to control or
direct the design architect in any way.

8. Format

The final format of each program document will vary to reflect the nature of the
project, but the basic arrangement of information should follow the format
suggested by the programming guide.

9. Minimum Distribution Requirements for Program Document

a. Six total printed copies will be required. Printed copies shall be 8½” x
   11” or 11” x 17”.

b. Ten total electronic copies will be required. Electronic copies will be
   searchable PFD format on CDs.

c. Six printed copies and five electronic CD PDF copies will be distributed
   by the University Project Manager as follows:

   (1) 2 printed copies and 1 CD to the user department/college
       (primary user group representative)

   (2) 1 printed copy and 1 CD to the department of Campus Planning

   (3) 1 printed copy and 1 CD to Director, Facility Operations

   (4) 1 printed copy and 1 CD to the department of Construction
       Project Delivery

   (5) 1 printed copy and 1 CD to the DFCM Designated
       Representative

d. Five electronic CD PDF copies will be distributed by the University
   Project Manager as follows:

   (1) 1 CD to the Cognizant Senior Vice President

   (2) 1 CD to the Cognizant Vice President for Administrative
       Services

   (3) 1 CD to the Cognizant Associate Vice President for Facilities
       Management

   (4) 1 CD to Director, Construction Project Delivery

   (5) 1 CD to Director, Space Planning & Management
2.2 The completed program shall include, but is not limited to the following:

A. Signature Page

\textit{ADDED:}

1. University of Utah Pre-design Phase Signature Sheet (See Appendix A).

B. Executive Summary

3. Programming team.

\textit{ADDED:}

a. Program Consultant

b. University Steering Committee

(1) A University steering committee is a small committee responsible to make final decisions regarding the scope, design and expenditure of funds for a Capital Development project. Consultants, contractors, project managers and working committees are ultimately responsible to the steering committee for approval and funding of their work. The steering committee should consist of the following people:

(a) Cognizant Senior Vice President, Vice President, Dean or designee

(b) Associate Vice President for Facilities Management

(c) Director, Construction Project Delivery

(d) Deans

(e) Others as approved by the AVP for Facilities Management

(2) Ex-officio staff on the committee in an advisory capacity:

(a) University Project Manager as assigned by Facilities Management

(b) DFCM Designated Representative

(c) Campus Planner from Campus Planning

(d) Director, Commuter Services

(e) Director, Office of Sustainability

(f) Director, Space Planning & Management
(g) Director, Facility Operations

(h) Others, as approved by the AVP for Facilities Management

(3) The steering committee should be assembled at the beginning of the project and should plan on meeting as required. Meeting once a month is an average frequency. More frequent meetings may be necessary, but meetings need not be held unless necessary. The objective is to keep the steering committee informed regarding progress, and make decisions in order to keep the project moving forward.

c. Working Committee

(1) The working committee is a group that meets on a regular and frequent basis. Meeting weekly is an average frequency. The group will be engaged with consultants to inform the programmatic and functional features of the project. It is important to include members and users that possess operational and program knowledge of the project’s major features.

(2) The working committee is facilitated by the assigned University Project Manager working in conjunction with the Consultant(s), and includes the cognizant dean or University unit administrator, facility occupants as determined by the dean or University unit administrator, the ex-officio staff on the steering committee above or their designees, as well as staff assignments and representatives from Facility Operations other departments as appropriate.

D. Space use program

1. Site considerations

**ADDED:**

a. Must include verification that new structure will not be placed over existing underground utilities.

E. Detailed space use descriptions

3. Program spaces summary

**ADDED:**

a. Utah State Higher Education (USHE) Adjustments to Inventory Matrix (See Appendix B).
H. Cost Analysis

1. Project estimate

**ADDED:**

a. The University will provide a *Utility Impact Assessment Cost* which the program architect will include as a line item in the program cost estimate.

b. The program architect’s cost estimator shall submit a list of recent comparable projects used to develop cost data for the program estimate. The comparables are to include square footage costs for each room type.

c. Include efficiency percentages and benchmarks from national models that adhere to the current Postsecondary Education Facilities Inventory and Classification Manual (FICM) standards.

3. Construction cost estimate description

a. Detailed estimate

**ADDED:**

(1) The space list shall be used to develop the construction cost estimate and associated square footage analysis. Each room or space type shall be listed with associated square footage costs.

(2) The space list and square footage analysis must use the University’s definitions of building areas (gross area, assignable area, and non-assignable area).

(3) The construction cost estimate shall be developed in the CSI format.

   (a) The square footage costs for each room type shall be subdivided to represent estimated costs in each of the CSI divisions.

   (b) Include a *CONSTRUCTION COST ESTIMATE SUMMARY REPORT* listing the costs apportioned to each CSI division in tabular form, totaled for the final estimate.

   (c) Include construction contingency allowance and overhead & profit costs for the Contractor and subcontractors.

(4) Include costs attributable to the site, such as:

   (a) Access, circulation, parking
(b) Utilities (existing, relocated, new, plans to abandon, etc.)
Non-State-funded projects will require utility metering and utility costs.

(c) Site improvements

(d) Replacement of outdoor lighting that does not meet current standards

(e) Contextual issues

(5) Include costs attributable to the building, such as:

(a) Space lists with square footage (as described above)

(b) Net-to-gross ratios

(c) Acoustical requirements

(d) Structural requirements

(e) Seismic requirements

(f) Code requirements

(g) ADA accessible route costs
ADA accessible route costs can amount up to 20% of the construction budget for alterations to existing buildings or additions in some cases.

(h) Integrated branding, showcasing, donor recognition and way finding (see Appendix “C”)

(i) Special systems
Auxiliary departments within the building will require separate metered utilities.

(6) Include costs attributable to general project costs:

(a) Site survey

(b) Asbestos consultant

(c) Utilities mapping

(d) On-site costs

(e) Geotechnical report

(f) Off-site costs

(g) Environmental assessment

(h) Testing and inspection

(i) Hazardous materials abatement
2.3 Introductory Information

A. Title Sheet

ADDED:
3. DFCM Project Number and University Project Number

B. Signature Sheet

ADDED:
1. Appropriate signatures should include the following:
   (See APPENDIX A for University of Utah required format.)

2.4 Executive Summary

B. Organization

2. Space Requirements Summary…

ADDED:
a. New buildings require the following (major remodels also require the following if not already existing):

   (1) Shipping/receiving dock

   (2) Mail receiving/distribution room

   (3) Grounds storage room with single entrance from the building exterior
b. The dock, mail room and ground storage room are required unless an exception is approved by the University steering committee.

2.7 Individual Space Outlines

D. Area Space Summary Sheet.

2. Identify the net to gross factor.

**ADDED:**

a. Identify source of the net-to-gross factor. Sources may include the following:

(1) DFCM guide. This is only appropriate for early drafts of the program. Ultimately more complete analysis of this factor is required.

(2) Program analysis (indicate page number)

(3) Other sources (indicate source)

(4) Floor plan studies.

**ADDED:**

2.9 Common Mistakes and Pitfalls

A. Common Pitfalls

The items listed below are descriptions of common pitfalls. The University suggests that programmers can take precautions with the following:

1. Shortcomings in Site Analysis

a. It is often discovered in design and construction that major cost items have not been discovered in the site during programming. These problems may have to do with the following among others:

(1) Incomplete asbestos surveys
(2) Inadequate net square footage
(3) Unrealistic assumptions about the space needs of users
(4) Inadequate assigned storage
(5) Inadequately sized basic rooms and spaces for functions
(6) Undiscovered hazardous waste
(7) Location of seismic fault lines
(8) Bad soils conditions
(9) Capacity of existing utilities
(10) Location of existing utilities
(11) Existing utilities that are already at capacity
(12) ADA accessible paths and parking

b. Inadequate Net-to-Gross Factor

(1) The tendency is to expect too much efficiency in buildings. The DFCM guides for net-to-gross are only guides.

(2) When the net-to-gross factor is defined too conservatively in the programming phase, then ultimately during design phase, more space is added to the building to compensate without a commensurate increase in cost per SF. Less is spent per square foot and the building quality comes down.

(3) Fully analyze the cost impact of all independent surveys including soils and hazardous materials.

c. Program needs and not wants without adequate budget coverage. Things to consider:

(1) Don’t please the users by programming items or details that are too explicit in nature.

(2) Don’t program design solutions without compelling reasons to do so.

(3) Don’t rely on previous programming for the projects without thorough evaluation and verification for accuracy.

(4) Often the University assembles extensive information for the programmer. Make sure all owner/user provided information is understood in the context of the source.

d. Promises made to donors without prior steering committee approval.

ADDED:

APPENDIX “A” University of Utah Pre-Design Signature Sheet
APPENDIX “B” Utah State Higher Education Adjustments to Inventory Matrix
APPENDIX “C” Integrated Branding, Showcasing, Way Finding and Donor Recognition
APPENDIX A: University of Utah Pre-Design Signature Sheet

University of Utah Review Signatures

We have reviewed the [document name] and warrant that it adequately represents our request for a facility to fulfill our mission and programmatic needs. All appropriate parties representing the University have reviewed it for approval.

Dean or University Unit Administrator  Date

Cognizant Senior Vice President  Date

Project Manager, Facilities Management  Date

Director, Construction Project Delivery  Date

Director, Facility Operations  Date

Campus Planner, Campus Planning  Date

Director, Campus Planning  Date

Associate Vice President, Facilities Management  Date

Vice President, Administrative Services  Date

Division of Facilities Construction & Management, State of Utah

I have reviewed the [document name], jointly prepared with the University for approval.

DFCM Designated Representative  Date
APPENDIX B: Utah State Higher Education Adjustments to Inventory Matrix

In order to facilitate the Capital Request process as mandated by the State Board of Regents, please complete the following matrix. All room use definitions can be found in Chapter 4.1 of the Post Secondary Facilities Inventory and Classification Manual (FICM): 2006 Edition. [http://nces.ed.gov/pubs2006/2006160.pdf]

Disaggregate the following FICM category 200 Series Laboratory Facilities into:

210/220 Class Lab/Open Lab (and service) Formally or Informally scheduled instruction laboratories {Section 4.3.1} and 250 Research and Non – Class Labs (and service) Space used for laboratory experimentation, research or training in research methods. {Section 4.3.1}

<table>
<thead>
<tr>
<th>Utah System of Higher Education</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Facilities Qualification and Prioritization Process</td>
<td></td>
</tr>
<tr>
<td>FY 2008-2009</td>
<td>Initials</td>
</tr>
</tbody>
</table>

Form Q&P 2 – Adjustments to Inventory for Renovations/New Construction in Progress (Pipeline)

<table>
<thead>
<tr>
<th>Institution:</th>
<th>University of Utah</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Existing Q&amp;P Space to be Deleted</th>
<th>Existing Q&amp;P Space to be Renovated</th>
<th>Classification of Q&amp;P Space after Renovation</th>
<th>New Q&amp;P Space</th>
<th>Non-Q&amp;P Space Added/Renovated/Delicted (Net)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
</tr>
<tr>
<td>100 – Classroom</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>200 - Teaching Labs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>250 - Research Labs</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>300 - Office</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>400 - Study</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>520 - P.E. Special Use</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>500 - Other Special Use</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>600 - General Use</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>700 - Support</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>800 - Health Care</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>900 - Residential</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>000 - Unclassified</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Subtotal - Net Assignable

Non-Assignable/Structural

Total

The room classifications ^ are defined in the FICM document and could just be referenced. The Q&P^2 space should be reviewed by Space Planning & Management.
APPENDIX C: Integrated Branding, Showcasing, Way Finding, & Donor Recognition

The University of Utah has seen success in recent new building projects that have integrated the mission of the institution, department or division into the core architectural design and form as well as an overlay of displays, donor recognition and exhibits.

The Sutton Geology and Geophysics Building is one example of the immersive environment that can be created when “integrated branding,” “showcasing,” “way finding,” and “donor recognition” is planned during the design phase.

Building on this recent success, it is an expectation of the University of Utah that “integrated branding,” “showcasing,” “way finding,” and “donor recognition” be fully integrated throughout new buildings. “Integrated branding,” “showcasing,” “way finding,” and “donor recognition” will include donor recognition and signage; and, theme elements celebrating the disciplines and programs of the facility, both academic and research. Inspiring themes will likely originate from the history, culture, faculty background and experience, academic and research enterprise, connections with donors, and future aspirations of programs within the new facility. Development of these branding, showcasing and recognition themes and design approaches will require significant time in research and interviews to develop the ideas that inspire, interest, and engage the students, as well as the broader community.

In order to give “integrated branding,” “showcasing,” “way finding,” and “donor recognition” proper focus and scope, a defined budget amount will insure an effective integration takes place during design and construction. The budget includes costs normally allocated to donor recognition. Furthermore, work on the package will need to occur during the design phase and often requires a specialized sub-consultant focused on the effort. Finally, an appropriate budget amount of approximately 2% should be allocated within the project budget.

Donor recognition and signage should be coordinated with “integrated branding,” “showcasing,” and “donor recognition”; and, signage includes all building signage, including room signs, interior way finding, and other related signs. It does not include campus designated exterior building identification signs which will be directed by the campus. There is a campus standard for those signs, and the project will have to pay for them, but they are not part of “integrated branding,” “showcasing,” “way finding,” and “donor recognition.”

Additional information on “integrated branding,” “showcasing,” “way finding,” and “donor recognition” can be obtained from Facilities Management.
3.0 DFCM REQUIREMENTS

General HVAC, Plumbing & Fire Protection

DETAIL DRAWINGS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 have been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 is included in the “Design Process” supplement while other chapters have become supplemental text in the “Design Requirements” volume.</td>
</tr>
</tbody>
</table>

Note: The last revision to Mechanical Detail Drawings occurred on 21 November 2003.
3.0 DFCM REQUIREMENTS

DESIGN REQUIREMENTS
University of Utah Supplement

Drawing Details: General HVAC, Plumbing & Fire Protection

3.0  DFCM REQUIREMENTS

Drawing Details: General HVAC, Plumbing & Fire Protection

<table>
<thead>
<tr>
<th>DRAWING NUMBER</th>
<th>TITLE / DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECH-D1</td>
<td>Flexible Duct/Rigid Duct Connection</td>
</tr>
<tr>
<td>MECH-D2</td>
<td>Floor Fire Damper Detail</td>
</tr>
<tr>
<td>MECH-D3</td>
<td>Low Pressure Duct Details</td>
</tr>
<tr>
<td>MECH-D4</td>
<td>Fire Damper Duct Detail</td>
</tr>
<tr>
<td>MECH-D5</td>
<td>Round or Oval Fire Damper Detail</td>
</tr>
<tr>
<td>MECH-D6</td>
<td>Ceiling Diffuser Detail</td>
</tr>
<tr>
<td>MECH-D7</td>
<td>Not Used</td>
</tr>
<tr>
<td>MECH-D8</td>
<td>Transfer Duct Detail</td>
</tr>
<tr>
<td>MECH-D9</td>
<td>Duct Mounted Fire Damper Detail</td>
</tr>
<tr>
<td>MECH-EQ1</td>
<td>Roof Hood Detail</td>
</tr>
<tr>
<td>MECH-EQ2</td>
<td>Roof Mounted Exhaust Fan Detail</td>
</tr>
<tr>
<td>MECH-EQ3</td>
<td>Equipment Foundation Detail</td>
</tr>
<tr>
<td>MECH-EQ4</td>
<td>Rooftop Equipment Base Detail</td>
</tr>
<tr>
<td>MECH-EQ5</td>
<td>Equipment Curb Detail</td>
</tr>
<tr>
<td>MECH-EQ6</td>
<td>Access Panel Detail</td>
</tr>
<tr>
<td>MECH-P1</td>
<td>Reduced Pressure Backflow Preventer Detail</td>
</tr>
<tr>
<td>MECH-P2</td>
<td>Island Sink Installation Detail MECH-P3</td>
</tr>
<tr>
<td></td>
<td>Schematic Piping to In-Line Pump</td>
</tr>
<tr>
<td>MECH-P4</td>
<td>VAV Hot Water Coil Piping Schematic</td>
</tr>
<tr>
<td>MECH-P5</td>
<td>Cooling Coil Drain Detail</td>
</tr>
<tr>
<td>MECH-P6</td>
<td>Heating Coil Piping Schematic</td>
</tr>
<tr>
<td>MECH-P7</td>
<td>Cooling Coil Piping Schematic</td>
</tr>
<tr>
<td>MECH-P8</td>
<td>Domestic Water Piping Schematic for HTW Converter</td>
</tr>
<tr>
<td>MECH-P9</td>
<td>Multiple Heating Coil Piping Schematic</td>
</tr>
<tr>
<td>MECH-P10</td>
<td>Multiple Cooling Coil Piping Schematic</td>
</tr>
<tr>
<td>MECH-P11</td>
<td>Heating Coil Piping Schematic</td>
</tr>
</tbody>
</table>
METAL DUCT  4"  MIN.

METAL DUCT SHALL INSERT A MIN. OF 4" INTO FLEXIBLE DUCT

FLEXIBLE DUCT

WRAP TIGHTLY W/TWO LAYERS OF SEALER TAPE. TAPE TO COVER SCREWS AND TO EXTEND 2" MIN. OVER METAL DUCT. <TAPE NOT SHOWN FOR CLARITY)

TAPE TO BE SIMILAR TO "HARDCAST" HIGH PRESSURE TAPE.

(3) SCREWS W/1" WASHERS SHALL BE PROVIDED AT 1/3 POINTS AROUND DUCT. SCREW TO BE ON FLEX SIDE OF WIRE W/WIRE PASSING UNDER WASHER.

Drawing Title: FLEXIBLE DUCT / RIGID DUCT CONNECTION

Revision Date: No_v_2003

Drawing No.: MECH-01
CLEARANCE FOR THERMAL EXPANSION 1/8" PER FOOT OF DUCT DIMENSION. MAX. 112" - HALF FOR EACH SIDE

RETAINING ANGLES ATTACHED TO SLEEVES W/1/4" BOLTS OR 1/2" WELDS 6" O.C. BEGIN 2" FROM CORNERS

1" MINIMUM

RETAINING ANGLES MIN. 1 1/2"x 1 1/2" x 12 GA. FOR DUCTS 0-48". 2"x 2"x 1/8" FOR DUCTS 48" AND LARGER - ALL SIDES

ACCESS DOOR

INTERIOR OF OPENING LINED W/ U.L. LISTED MATERIAL HAVING SAME FIRE RESISTIVE RATING AS FLOOR

FIRE DAMPER BLADES

BOLT OR WELD DAMPER TO SLEEVE. <TYPICAL

SLEEVE TO EXTEND A MIN. OF 3" BEYOND FLOOR LINE

STEEL SLEEVE MIN. 14 GAUGE
NOTE:
PROVIDE SLEEVE WITH ANGLES
AT ALL FIRE RATED PARTITIONS

1-112" X 1-112" X
1/8" ANGLE W/ 1/4"
BOLTS AT 8" O.C.

WALL

1-114"-20 RHMS
X 314" LONG W/ 11/2" NUT AT 12" O.C.
CTYPICAL)

NOTE:
PROVIDE ACCESS
DOOR IN DUCT
NEAR DAMPER

14 GA. SLEEVE
U.L. FIRE DAMPER
CF.L.F.D.)

14 GA. SLEEVE
WI 1.112" X
1.112" X 118"
ANGLE ALL AROUND
OPENING
2" X 1-1/2" PERIMETER ANGLES

16 GA. SLEEVE

U.L. LISTED FUSIBLE LINK

ROUND OR OVAL DUCT

PROVIDE SCREWS ON 12" CENTERS AND APPLY NON-HARDENING DUCT SEALANT

FIRE RATED WALL
DUCT LINER. (AS REQ'D.)

Outside air seal ring

See duct/rigid duct connection detail

Flexible duct

Spin-in fitting w/balancing damper & locking quadrant

Support from structure <typical>

Ceiling or fixture line

Ceiling diffuser

Insulation shield where duct is lined
DUCT LINER

CEILING STRUCTURE

5'-0" MINIMUM

2 1/2"

TRANSFER GRILLE (TYPICAL)

18"x18" ACCESS DOOR

FIRE DAMPER TYPE 'B'

BREAKAWAY SLEEVE

CEILING (WHERE APPLICABLE)

CORRIDOR WALL

ROOM

FLOOR

Drawing Title: TRANSFER DUCT DETAIL

Revision Date: 21NOV.2003

Drawing No.: MECH-08
GASKETED ACCESS DOOR----

BREAKAWAY SLEEVES, JOINTS & ANGLES FASTENED SECURELY TO WALL -- ————>

DUCT

GASKETED ACCESS DOOR

WALL

FIRE DAMPER

DUCT

WALL

GASKETED ACCESS

WALL

TYPE 'A'

BLADES OUT OF AIRSTREAM

--- FIRE DAMPERS
S DRIVES <TYP.)

BREAKAWAY SLEEVES, JOINTS & ANGLES FASTENED SECURELY TO WALL

TYPE 'B'

TYPE 'C'

[Academic use only] N \DGN\DETAILS\MECH\MECH-D90GN 12119/2003 2 57 05 PM
ALUMINUM HOOD

PRE-FABRICATED CURB W/2" MIN. GLASS FIBER INSUL. BY ROOF HOOD MFGR. (8" MIN. HEIGHT ABOVE ROOF)

EXTEND DUCT OVER SIDE OF CURB & SOLDER ---

ROOF INSULATION

NOTE:
CURB TO BE INSTALLED BEFORE BUILT-UP ROOF IS APPLIED

BIRDSSCREEN
LAG (4 PLACES>
CANT STRIP
ROOF LINE
METAL DECK
SAME THICKNESS WOOD BLOCKING AS ROOF INSULATION
DAMPER AS REQUIRED

Drawing Title:
MECH-EQ1

Revision Date:
21 NOV. 2003
LOCAL DISCONNECT UNDER FAN HOOD
FACTORY CURB SHALL BE INSTALLED BEFORE ROOF MEMBRANE IS APPLIED
ANCHOR FAN SECURELY TO CURB
ANCHOR CURB TO BUILDING STRUCTURE
VERIFY SIZE OF BOLT WITH MANUFACTURES CATALOG.

HOLD DOWN BOLT

EQUIPMENT BASE

PIPE SLEEVE

WASHER

\* 4 (\$) 12" O.C.
EACH WAY, TOP AND BOTTOM

FILL

1/2" EXPANSION JOINT

<table>
<thead>
<tr>
<th>BOLT SIZE</th>
<th>PIPE SIZE</th>
<th>SCH.4D</th>
<th>AM. STD. FLAT WASHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.D.</td>
<td>MIN. LEN.</td>
<td>O.D.</td>
<td>GAGE</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>11/2&quot;</td>
<td>4&quot;</td>
<td>-3/8</td>
</tr>
<tr>
<td>11/2&quot;</td>
<td>3/4&quot;</td>
<td>6&quot;</td>
<td>-3/8</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>3/4&quot;</td>
<td>6&quot;</td>
<td>-3/4</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>1&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>1&quot;</td>
<td>7&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1-11/4</td>
<td>8&quot;</td>
<td>2-11/4</td>
</tr>
</tbody>
</table>

VERIFY SIZE OF BOLT WITH MANUFACTURES CATALOG.

HOLD DOWN BOLT

EQUIPMENT BASE

PIPE SLEEVE

WASHER

\* 4 (\$) 12" O.C.
EACH WAY, TOP AND BOTTOM

FILL

1/2" EXPANSION JOINT

HOLD DOWN BOLT

CONCRETE

FILL

6" MIN.

\* VERIFY SIZE OF BOLT WITH MANUFACTURES CATALOG.

HOLD DOWN BOLT

EQUIPMENT BASE

PIPE SLEEVE

WASHER

\* 4 (\$) 12" O.C.
EACH WAY, TOP AND BOTTOM

FILL

1/2" EXPANSION JOINT

HOLD DOWN BOLT

CONCRETE

FILL

6" MIN.
REDWOOD RAILS TO FORM A CONTINUOUS CURB. BOLT EACH SECTION TO ROOF IN 3 PLACES.

CANT STRIP & ROOF FLASHING

8" CLEAR MIN.

ROOF LINE

ROOF STRUCTURE

DRILL THRU ROOF STRUCTURE & BOLT DOWN EQUIPMENT RAIL

-- FLOOD RECESS WITH PITCH

---- 22 GAUGE GALV. SHEET METAL PAN OVER TOP OF BASE

---- 3/4" PLYWOOD ON TOP OF RAILS

3/4" STEEL STOVE BOLT IN RECESS W/ 2" WASHER

ROOF INSULATION

---- 3/4" NUT & 3" DIA. WASHER
The Department of
CAMPUS DESIGN & CONSTRUCTION
1795 E. So. Campus Drive, Rm 201
Salt Lake City, UT 84112-9403
Phone: (801)581-6883
FAX: (801)581-6081

Drawing Title:
EQUIPMENT CURB
DETAIl

Revision Date:
21NOV.2003

Drawing No.:
MECH-EQS

EQUIPMENT SUPPORT
LEG

LAG ISOLATOR TO
REDWOOD RAIL &
CAULK

CANT STRIP

----SPRING TYPE
VIBRATION
ISOLATOR

--- 26 GAUGE G.I.
COUNTER FLASHING
CAP. FLOOD BELOW
CAP WITH MASTIC

- ROOF INSULATION
VERIFY THICKNESS
BEFORE SETTING
REDWOOD RAILS

8" CLEAR ABOVE
ROOF

ROOF DECK

ROOFING

[Academic use only]  \DGN\DETAILS\MECH\MECH-EQS DGN  12/22/2003  104919 AM
2'-0" x 2'-0" ACCESS PANEL

EXISTING SUPPORT CHANNELS
CEILING SUPPORT CHANNELS

WILKINSON 2'-0" x 2'-0" FIRE RESISTANT ACCESS PANEL.
CUT OPENING IN EXISTING CEILING.
SIZE OPENING TO MANUFACTURERS SPECIFICATIONS & INSTALL AS PER MANUFACTURERS SPECIFICATIONS.

MASTIC
%" GYPSUM BOARD
Y2" ACOUSTICAL CEILING TILE
HINGE

NOTE:
CUT & REBUILD CEILING STRUCTURE AS NEEDED.
1" DRAIN LINE
RUN TO WALL, DROP
TO FLOOR, AND RUN
TO TRENCH DRAIN

1" MINIMUM CLEARANCE

18" X 8"
GALVANIZED DRAIN
PAN UNDER REDUCED
PRESSURE BACKFLOW
PREVENTER

REOUCED
PRESSURE BACK-
FLOW PREVENTER
VENT THRU ROOF

RETURN BEND. ------
ELEVATE TO HIGHEST POINT POSSIBLE

SINK

ISLAND CABINET

P-TRAP

FLOOR LINE

LONG SWEEP FITTING CTYPICAU

FOOT VENT

PITCH UP

PITCH DOWN

THEU
UNIVERSITY
OF UTAH

Drawing Title:
ISLAND SINK INSTALLATION DETAIL

Revision Date:
SEPT. 1992

Drawing No.:
MECH-P2
MANUAL AIR VENT

HEATING COIL

UNION CTYP.)

CIRCUIT SETTER (TYP.)

PROVIDE BY-PASS LINE ON 3-WAY VALVE INSTALLATION

STRAINER

2-WAY AT C VALVE EXCEPT WHERE 3-WAY MIXING VALVES ARE NOTED ON PLANS

BALL VALVE CTYP.)

RETURN MAIN

SUPPLY MAIN

BALL VALVE WITH CAP

CFOR SMALL COILS)

Drawing Title: VAV HOT WATER COIL PIPING SCHEMATIC

Revision Date: 4-22-96

MicroStation: Licensed For Academic Use Only
CEILING OF PLENUM

COOLING COIL

DRAIN LINE

DRIP PAN

---INSULATED SHEET METAL PLENUM PARTITION

1" AIR FLOW

COOLING COIL (TYPICAL)

FLOOR LINE

"-----CONCRETE PAD BY GENERAL CONTRACTOR

EXTEND DRAIN LINE FROM DR N PAN TO NEAREST FLOOR DRAIN

Drawing Tide: COOLING COIL DRAIN DETAIL

Revision Date: 21 NOV. 2003

Drawing No.: MECH-PS
2-WAY ATC VALVE EXCEPT WHERE 3-WAY MIXING VALVES ARE SHOWN ON PLANS.

REDUCER <TYPICAL>

BELL & GOSSETT CIRCUIT SETTER

BALL VALVE OR BUTTERFLY VALVE <TYPICAL>

RETURN

PROVIDE BY-PASS LINE W/ CIRCUIT SETTER ON 3-WAY VALVE INSTALLATION

SUPPLY

STRAINER WITH BLOW-OFF

1/4" DRAIN VALVE WITH THREADED HOSE CONNECTION

THERMOMETER <TYPICAL>

MANUAL AIR VENT <TYPICAL>

UNION <TYPICAL>
2-WAY ATC VALVE EXCEPT WHERE 3-WAY MIXING VALVES ARE SHOWN ON PLANS

REDUCER <TYPICAL)

BELL & GOSSETT CIRCUIT SETTER-

BALL VALVE OR BUTTERFLY VALVE <TYPICAL)

RETURN

PROVIDE BY-PASS LINE W/ CIRCUIT SETTER ON 3-WAY VALVE INSTALLATION

SUPPLY

STRAINER WITH BLOW-OFF

%" DRAIN VALVE W/ THREADED HOSE CONNECTION

THERMOMETER <TYPICAL)

MANUAL AIR VENT (TYPICAL)

_UNITION <TYPICAL)

Drawing Title: COOLING COIL PIPING SCHEMATIC <FOR CONSTANT FLOW)
THERMOMETER
MANUAL AIR VENT
2-WAY ATC VALVE
EXCEPT WHERE 3-WAY
MIXING VALVES ARE
SHOWN ON PLANS
REDUCER
(RETURN)
PROVIDE BY-PASS LINE W/ CIRCUIT SETTER ON 3-WAY VALVE INSTALLATION
STRAINER W/ BLOW-OFF
BALL VALVE OR BUTTERFLY VALVE
< TYP I
SUPPLY
HEADERS TO BE LINE SIZE
TO OTHER BANK OF COILS WHERE REQ'D
SUPPLY BALL VALVE OR BUTTERFLY VALVE < TYP I
3/4" BALL VALVE DRAIN WITH HOSE END
THERMOMETER <TYPICAL>

MANUAL AIR VENT <TYPICAL>

2-WAY ATC VALVE EXCEPT WHERE 3-WAY MIXING VALVES ARE SHOWN ON PLANS

REDDER <TYPICAL>

RETURN

PROVIDE BY-PASS LINE W/ 3-WAY CIRCUIT SETTER ON VALVE INSTALLATION STRAINER W/ BLOW-OFF

SUPPLY BALL VALVE OR BUTTERFLY VALVE <TYPICAL>

CIRCUIT SETTER <TYPICAL>

HEADERS TO BE LINE SIZE

TO OTHER BANK OF COILS WHERE REQ'D

SAME SIZE AS COIL TAPPING <TYPICAL>

UNION <TYPICAL>

3/4" BALL VALVE DRAIN WITH HOSE END

COILS
THERMOMETER

MANUAL AIR VENT

3-WAY ATC VALVE

REDUCER

PROVIDE BY-PASS W/CIRCUIT SETTER & CHECK VALVE FOR CONSTANT SPEED PUMPS

RETURN

SUPPLY

STRAINER W/BLOW-OFF

BALL VALVE OR BUTTERFLY VALVE

CIRCULATING PUMP

CIRCUIT SETTER

HEADERS TO BE LINE SIZE

NOTE:

USE CIRCULATING PUMP WHEN HEATING COIL IS IN DANGER OF FREEZING.
3.0 DFCM REQUIREMENTS

3.8 HVAC

Laboratory Ventilation

DETAIL DRAWINGS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016

The University of Utah
FACILITIES MANAGEMENT – FACILITIES BUSINESS SERVICES
V. Randall Turpin University Services Building
1795 E. South Campus Drive, Room 201
Salt Lake City, Utah 84112-9403
Phone (801) 581-4707
FAX (801) 581-6081
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative
Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or
“Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided
for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the
Manual with requirements which are needed to satisfy University organization and mission objectives.

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 have been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 is included in the “Design Process” supplement while other chapters have become supplemental text in the “Design Requirements” volume.</td>
</tr>
</tbody>
</table>

Note: The last revision to Lab Hood Detail Drawings occurred in July 1999.
### DFCM REQUIREMENTS

3.8 Drawing Details: Laboratory Ventilation

<table>
<thead>
<tr>
<th>DRAWING NUMBER</th>
<th>TITLE / DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECH-FH3</td>
<td>Hood Connection Detail</td>
</tr>
<tr>
<td>MECH-FH4</td>
<td>Duct Connection Detail</td>
</tr>
<tr>
<td>MECH-FH7</td>
<td>Roof Curb Detail 2</td>
</tr>
</tbody>
</table>
NEW EXHAUST DUCT

30 DEG. MAX.
SLIP JOINT------
SEE DETAIL

TRANSITION AS REQUIRED

SILICONE SEALANT

EXISTING HOOD OUTLET

HOOD CONNECTION DETAIL
STAINLESS STEEL SHEET METAL SCREWS OR BLIND RIVETS AT 15 DEG. INTERVALS MAXIMUM CMN. OF 3 FASTENERS)

SILICONE SEALANT

2"

SLIP JOINT SHALL BE TIGHT TO INSIDE OF DUCT

NOTE:
SILICONE SEALANT MAY ONLY BE USED ON FIELD CONNECTIONS WHERE STAINLESS STEEL DUCTS CONNECT WITH EXHAUST FAN AND LABORATORY HOOD CONNECTIONS. ALL OTHER EXHAUST DUCT CONNECTIONS & JOINTS SHALL BE TIG OR MIG WELDED. WHERE WELDING IS NOT POSSIBLE, THIS METHOD OR AN APPROVED EQUAL MAY BE USED WITH THE PRIOR APPROVAL OF THE PROJECT MANAGER.
NOTE:
REMOVE ROOFING MATERIAL AT AREA OF NEW CURB DOWN TO ROOF STRUCTURE. THIS IS A BONDED ROOF & CONTRACTOR SHALL PERFORM THE WORK AS REQUIRED TO PRESERVE BOND.

NEW 18 GA. CURB CAP
NEW 3/4" EXTERIOR PLYWOOD SUPPORT PLYWOOD ON 2'-0" CENTERS W/ 2"X6" LUMBER OR OTHER APPROVED METHOD

2"x14" PLATFORM BOX ANCHOR TO STRUCTURE W/EXPANSION BOLTS.

20 GA G.I. COUNTER FLASHING

WOOD CANT STRIP

EXISTING ROOF STRUCTURE

SEAL JOINTS OF FLASHING WITH ROOFING CEMENT. FLASHING TO BE COMPATIBLE WITH ROOF MEMBRANE

EXISTING BUILT-UP ROOF & INSULATION

MicroStation: Licensed For Academic Use Only
3.0 DFCM REQUIREMENTS

High Temperature Hot Water System

DETAIL DRAWINGS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>02 July 2010</td>
<td>HTW-8</td>
<td>Space Heating Converter. Added socket weld fittings</td>
</tr>
<tr>
<td>02 July 2010</td>
<td>HTW-9</td>
<td>Hot Water Generator. Added socket weld fittings</td>
</tr>
</tbody>
</table>
### 3.0 DFCM REQUIREMENTS

#### 3.5 Mechanical Part 3 Detail Drawings: High Temperature Hot Water System

<table>
<thead>
<tr>
<th>DRAWING NUMBER</th>
<th>TITLE / DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTW-1</td>
<td>HTHW System, Domestic Hot Water Converter Schematic</td>
</tr>
<tr>
<td>HTW-2</td>
<td>Typical HTW Steam Generator</td>
</tr>
<tr>
<td>HTW-3</td>
<td>Typical Level Control for Steam Generator</td>
</tr>
<tr>
<td>HTW-4</td>
<td>Piping Schematic (Sheet 1)</td>
</tr>
<tr>
<td>HTW-5</td>
<td>Piping Schematic (Sheet 2)</td>
</tr>
<tr>
<td>HTW-6</td>
<td>Pressure Metering Installations</td>
</tr>
<tr>
<td>HTW-7</td>
<td>Cross Section Typical HTW Converter</td>
</tr>
<tr>
<td>HTW-8</td>
<td>Typical HTW Space Heating Converter</td>
</tr>
<tr>
<td>HTW-9</td>
<td>HTW Domestic Hot Water Generator</td>
</tr>
<tr>
<td>HTW-10</td>
<td>Thermometer Well Detail</td>
</tr>
<tr>
<td>HTW-11</td>
<td>Visible Drain Funnels</td>
</tr>
<tr>
<td>HTW-12</td>
<td>Typical HTW Service Entrance</td>
</tr>
<tr>
<td>HTW-13</td>
<td>Wall Entry Detail</td>
</tr>
<tr>
<td>HTW-14</td>
<td>HTW Insulated Envelope Detail</td>
</tr>
<tr>
<td>HTW-15</td>
<td>HTW Pipe Guides &amp; Pipe Support Detail</td>
</tr>
<tr>
<td>HTW-16</td>
<td>Typical HTW Anchor Detail</td>
</tr>
<tr>
<td>HTW-17</td>
<td>Heat Dissipation Plate at Ductbank Crossover</td>
</tr>
<tr>
<td>HTW-18</td>
<td>Air Vent Detail</td>
</tr>
</tbody>
</table>
MicroStation: Licensed For Academic Use Only
NOTES:

1. BONNET FLANGES 600 LB. ANSI.
2. RADIAL FLANGE HTW SUPPLY & RETURN 600 LBS. ANSI.
3. DRAIN CONNECTION AS REQUIRED.
4. VENT CONNECTIONS AS REQUIRED.
5. TUBE SUPPORTS AS REQUIRED.
6. TRACK & TRACK SUPPORTS.
7. TUBE PASS PARTITIONS AS REQUIRED. (GASKETED)
8. TUBE SHEET.
9. TUBE BUNDLE.
10. SHELL.
11. WATER INLET & DISTRIBUTION PIPE. (BUTT WELD)
12. SPLASH BAFFLE IF REQUIRED.
13. SEPARATOR.
14. CRADLE MAKE PROVISIONS FOR EXPANSION OF UNIT.
15. CONCRETE OR STRUCTURAL SUPPORT PIER.
16. MINIMUM 11"x15" MANHOLE.
17. ROLLED 3"x3"x1/4" L INSULATION RING WELD BOTTOM HALF CONTINUOUS. TOP HALF 2" IN 4" TO SHELL.
18. STEAM OUTLET CONNECTION MINIMUM 150 LB. ANSI.
19. SLOWDOWN CONNECTION (BUTT WELD).
20. SAFETY VALVE CONNECTION.
21. COUPLING FOR PRESSURE CONTROL.
22. COUPLING FOR PRESSURE GAGE.
23. COUPLING FOR CHEMICAL FEED.
24. COUPLING FOR CONTINUOUS SLOWDOWN.
25. COUPLING FOR WATER COLUMN.
26. COUPLING FOR WATER LEVEL CONTROL.
27. COUPLING FOR HIGH LEVEL CONTROL.
28. COUPLING FOR LOW LEVEL CONTROL.
29. COUPLING FOR VENT CONNECTION.
30. FOR MATERIAL TO BE USED SEE SPECIFICATION.
31. FOR INSULATION OF UNIT SEE SPECIFICATION.
32. FOR PAINT SEE SPECIFICATION.
33. FOR REQUIRED DESIGN & TEST PRESSURES AND DESIGN TEMPERATURES, SEE SPECIFICATIONS.
34. SHOW DIMENSION FOR SPACE REQUIRED TO REMOVE BUNDLE.
35. STEAM SPACE TO OCCUPY 551. VOLUME OF SHELL.

MicroStation: Licensed For Academic Use Only
FLOAT CAGE FOR LEVEL CONTROL, HIGH & LOW WATER LEVEL CONTROLS, ALARM SWITCHES, ETC.

PLUG <TYPICAL)
GLOBE DRAIN VALVE.
EXTEND TO EQUIPMENT DRAIN. <DWG.NO. HTW-8)

SINGLE POST

NOTE:
PIPE SIZES SHALL SUIT FLOAT CAGES & SWITCHES.

FLOAT CAGE FOR LEVEL CONTROL, HIGH & LOW WATER LEVEL CONTROLS, ALARM SWITCHES, ETC.

PLUG <TYPICAL)
UNIONS.
GLOBE DRAIN VALVE.
EXTEND TO EQUIPMENT DRAIN. <DWG.NO. HTW-8)

MULTIPLE FLOATS FOR SAME TANK CONNECTIONS
NOTES:
1. HTW DOMESTIC HOT WATER GENERATOR.
2. HTW SPACE HEATER CONVERTER.
3. TEMPERATURE CONTROLLER INSTRUMENT.
4. DOUBLE VALVED VENTS 5. DRAINS INSTALLED ON ALL CONVERTER HEADS AS REQUIRED FOR PROPER DRAINING & VENTING.
5. DOUBLE VALVED. SEE SPECS FOR SPECIAL VALVE WELD 3" LONG NIPPLE WITH Plain END INTO VALVE. DISCHARGE END OF NIPPLE TO HAVE MALE PIPE THREAD.
6. THREE VALVE BY-PASS.
7. PROVIDE REQUIRED STRIP-JOINT RUN OF PIPE FOR PROPER FLOW MEASUREMENT AT ORIFICE PLATE OR SENSOR.
8. DOUBLE VALVED DIP-IN PROVIDE AT ALL LOW POINTS.
9. SECONDARY SYSTEM LINES.
10. VENT AT HIGH POINT OF LINES GRADE LINES TO HIGH POINT. TYPICAL ALL HTW SUPPLY 5. RETURN LINES.
11. VALVED DRAIN. EXTEND TO DRAIN OR FLOOR.
12. FOR TYPICAL HTW SERVICE ENTRANCE. DRAWING NO. HTW-61.
13. VENT. EXTEND TO FLOOR.
14. PROVIDE TEMPERATURE WELLS & OTHER SENSING POINTS FOR CENTRAL CONTROL SYSTEM.

MicroStation: Licensed For Academic Use Only
NOTES:
1. HTW STEAM GENERATOR.
2. CONDENSATE TANK.
3. CHEMICAL FEED TANK & PUMP, SEE SPECIFICATIONS.
4. WATER SOFTENER.
5. BRINE & SALT STORAGE TANK.
6. HIGH LEVEL CUT OFF & ALARM.
7. HIGH LEVEL CUT OFF & ALARM.
8. WATER LEVEL CONTROL CYCLES PUMPS.
9. LOW LEVEL CUT OFF & ALARM.
10. LOW WATER CONTROL.
11. LOW LEVEL PUMP CONTROL.
12. WATER Meter.
13. DOUBLE VALVED VENTS & DRAINS INSTALLED ON ALL STEAM GENERATOR HEAD & PWG AS REQUIRED FOR PROPER VENTING & DRAINING. 3/4" LONG NIPPLE WITH PLAIN (N) INTO VALVE DISCHARGE END OF NIPPLE TO HAVE MALE PIPE THREAD.
14. DOUBLE VALVED, 3/4" LONG NIPPLE WITH PLAIN END INTO VALVE DISCHARGE END OF NIPPLE TO HAVE MALE PIPE THREAD. SEE SPECS FOR SPECIAL VALVES.
15. THREE VALVES BY PASS.
16. SHUT OFF VALVE OR NON-RETURN VALVE & MORE THAN ONE HTW STEAM GENERATOR CONNECTED IN PARALLEL.
17. VALVED DRAINS AT LOW POINTS, EXTEND TO DRAIN.
18. DRAIN ELBOWS WITH OR NS.
19. FEED PUMPS, PROVIDE STAND BY AS PER SPEC.
20. AUTOMATIC CONTINUOUS SLOWDOWN, SEE SPECIFICATIONS.
21. TEMPERATURE REGULATOR.
22. SAMPLE CONNECTION.
23. REFLUX VALVE OR ORIFICE TO SUIT TYPE PUYP FURNISHED.
24. RETURN TO CHEMICAL HEAT TANK.
25. PRESSURE RELIEF VALVE, STRAIGHT RUN, OR PIPE FOR PROPER FLOW MEASUREMENT AT ORIFICE PLATE.
26. FOR TYPICAL HTW SERVICE ENTRANCE, SEE OWC NO. HTW-6.
27. OVRFLW VALVE, DRAIN, EXTEND TO DRAIN.
28. PRESSURE CONTROLLER.
29. FLOAT CAGE SIGHT GLASS ASSEMBLY.
30. FLOAT TANKS & PUMP, SEE SPECIFICATIONS.
31. SPECIAL VALVES.
32. THREE VALVES BY PASS.
33. PRESSURE REGULATING VALVE.
34. SLOWDOWN HEAT RECOVERY FOR HUMIDIFICATION SYSTEM.
35. REDUCED PRESSURE VALVE, PREVENTER.
36. PRESSURE REGULATING VALVE.
37. AUTOMATIC CONTINUOUS SLOWDOWN, SEE SPECIFICATIONS.
38. TEMPERATURE REGULATOR.
**DIRECT CONNECTION**

- 1/2" PIPE OR 1/2"
- O.D. SEAMLESS TUBING.

**REMOTE CONNECTION**

- INSERT GUIDE NIPPLE.
- WELD THREADOLET TO PIPE.
- GLOBE VALVES.
- BLOWOFF. EXTEND PIPING TO OPEN BLOW AT DRI'IN OR FUNNEL.

**DETAIL "A"**

- PRESSURE GAGE OR OTHER PRESSURE MEASURING DEVICE.
- PRESSURE SNUPPER WHERE REQUIRED.
- NEEDLE VALVE.
- GLOBE VALVE.
- TO CLEAR INSULATION.
- MAIN PIPING.

**NOTES:**

1. PIPING & GLOBE VALVES TO BE OF SAME PRESSURE CLASS AS MAIN PIPING.

2. ALL GAGES OR DEVICES MEASURING RAPIDLY FLUCTUATING OR PULSATING PRESSURES TO BE PROTECTED BY PRESSURE SNUBBERS.

3. REMOTE CONNECTED GAGES TO BE CALIBRATED TO COMPENSATE FOR STATIC FLUID HEAD IN GAGE WHEN DIRECTED BY ENGINEER.
RECESSED GASKET SURFACE TO HELP RETAIN GASKET AND REDUCE THE POSSIBILITY OF BLOW OUT

HEAD

HTW HEAD GASKET

TUBE SHEET

B-7 STUD

SHOULDER BOLT NUT

2H NUT

TUBE BUNDLE

SHELL

SECONDARY GASKET

MicroStation: Licensed For Academic Use Only
NOTES:

1. BONNET FLANGES 600 LB. ANSI.
2. RADIAL FLANGE HTH SUPPLY & RETURN 600 LBS ANSI.
3. INLET FLANGE
4. OUTLET FLANGE
5. TUBE SHEET
6. TUBE BUNDLE
7. SHELL
8. BAFFLES
9. STAY RODS
10. SPACER
11. TUBE PASS PARTITIONS AS REQUIRED.
12. CRADLE. MAKE PROVISIONS FOR EXPANSION OF UNIT
13. CONCRETE OR STRUCTURAL SUPPORT PIER.
14. THERMOMETER WELL FOR CONTROL ELEMENT. ARRANGE PIPING TO PROVIDE WELL IMMEDIATELY ADJACENT TO CONVERTER OUTLET.
15. SOCKET WELDED ELBOWLETS. LOCATE AS NEAR TO SHELL OUTLET AS POSSIBLE.
16. THERMOMETER WITH SEPARABLE SOCKET.
17. DRAIN CONNECTION
18. VENT CONNECTIONS AS REQUIRED.
19. RELIEF VALVE CONNECTIONS
20. VENT
21. DIMENSION "L" NOT TO BE GREATER THAN 5 TIMES DIMENSION "D".
22. SHOW DIMENSION FOR SPACE REQUIRED TO REMOVE BUNDLE.
23. FOR MATERIAL TO BE USED, SEE SPECIFICATIONS.
24. FOR INSULATION OF UNIT, SEE SPECIFICATIONS
25. FOR PAINT, SEE SPECIFICATIONS.
27. COUPLING FOR PRESSURE GAGE.

Notes 17 and 18:
Add "Socket weld fitting" to each note.
NOTES:

1. BONNET FLANGES 600 LB. ANSI.
2. RADIAL FLANGE HTW SUPPLY S. RETURN 600 LBS. ANSI.
3. TUBE SUPPORTS AS REQUIRED.
4. TUBE PASS PARTITIONS AS REQUIRED.
5. VENT CONNECTIONS AS REQUIRED.
6. TUBE SHEET
7. TUBE BUNDLE
8. SHELL
9. DRAIN CONNECTION AS REQUIRED.
10. WATER INLET
11. WATER OUTLET
12. CRADLE MAKE PROVISIONS FOR EXPANSION OF UNIT.
13. CONCRETE OR STRUCTURAL SUPPORT PER.
14. MINIMUM 11"x15" MANHOLE.
15. DRAIN CONNECTION.
16. RELIEF VALVE CONNECTION.
17. THERMOMETER WITH SEPARABLE SOCKET.
18. THERMOMETER WELL FOR CONTROL ELEMENT.
19. SHOW DIMENSION FOR SPACE REQUIRED TO REMOVE BUNDLE.
20. FOR PAINT, SEE SPECIFICATIONS.
21. FOR INSULATIONS OF UNIT, SEE SPECIFICATIONS.
22. FOR REQUIRED DESIGN S. TEST PRESSURE S. DESIGN TEMPERATURE, SEE SPECS.
23. ROLLED 3"x3"x1/4" L INSULATION RING. WELD BOTTOM HALF CONTINUOUS.
   TOP HALF 2" IN 4" TO SHELL.
24. PROVIDE VENT FOR SHELL.
25. PROVIDE VENT FOR SHELL.
26. PRESSURE GAUGE CONNECTION.
27. PROVIDE SUITABLE COATING & CORROSION PROTECTION FOR INSIDE OF TANK.
28. PROVIDE 1-1/4" THREADED FITTING ON VESSEL WITH A 24" TO 30" LONG MAGNESIUM SACRIFICIAL ANODE. INSTALL WITH A CENTER CORE WEEP DETECTION HOLE. INSTALL ANODE IN FRONT OR BACK FOR EASY ACCESSIBILITY.

NOTE: THIS DETAIL APPLIES TO BOTH STORAGE TYPE AND INSTANTANEOUS TYPE GENERATORS, EXCEPT MANWAY MAY BE DELETED ON INSTANTANEOUS SHELLS.

Notes 5 and 9:
Add "Socket weld fitting" to each note.
THERMOMETER WELL
INSTALLATION IN VERTICAL PIPE

45 DEG. MIN. 90 DEG. PREFERRED WHERE ACCESSIBLE.

THERMOMETER WELL
INSTALLATION IN HORIZONTAL PIPE

SOCKET WELDED ELBOLET.

INSULATION.
DIA. OF PIPE MUST BE LESS THAN DIM. X.

PIPE GUIDE (CAS REQUIRED)

PLATE THICKNESS NOT LESS THAN 1/4".

FUNNEL TYPE "A"
(for single visible drain)

FUNNEL TYPE "B"
(for more than one visible drain)

THE UNIVERSITY OF UTAH

MicroStation: Licensed For Academic Use Only
NOTES:

1) AIR VENTS AT HIGH POINTS.
2) THERMOMETER WITH SEPARABLE SOCKET.
3) PRESSURE GAUGE ASSEMBLY. MOUNT GAUGES ON BRACKETS.
4) BY-PASS GLOBE VALVE. PROVIDE OFFSETS OR LOOPS IN BY-PASS PIPING TO PERMIT FREE & UNRESTRICTED PIPE MOVEMENT DUE TO TEMPERATURE CHANGES.
   - 1" FOR LINES TO 3";
   - 1 - 1/4" FOR LINES 4" TO 6".
5) DRAINS EXTEND TO EQUIPMENT DRAINS.
6) HIGH TEMPERATURE WATER SUPPLY & RETURN IN CONDUIT WITH END SEAL.
7) ORIFICE FLANGES FOR FLOW MEASUREMENT. PROVIDE REQUIRED STRAIGHT RUN OF PIPE PROPER MEASUREMENT FOR NEW OR FUTURE INSTALLATIONS.
EXISTING WALL FLASING CEMENT.

1/4" PLA'S SECURE "D" WALL WITH (4) 5/8" D.A. EXPANSION BOLTS, 1/2" EMBEDMENT.

CALCUM SILICATE INSULATION.

PROVIDE OPENING IN PLATE 1/2" LARGER THAN DIA. OF PIPE.

PIPE SLEEVE
- 14" FOR 10" PIPE
- 12" FOR 8" PIPE

Silicon Caulking.

EXISTING UNDAMAGED PLASTIC Z-CRETE WRAP.

MIN. 4" THICK GILSULATE TOP & SIDES.

NOTE

SEE DRAWING NO. HTW-14 FOR LETTER DIMENSIONS.

TYPICAL TRANSITION DETAIL GILSULATE TO Z-CRETE.

1. 24" PIECE OF CONTINUOUS ROOFERS FIBERGLASS OVER TOP & DRAPED DOWN SDS. WITH FLASHING CEMENT ON BOTH SLOPS.

2. EXTEND TWO Z-CRETE SEAM & DRAIN OPENINGS INTO INSIDE OF WALL WITH 1-1/2" GALVANIZED PIPE CAP END OF PIPE. BURY PIPE INSIDE OF GILSULATE INSULATION.
PIPE SIZES

<table>
<thead>
<tr>
<th>PIPE SIZES</th>
<th>DIM. INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;-3&quot;</td>
<td>A: 5, B: 5, C: 6</td>
</tr>
<tr>
<td>4it-6lt</td>
<td>A: 6, B: 5, C: 7</td>
</tr>
<tr>
<td>8&quot;</td>
<td>A: 7, B: 5, C: 8</td>
</tr>
<tr>
<td>10&quot;</td>
<td>A: 8, B: 5, C: 10</td>
</tr>
</tbody>
</table>

WHERE FIBROUS WRAP IS REQUIRED DIMENSION BETWEEN CENTERLINE OF PIPES SHALL BE INCREASED IN ORDER TO PROVIDE DIMENSION "B" THICKNESS OF INSULATION MEASURED FROM OUTSIDE OF WRAP INSTEAD OF PIPE.

- COMPACTED SAND BACKFILL.
- PRE-CUT GYPSUM BOARD FORMS INSTALL ACCORDING TO INSULATION MANUFACTURES INSTRUCTIONS.
- HTW SUPPLY & RETURN.

PROVIDE TEMPORARY BLOCKS TO POSITION PIPE. ALL BLOCKS SHALL BE REMOVED AS INSULATION IS APPLIED & COMPACTED.

ENVELOPE DIMENSIONS: (APPLIES TO ALL DETAILS AT COMPACTED DENSITY OF INSULATION).

MINIMUM DISTANCE BETWEEN PIPE & LENGTHS & THICKNESS OF FIBROUS WRAP SEE PLAN & PROFILES.

NOTE:
FIBROUS WRAP SHALL BE 500 DEGREE F. MINERAL FIBER OR COMPARABLE FIBERGLASS INSULATION.
COMPACTED SAND.

METAL SURFACES BURIED IN CONCRETE SHALL BE PAINTED WITH (2) COATS OF EPOXY PAINT.

SEE DETAIL SHEET HTW-14 FOR DIMENSION BETWEEN PIPES & LOCATION OF GUIDES.

PIECE GUIDE DETAIL
NO SCALE:

CONCRETE FILLED PVC PIPE END NOT TO EXTEND BEYOND INSULATION.

 DETAIL OF SUPPORT
NO SCALE:
3/8" CONTINUOUS WELD WEB
S. FLANGES OF WIDE FLANGES TO PIPE.
TRIM AS REQUIRED.

GILSULATE INSULATION.

COAT ALL SURFACES OF STEEL
S. TOP OF CONCRETE WITH KOPPERS
SUPER-SERV BITUMASTIC.

4 BARS AT 9" O.C. EACH WAY
IN ALL FACES.

METAL SURFACES BURIED IN
CONCRETE SHALL BE PAINTED
WITH (2) COATS OF EPOXY PAINT.

POUR ENTIRE CONCRETE ANCHOR
BLOCK IN AGAINST UBDISTURBED
EARTH. (HAND EXCAVATE)

--- 3/8" MIN. ---

UNDISTURBED EARTH.

WIDE FLANGE BEAM

--- 11"-3" TYP. ---

2'-3" MIN.

--- 3" MIN. ---

--- 3'-0" ---

8" MIN.

8" MIN.

--- 3/8" CONTINUOUS WELD WEB
S. FLANGES OF WIDE FLANGES TO PIPE.
TRIM AS REQUIRED.

GILSULATE INSULATION.

COAT ALL SURFACES OF STEEL
S. TOP OF CONCRETE WITH KOPPERS
SUPER-SERV BITUMASTIC.

4 BARS AT 9" O.C. EACH WAY
IN ALL FACES.

METAL SURFACES BURIED IN
CONCRETE SHALL BE PAINTED
WITH (2) COATS OF EPOXY PAINT.

POUR ENTIRE CONCRETE ANCHOR
BLOCK IN AGAINST UBDISTURBED
EARTH. (HAND EXCAVATE)
4' x 8' x 1/4" COPPER PLATES CENTERED ON CROSSOVER DO NOT OVERLAP PLATES

1" STYROFOAM SHOWN CROSS HATCHED

PLAN VIEW

DUCT BANK

ELECTRICAL OR COMMUNICATION DUCT BANK

MASTIC

ADDITIONAL GILSULATE PACKED UNDER PLATES

STANDARD GILSULATE INSTALLATION

HTW PIPES

SHEET ROCK

4' x 8' x 1/4" COPPER PLATES CENTERED ON CROSSOVER POINT

1" STYROFOAM, 8' LONG X WIDTH OF DUCT BANK (NOT TO SCALE)

3'-0"

BOTH SIDES MINIMUM OVERLAP

* THIS DETAIL TO BE USED WHEN DISTANCE BETWEEN DUCT BANK AND HTW INSTALLATION IS LESS THAN 12".

CROSS SECTION

Drawing Title:
HEAT DISSIPATION PLATE AT DUCTBANK CROSSOVER

Revision Date:
MAR.2001

Drawing No.:
HTW-17

MicroSlation: Licensed For Academic Use Only
3" LONG NIPPLE WELDED TO VALVE DISCHARGE. END OF NIPPLE TO HAVE MALE PIPE THREAD.

FOR VENTS LOCATED > 8' FROM FLOOR, EXTEND SECOND VALVE AS SHOWN.

LOCATE VALVE APPROX. 4'-6" FROM FLOOR.

3" LONG NIPPLE WELDED TO VALVE DISCHARGE. EYDOT NIPPLE TO HAVE MALE PIPE THREAD.

REDUCER AS REQ'D.

WELD-O-LET.

NOTE: HIGH POINTS OF ALL PIPING TO BE VENTED.

<table>
<thead>
<tr>
<th>PIPE SIZE (NOM.)</th>
<th>DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>1-1/2&quot; &amp; 1-1/4&quot;</td>
<td>1-1/2&quot; &amp; 1-1/4&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>10&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

3" LONG NIPPLE WELDED TO VALVE DISCHARGE. END OF NIPPLE TO HAVE MALE PIPE THREAD.
DESIGN PROCESS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Process” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated March 15, 2006, is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University policies, procedures, and requirements which pertain to the construction of new and remodeled facilities.

This supplement is an essential tool and guide to be used by the A/E through all phases of project development. It is not meant to dictate design solutions, but rather guide design decisions to be in harmony with University standards.

ADDED:

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>8.0</td>
<td>CAD Added new requirements</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapter 1 “General Guidelines” has been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 has been placed in the “Design Process” supplement while other portions have become supplemental text to the other two volumes, “Programming Standards” and “Design Requirements.” Chapter 1 text which duplicates DFCM or A/E</td>
</tr>
</tbody>
</table>

Design Process – University of Utah Supplement 2
Agreement language has been removed.

### Revisions Summary (continued)

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Campus Design &amp; Construction: CD&amp;C has changed to Construction Project Delivery</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Facilities Planning: Facilities Planning has changed to Campus Planning</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Business Services: Business Services has changed to Facilities Business Services</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Plant Operations: Plant Operations has changed to Facility Operations</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>O&amp;M Manuals: Removed Chapter 1 O&amp;M manual requirements which are now located in the Supplemental General Conditions for University of Utah Projects</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Printed Bid Sets to University: Removed the requirement for 5 bid sets delivered to the Project Manager. No hard copy sets of bidding documents are needed unless requested by the Project Manager. Building Officials reviews are now accomplished in electronic format.</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>8.3 / A. / 1.</td>
<td>XREFs: Submitted CAD drawings using xrefs to have xrefs bound</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>8.1 / B. / 2.</td>
<td>Revit: Revit drawings to be converted to CAD for submittals</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / F. / 5. / b.</td>
<td>GIS: DD Phase Submittals are to comply with GIS requirements</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / a. / (3)</td>
<td>XREFs: As-Built Drawings using xrefs to have xrefs bound</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / c. / (1)</td>
<td>“As-Built” Tracings: Two As-Built original tracings required (previously one)</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / c. / (2)</td>
<td>Revit: One electronic copy of Revit model is required if designed in Revit</td>
</tr>
</tbody>
</table>
1.0 GENERAL

1.1 General

REvised:

A. Design Process
The Design Process applies to the capital development and capital improvement activities of DFCM, and the design of construction projects at the University of Utah. It contains specific information for the preparation of contract documents administered by the Division of Facilities Construction and Management or University of Utah Facilities Management. It delineates and supplements (either directly in the document or indirectly by reference) codes, industry recognized standards, and guide specifications. Many of the criteria are based upon the experience of DFCM and the University and the input of professional and industry representatives.

REvised:

B. Performance Evaluation
Each entity which has a contract with DFCM or the University of Utah will be evaluated on its performance in accordance with the Design Process which includes both self-performed work and the performance of its subconsultants. As a result, it is critical that the A/E, which is in contract with DFCM or the University of Utah, communicate to its subconsultants the requirements of the Design Process and that the subconsultants communicate to the A/E and DFCM / University any deviations from the Design Process.

ADDED:

C. A/E Selection
DFCM (assisted by the University) selects and manages A/Es for University projects administered by the State. University of Utah Facilities Management selects and manages A/Es for University administered projects.

D. Projects Over $10 Million
Projects larger than $10 million are generally administered by DFCM. For DFCM managed projects, DFCM will issue contracts, authorize payments, manage change orders, etc., until completion, whereupon the University will occupy, operate, and maintain the new or remodeled facility. Though managed by DFCM, the University will participate in the development and management of the project. This includes design reviews and approval of each design phase before further progress is authorized.

E. Delegation / Designing University Projects
The State has delegated to the University the authority to manage construction projects costing less than $10 million and may also delegate larger projects on a project specific basis. Facilities Management will manage all aspects of these projects (contracts,
authorize payments, manage change orders, etc.) and is directly responsible to University Administration, the Board of Trustees, the DFCM, and the State Building Board.

1. Designing University of Utah Construction Projects

   a. Point of Contact

      Facilities Management is generally the A/E’s only authorized contact with the University on project related items.

   b. Direction from Facilities Management Only

      The A/E and Contractor are cautioned to take no action on directions issued by other University staff or departments until approval is obtained from Facilities Management, because any cost to the designer or Contractor, either by the action itself or subsequent repair or realignment to the project scope, will not be compensated by project funds, Facilities Management, nor by DFCM.

2. The role of Facility Operations

   The Facility Operations department is responsible for the operation and maintenance of most campus buildings, systems, and grounds; and, participates in the development of the University’s "Design Standards". Project information needed from Facility Operations is to be requested through the University Project Manager.

3. The role of Campus Planning

   The Campus Planning department identifies the site for each new building and manages the program phase of design. This department is responsible for continuity in campus development.

4. The role of the University Purchasing Department

   The Purchasing department oversees bidding on projects administered by the University. The procurement processes for A/E services and construction are managed and conducted by Facilities Management (Facilities Business Services). Procurement processes for material purchases are generally managed and conducted by Purchasing.

5. The role of the A/E

   a. DFCM (assisted by the University) selects and manages A/Es for campus projects administered by the State. Facilities Management selects and manages A/Es for University administered projects.

   b. Design A/Es and their subconsultants must be licensed or permitted as required by pertinent Utah State laws. Subconsultants must be identified in the fee proposal before contractual agreements are processed.
c. Creativity and innovation, which encourage a fresh review of University direction, are openly welcomed.

6. University Hospital / Clinic Facilities Design and Construction

a. Construction projects in the University Hospital and some surrounding buildings are handled differently than other buildings on campus. Understanding the reasons for these differences will help clarify the intent of the University’s policies. Specific differences include:

(1) Accreditation

Construction and maintenance work in the hospital and associated buildings is required to meet the stringent requirements of the JCAHO. These requirements will affect project design.

(2) Construction Activity

Construction activity will be affected by patient care concerns. Noise, dust, contamination, electrical outages, and similar problems could severely compromise patients’ welfare. Therefore, construction activity will often require special schedules and techniques.

(3) Timely Performance

Timely performance of design and construction is a constant concern. University Hospital functions as a teaching institution as well as a patient care facility and is a self-funding institution. Revenue generated by the hospital is critical to maintaining quality of care. Excessive lead time for construction materials or down time for site renovation negatively affects patient care, teaching schedules, and lost revenue for the facility.

(4) Utility Systems

Hospital utility systems serve several buildings. Work on the utility systems may adversely affect other buildings and must be carefully monitored and controlled.

b. The Hospital Department of Facilities and Engineering (or “Hospital F&E”) consists of project supervisors, designers, draftsmen, estimators, maintenance, and construction personnel.

(1) Hospital F&E may contract directly with A/Es up to a delegated threshold limit. When the construction cost estimate exceeds a certain threshold, Facilities Management will bid the construction via the University’s Internet based bid system.
Projects in the hospital area of the campus will often require joint coordination with Hospital F&E and Facilities Management. For such projects, the A/E will primarily work with both a Hospital F&E designer and a Hospital F&E project supervisor, and secondarily with a University Project Manager assigned by Facilities Management who will organize the bidding process.

1.2 Related Documents

**REVISED:**

A. Documents incorporated by reference. The Design Process (refer to [http://dfcm.utah.gov/](http://dfcm.utah.gov/) for DFCM managed projects and [http://www.facilities.utah.edu/designstandards](http://www.facilities.utah.edu/designstandards) for University managed projects) includes the following documents which are incorporated herein by reference:

**REVISED:**


**REVISED:**

2. Design Requirements documents DFCM requirements which have resulted from DFCM’s expertise and experience from previous projects. Design Requirements, University of Utah Supplement, details specific University requirements accumulated from University experience. Refer to [http://dfcm.utah.gov/](http://dfcm.utah.gov/) for DFCM managed projects and [http://www.facilities.utah.edu/designstandards](http://www.facilities.utah.edu/designstandards) for University managed projects. Both documents are required for University projects.

B. DFCM incorporates by reference Codes, Standards, Rules…

**ADDED:**

1. Refer to the University of Utah Facilities Management Web Site ([www.facilities.utah.edu](http://www.facilities.utah.edu)), Departments, Building Official for current code information required for University of Utah project design.

C. Date of Applicable Documents

**ADDED:**

2. The A/E shall insure that all applicable requirements of both the DFCM Design Manual and the University of Utah Supplement are included in the A/E’s design.

   a. To ensure compliance with the latest version of the DFCM Design Manual and the University of Utah Supplement, the A/E shall incorporate any revisions of these documents up to the date of the University’s approval of the A/E’s submitted design development documents.
b. To ensure compliance with the latest requirements for specific products and vendors in the DFCM Design Manual and the University of Utah Supplement, the A/E shall include any revisions of these documents regarding such items up to the submittal of Contract Documents for Contractor bidding.

1.3 Communication

**REVISED:**

A. Project Manager

DFCM’s Designated Representative or the University Project Manager shall arrange for implementing an effective process for communicating with the Agency’s University inquiries, and concerns related to the project.

1.4 Conflicts, Exclusions, Omissions, and Revisions

A. Conflicts

**REVISED:**

2. In cases where references in the Design Process have changed or are otherwise incorrect, document issues to DFCM’s Designated Representative for DFCM managed projects.

**ADDED:**

a. For Design Manual or supplement conflicts on University of Utah projects, any anticipated change to, or variance from any portion of the DFCM Design Manual and its associated supplements will require a review by the University Design Standards Committee. Each request for change or variance must be submitted to the Committee on the appropriate form found herein and on the Facilities web site. Document the issue on the appropriate form and route the completed form through the University Project Manager to Facilities Business Services.

B. Exclusions

**REVISED:**

1. Where any requirement cannot be applied due to project specific requirements that conflict with the Design Process, they will be considered for exclusion. A requirement may be excluded only when the exclusion may not affect DFCM’s or the University’s ability to deliver high quality facilities and does not absolve DFCM or the University, or entities which contract with DFCM or the University, from the responsibility to provide facility realization services that comply with the Design Process.

**REVISED:**

2. DFCM’s Designated Representative is responsible for submitting exclusions from the Design Process for a specific project to the Director of DFCM for DFCM managed projects. For University of Utah projects, managed either by DFCM or the University, proposed exclusions to the DFCM Design Manual and its University of Utah Supplement for University Projects shall be documented on a University of Utah Design Standards “Project Variance Request Form” and
routed through the University Project Manager to the University’s Design Standards Committee for review. The Director (DFCM) has the responsibility and authority for examining whether the proposed exclusions are appropriate and for approving them on DFCM managed projects. University’s Design Standards Committee has the responsibility and authority to evaluate University specific issues.

**ADDED:**

C. Change and Variance Forms.

The University of Utah Design Standards “Change Request Form” and “Project Variance Request Form” are provided on the following two pages.

*Intentionally left blank.*
<table>
<thead>
<tr>
<th>Section of the Design Standards Being Considered</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requested By</td>
<td></td>
</tr>
<tr>
<td>Requestor’s Office / Shop Organization</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brief Description of the Current Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested Wording for the Proposed Addition / Deletion / Change (attach additional document(s) for lengthy changes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Committee Review Date</th>
<th>Committee Decision / Action Assignment</th>
</tr>
</thead>
</table>
# VARIANCE REQUEST FORM

<table>
<thead>
<tr>
<th>UNIVERSITY OF UTAH DESIGN STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT VARIANCE REQUEST FORM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>University Project Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Project Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requested By</th>
<th>Requestor’s Office / Shop Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Current Design Requirement (Reference the Applicable Design Standard)**

**Brief Description of the Problem (Include the Proposed Addition / Deletion / Change to the Design Requirement)**

**Justification**

<table>
<thead>
<tr>
<th>Committee Review Date</th>
<th>Committee Decision / Action Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.0 PROJECT SPECIFIC REQUIREMENTS

2.1 Image to Public and Occupants

A. General

REVISIED:

2. Provide facilities that are aesthetically compatible with the function and importance of the facility. Obtain permission from DFCM’s Designated Representative / University Project Manager to expose facility components which detract from the aesthetic quality of the facility.

REVISIED:

3. Review aesthetic features, which are defined as architectural elements other than finishes that are not required for the facility to function efficiently for the Agency University, with the DFCM’s Designated Representative / University Project Manager. Examples of aesthetic features are: atriums, fountains, skylights, spaces with excessive volume, and exterior free standing architectural elements.

B. Appearance and Image of the Facility

REVISIED:

1. Determine, with the University Project Manager (and DFCM’s Designated Representative where applicable), the required appearance and image of the facility.

2.2 Budget

REVISIED:

A. Services within Budget

Provide Design Services that do not exceed the project budget in the Agreement with either DFCM or the University of Utah.

B. The project budget, which must not be exceeded...

REVISIED:

1. In projects where the services of an A/E are procured, the A/E with the University (or DFCM for DFCM managed projects) shall develop a cost model within the budget for the construction of the project. The different portions of the cost model will be assigned to the A/E and the Design Subconsultants for identifiable elements of the project. Refer to the Cost Model Requirements for additional requirements.

C. Alternates

REVISIED:

1. Obtain approval from the University Project Manager (or DFCM’s Designated Representative as applicable) for any alternates prior to advertisement. Do not exceed six alternates, unless approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects).
**ADDED:**
6. For University managed projects, alternates shall be listed in ranked priority. The determination of the low bidder must be based on the base bid plus any alternates awarded in the order in which they were ranked.

2.3 Schedule

**REVISED:**
A. Complete Services on Schedule
   Provide Design Services that are completed on schedule as documented in the Agreement with the University or DFCM for the specific project.

**REVISED:**
1. Written approval of any changes in the schedule is required from the University Project Manager or DFCM’s Designated Representative for DFCM managed projects.

2.4 Agency Related Requirements

**REVISED:**
A. Constraints to Design Services
   Provide Design Services, within the constraints of the Design Process and other DFCM and University specified constraints, which meet requirements specified by the Agency, University, requirements not stated by the Agency University but which are necessary for the intended use, statutory and regulatory requirements, and additional requirements specified by the participants in the Facility Program (if one is prepared).

**REVISED:**
1. Minimize the disruption of the Agency’s University’s mission.

---

### 3.0 REGULATORY, STANDARDS, AND DFCM REQUIREMENTS

3.1 General

**REVISED:**
A. Document Design Assumptions
   Document in the Basis of Design the assumptions utilized in the design, including codes and other regulatory requirements (including dates and amendments), consensus based standards, and DFCM / University requirements.

**ADDED:**
1. The A/E will comply with the program/scope document as a contractual obligation. Design progress is to be reviewed with the University Project Manager in an ongoing dialogue intended to aid the A/E in achieving a design solution appropriate to meet the needs of the University.

2. There are master plans which govern the development of all projects within the University's jurisdiction. The A/E is to follow these guidelines.
C. Utilize design practices…

1. Exceptions

**REVISED:**

   a. If a proposed system is not designed in accordance with a consensus based standard, notify the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). This requirement provides the University or DFCM the opportunity to determine whether the risk of an option that does not comply with a consensus based standard is acceptable.

---

### 4.0 PROJECT PROCESS

#### 4.1 General

**REVISED:**

A. CSI Project Development Stages

This section defines, in general, the stages in the facility life cycle based upon the Construction Specification Institute’s Project Resource Manual. The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) has the flexibility to adapt or combine stages to the needs of the project subject to DFCM / University processes and procedures.

C. Documentation Requirements

**REVISED:**

1. Document Submittals

For non-University projects, DFCM encourages document submittals to be submitted in digital pdf format; however, provide paper copies in accordance with agreements and as required to fulfill requirements. Copies in digital format may be transmitted by email, except for copies which shall become a permanent record which shall be submitted in DVD format.

**ADDED:**

   a. For University of Utah projects, managed either by DFCM or the University, and in addition to the requirement for CAD formatted drawings, submit electronic review drawings and specifications in Bluebeam PDF searchable format with drawing sheet identifiers in accordance with the National Cad Standard using the specific University approved parent-child format for discipline designators. Request these Bluebeam PDF formatting requirements from the University Project Manager well in advance of design phase review submittals.
2. Permanent Record Documents

Design for most projects is developed in five stages. Each design stage is submitted for review. Revision comments and approval to proceed are directed to the A/E. Some projects will not require all five stages, and for such projects the A/E should clearly understand which submittals are required. Permanent Record Documents…

REVISED:

3. Digital Documents

For non-University projects, Digital Documents in pdf, DWG, DGN, DOC, XLS, and similar formats. Specific digital document requirements for University of Utah projects are described below.

REVISED:

a. For all projects, provide documentation of Virus Free Format: Virus Scanning Software, Version, Date; Scan Date.

ADDED:

4. Code Summary

For all University of Utah projects, managed either by DFCM or the University, include a code summary placed on the second drawing sheet following the title sheet. The code summary form is located on the University of Utah Facilities Management Web Site (www.facilities.utah.edu), Building Official (under “Departments”).

5. Performance Parameters

For all University of Utah projects, managed either by DFCM or the University, include a summary of building performance parameters (design temperatures for spaces, humidity control set-points, special ventilation requirements, lighting levels for spaces, etc.) with the code summary.

D. Verification

REVISED:

1. Both DFCM and the University of Utah expects that each project task can be completed right the first time. In order to meet this expectation, the goal is to eliminate nonconformity by concentrating the efforts of all participants necessary to contribute to proper planning. Without proper planning, rework absorbs resources that often results in compressing the schedule which can increase costs, cause additional schedule compression, and reduce quality. To avoid rework, both DFCM and the University require that each member of the A/E team is expected to verify that their work is complete prior to submitting it for observation by DFCM, the University or its their agents. The DFCM’s / University verification process shall not be a substitute for the verification process required by the parties in contract with DFCM or the University and shall not relieve these parties of their responsibilities.
REVISED:
b. Notwithstanding this expectation, it is understood that the planning, programming, and design services develop through an iterative process; however, it is expected that the deliverables required at each phase of the process shall be substantially complete prior to obtaining approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) to proceed to the next phase of the process. The reason for this requirement is to avoid compressing the schedule which contributes to poor quality. Major changes in approved documents shall be avoided and require approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects).

E. Validation.
The A/E shall fully cooperate in providing information required to validate the design.

REVISED:
1. Either DFCM or the University may validate, or arrange to have validated, that the work process and the facility complies with the Design Process, the Facility Program (if prepared), and other Agency University Design Criteria. Refer to the related documents for Design Requirements.

REVISED:
2. Either DFCM or the University may arrange for the validation of the Structural Design by a Structural Engineering Peer Review. The Structural Engineering Peer Review shall be performed by a Utah registered SE experienced in similar project types.

REVISED:
3. Either DFCM or the University may arrange for the validation of the Energy Design for conformance with DFCM's energy conservation requirements by a Utah Professional Engineer specializing in mechanical engineering.

REVISED:
4. Either DFCM or the University may arrange for the validation of the Irrigation Design for conformance with DFCM's water conservation requirements by a certified Landscape Irrigation Auditor.

4.2 Project Conception Stage

REVISED:
A. Need Statement
All DFCM / University projects start off as a need statement…

ADDED:
1. A need statement (scope statement) describes the basic requirements, goals, design objectives, etc. of the project. The University Project Manager may prepare a scope statement or assign this task to the A/E. The scope of a project defines the design and construction limits for the intended work.

2. The A/E will comply with the program / need / scope document as a contractual obligation. Design progress is to be reviewed with the University Project
Manager in an ongoing dialogue intended to aid the A/E in achieving a design solution appropriate to meet the needs of the University.

3. There are master plans which govern the development of all projects within the University's jurisdiction.

4. The A/E is to follow these guidelines.

**REVISED:**

B. Steering Committee

DFCM or the University shall assemble a steering committee which includes the appropriate representation from DFCM / the University and the Agency appropriate University entities to provide guidance to the design team throughout the process.

**REVISED:**

C. Funding

DFCM / The University shall allocate the funding in accordance with its procedures and prepare a schedule documenting the major milestones for the funded portions of the project. DFCM / The University shall define project quality by requiring compliance with the Design Process and other specific requirements necessary for project success.

4.3 Project Delivery Stage

**REVISED:**

A. Delivery Method

The University (or DFCM for DFCM managed projects) shall determine the project delivery method and selection procedures. The project delivery method…

B. Construction Delivery Methods:

**REVISED:**

1. Construction Management/General Contractor (CM/GC)

This method of construction is the preferred construction delivery method for the State development projects. University of Utah projects over $2.5 million will be evaluated to determine the better procurement method between CM/GC and 2-step low bid. The CM/GC assists the A/E by…

**REVISED:**

3. Design-Build

DFCM or the University contracts with a single-entity for the complete design and construction of a project. The selection of this delivery method requires approval of the Director (for DFCM managed projects) or the Associate Vice President, Facilities Management (for University managed projects). Either the Single Bid or Multiple Bid Procurement methods are acceptable in this construction delivery method.
4.4 Design Stages

**REVISED:**

Note: If the project is small and uncomplicated the different design stages may be combined with approval of the University Project Manager (or DFCM Designated Representative for DFCM managed projects).

B Expectations of Design Team.

**REVISED:**

1. Both DFCM and the University expects that the A/E, together with its subconsultants, have responsible charge of the Design. The A/E shall designate the person who is in responsible charge of a specific design service for a specific project and through a qualification’s process assure DFCM / the University that the person is qualified legally and by experience to perform the specific design service. This designated person shall be…

**REVISED:**

2. The goal is a quality coordinated design that minimizes the need for RFI’s or change orders, and achieves a high value for cost. It is necessary that drawings, notes, and specifications be coordinated so as to minimize conflicting provisions. A design that relies upon a preponderance of vendor expertise and design effort, generally, will not accomplish this goal. Include the necessary expertise in your A/E team. Obtain permission from DFCM / the University for the use of any performance specifications which do not show the extent of the work on the drawings and which are significantly a product of vendor input. Coordinate all work between disciplines.

**REVISED:**

3. Either DFCM or the University may utilize the services of an independent commissioning agent. The A/E shall coordinate with the selected commissioning agent to incorporate the commissioning requirements in to the specification. The commissioning agent shall provide the information that must be included in the specification. The goal of the commissioning agent is to focus on key systems identified with DFCM / the University that, from past experience, have been problematic. The commissioning agent validates that the key systems will comply with the Design Process, DFCM’s / the University’s Project Constraints, and the Basis of Design at each phase of the project after their services have been procured.

**REVISED:**

C. Cover Sheets

DFCM has established cover sheets for the drawings for each design phase of DFCM managed projects. These are available through the DFCM web site. Utilize these cover sheets for each submittal phase to DFCM.

**ADDED:**

1. The University has likewise established cover sheets for project drawings. Use University of Utah cover sheets for each phase submittal to the University.

D. Stage 1 – System Selection

System Selection Design Phase
REVISED:
1. In the System Selection Design phase (at approximately 50% to 75% completion of Schematic Design), the A/E shall confirm the facility program requirements defined in the facility program document or as otherwise defined by the University (or DFCM as applicable).

REVISED:
2. The A/E shall document its Basis of Design including any design assumptions, and confirm the assumptions with the authorities having jurisdiction, the University Agency and DFCM where applicable.

REVISED:
3. The A/E shall provide the University, DFCM, steering committee (as applicable) with system options and evaluate the impact of each. Adjust the allocation of resources within the cost model, without exceeding the budget, based upon the direction from the steering committee or University as applicable. Obtain mutual agreement in order to proceed.

ADDED:
a. For University projects, describe design alternatives with an economic analysis, if requested. Such design alternatives might include one level versus multi-level construction, glass fiber reinforced concrete versus brick veneer, steel versus concrete, or chilled water versus DX systems.

(1) If requested, submit the following considerations with recommendation for:

(a) Alternative Structural Systems (including seismic)

(b) Alternative Mechanical Systems

(i) Heating

(ii) Air conditioning

(iii) Ventilation

(iv) Controls

(v) Plumbing (if specialized)

(vi) Fire protection

(c) Alternative Electrical Systems

(i) Power

(ii) Lighting

(iii) Fire notification

(d) Alternative Acoustical Systems

(e) Energy Saving Considerations

b. For University projects, when an economic analysis is requested, include life cycle costs in which initial investment, operation, and maintenance
4. System Selection Submittal Requirements:

b. Drawings Requirements

**REVISED:**

(1) Use the University / DFCM provided cover sheets and input the required information.

(4) Architecture

**REVISED:**

(a) Architectural Drawings: should include floor plans and room names, exit pathways and exterior rough elevations to show the essence of the building material types. Note that room numbers on University projects are assigned by the University and provided to the A/E at the design development stage of design.

E. Stage 2 – Schematic Design

Schematic Design Phase

2. In the Schematic Design phase, the A/E documents…

**ADDED:**

a. Schematic Design Drawing

(1) For University projects, the schematic design is generally presented in a "single-line" type drawing showing the type of construction and materials to be used and a visual organization of the total facility and site.

(2) This stage of the design should include the site plan, floor plans, building cross sections, elevations as required, mechanical systems, electrical systems, and a CSI outline specification.

b. Site Drawing

For University projects, the site drawing is to include proposed adjacent development as well as existing buildings, landscape, trees, walks, plazas, roads, parking, utilities, etc., all properly oriented with the coordinate requirements for University projects described in CAD Requirements 8.2.C herein. This is intended to provide a clear understanding of all influences affecting the building design.

c. Existing Utilities

For University projects, special attention must be given to existing utilities. The A/E is responsible for the identification and impact...
assessment of the numerous underground utilities in and around the project site. Consideration of future utility development is also required. The University Project Manager can assist in utility identification and future development plans. Field verification should be considered with the University Project Manager.

d. Value Management Session

For University projects, the schematic design may be evaluated in a value management Session where additional alternatives may be considered. The A/E will be expected to implement approved design change proposals identified by the value management team.

**REVISED:**

3. The A/E shall be responsible to communicate with the State Fire Marshall’s Office to receive any direction required to move to the next phase of design. On University managed projects, the A/E shall be responsible to communicate with the University Building Official and University Fire Marshall as appropriate.

4. Schematic Submittal Requirements:

   a. Written Requirements.

   **REVISED:**

   (2) Updated Cost Model

   Note: The A/E is not to proceed unless the cost estimate is within the budget.

**ADDED:**

5. Schematic Design Review and Approval on University Managed Projects

   a. The schematic design (including the cost estimate) is to be submitted for review. The University Project Manager will coordinate the review of the mechanical and electrical portion with Facility Operations. The A/E is responsible for coordinating code reviews with the Fire Marshal for compliance with Life Safety, ADA, Board of Health, and OSHA requirements. The A/E should plan to present the schematic design at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

   (1) The schematic design submission must be within budget. The University reserves the right to verify the estimate. A submission not within the project budget will be returned to the A/E without review, will be considered incomplete, and will not meet contractual scheduled submission deadlines.

F. Stage 3 – Design Development

   Design Development Phase

1. Continue to Develop and Refine the Schematic Design Requirements

   **REVISED:**
2. After written approval of Schematic Design has been obtained from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects), the A/E shall proceed with the design development phase of the project upon receipt of written confirmation to initiate the next phase of design. The design development phase fixes and describes the size and character of the entire project. Submittal drawings should have enough detail with a scale large enough to show furnishings, equipment, and all elements necessary for the proper function of the facility and the spaces within. In order for the project design to be considered successful, only minor modifications to the location of the facility on the site, the floor plans, and facility sections should be required during the Construction Documents Stage.

**REVISED:**

3. The A/E shall be responsible to communicate with the State Fire Marshall’s Office to receive any direction required to move to the next phase of design. On University managed projects, the A/E shall be responsible to communicate with the University Building Official and University Fire Marshall as appropriate.

**REVISED:**

4. Design Development Plan Review. The DD Design (including the cost estimate) is to be submitted for review. The A/E is responsible for coordinating code reviews with the Building Official and the State Fire Marshal for compliance with Life Safety, ADA, Board of Health, and OSHA requirements. For University managed projects, the A/E should plan to present the design development submittal at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

e. Typical floor plans

**ADDED:**

(1) Electronic Submittal for Room Numbering (all University projects):

(a) When the design of a project includes the addition or deletion or relocation of walls, the design development submittal shall include an electronic version of the design development drawings in accordance with Section 8.0 “CAD Requirements” herein AND include PDF formats. The revised floor plan will be used for room numbering by the University.

**ADDED:**

f. The design development submission must be within budget. The University reserves the right to verify the estimate. A submission not within the project budget will be returned to the A/E without review, will be considered incomplete, and will not meet contractual scheduled submission deadlines.

5. Design Development Submittal Requirements:

a. Written Requirements:

**REVISED:**
(2) **Updated Cost Model**

The cost estimate must include the current CSI divisions with detailed quantities and unit costs.

(3) **Project Manual (refer to CSI Project Resource Manual)**

*ADDED:*

(a) For University managed projects, the University's general requirements "boiler plate" section is not to be included with the specifications for this submittal.

(b) For University managed projects, the specification should include a summary of recommendations concerning the general type, quality, and character of building systems and materials included in the project.

b. **Drawing Requirements:**

*ADDED:*

For the DD submission on all University projects, the following specific requirements for campus GIS must be followed. These requirements apply to every type of delivery method (design-bid-build, design-build, or CM/GC) and are applicable to every bid package submitted for DD review.

(1) Include electronic copies of the ACAD drawings and PDFs of the DD drawings.

(a) **ACAD DD Drawings**

   (i) Provide all civil, landscape, architectural and structural drawings.

   (ii) Civil drawings are to show the utility information leading up to the building.

(b) **PDF DD Files**

   Provide a PDF set of files containing all DD drawings.

*REVISED:*

Continue to update and refine what was previously shown and add the following information. **Submittal drawings should have enough detail with a scale large enough to show furnishings, equipment, and all elements necessary for the proper function of the facility and the spaces within.**

G. **Stage 4 – Construction Documents**

**Construction Documents Phase**

*REVISED:*
1. After written approval of the Design/Development Documents has been obtained from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects), the A/E shall proceed with the construction documents phase of the project. The construction documents are…

**ADDED:**

a. Project Review Meeting

For University managed projects, the A/E should plan to present the completed construction documents submittal at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

**REVISED:**

2. Coordinate requirements for the following items with the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) and assist the University / DFCM as needed.

**REVISED:**

d. Obtain list of contractors from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects), if applicable.

**ADDED:**

i. Material and Equipment Selections

For University managed projects, material and equipment selections used in the completed design are to be reviewed with the University Project Manager and approved before the final review submittal.

**REVISED:**

3. The University (or DFCM for DFCM managed projects) will initiate and prepare, with assistance as required from A/E, the following standard documents.

a. Notice to Contractors
b. Bid Form
c. Bid Bond (DFCM)
d. Bidder’s Proposed Subcontractors (DFCM)
e. Contractor Agreement Form (DFCM / University of Utah)
f. Payment Bond (DFCM)
g. Performance Bond (DFCM)
h. Certificate of Substantial Completion (DFCM / University of Utah)
i. General Conditions (DFCM / University of Utah)
j. Supplementary Conditions (DFCM) / Supplemental General Conditions for University of Utah Projects (University of Utah). The University of Utah General Conditions and Supplemental General Conditions for University of Utah Projects are available at http://www.facilities.utah.edu/contractdocuments.
4. Construction Documents Submittal Requirements

**REVISED:**

a. Written Requirements

Submit a detailed cost estimate. This estimate shall include a careful take-off and breakdown of trades, quantities, labor, material, profit, overhead, contingencies, architect's fees, furnishings, equipment, etc., and shall include all design changes made up to the estimate date. The University may choose to verify the estimate. If so, the A/E will be required to meet with the University’s estimator to reconcile differences between the two estimates.

**REVISED:**

b. Drawing Requirements

For University managed projects, the A/E is to submit six hard-copy sets and one electronic CAD drawing and PDF of drawings and specifications for construction (or furnishings/equipment installation) that depict and define complete requirements for the facility. The University Project Manager will distribute copies internally, including one set to the University’s Environmental Health and Safety Department. Complete, coordinated drawings ready for final review and comment by DFCM (as applicable), the Agency **University** and Authorities having jurisdiction include the following:

**REVISED:**

1. Project Title Page: Template provided by the University (or DFCM for DFCM managed projects).

**ADDED:**

**d. Specific University of Utah review requirements:**

1. **Budget**

   A submission not within the project budget will be returned to the A/E without review.

2. **Site Plan**

   When a site plan is applicable to a project, or when the footprint of an existing building changes, an electronic drawing (in accordance with Section 8.0 “Cad Requirements” herein) and PDF of the project site plan showing the building footprint, including extensions, awnings, connecting bridges, etc., in relation to the surrounding environment shall accompany the construction document Submittal for review.

3. **Special Events Affecting the Construction**
The University of Utah operates 365 days per year, 24 hours per day. On occasion, there are a number of special events which may have an adverse effect on the construction schedule for any project. The most prominent of these are the annual commencement ceremonies, but there may be other such events. It is the responsibility of the A/E to specifically identify those events, and to clearly delineate them in the contract documents, if such events may cause construction efforts to be halted, delayed, or modified. Such wording must enable the bidding Contractor to anticipate shutdown costs and schedule delays in its bid.

(4) Inspection Checklist

The A/E shall prepare a comprehensive inspection checklist comprised of specifications requirements to be published as part of the specifications package. The checklist will be used later during project inspections and systems commissioning. This checklist should be organized to follow the specifications numbering system and shall include all sections.

H. Stage 5 – Contract Documents

Contract Documents Phase

REVISED:

1. Written Approval to Proceed

After the construction documents have been modified to comply with requirements of the authorities having jurisdiction and requirements of the steering committee written approval by DFCM’s Designated Representative (for DFCM managed projects) or the University Project Manager (for University managed projects) is required to issue the Contract Documents.

REVISED:

a. Building Official Plan Sets

Provide two complete and corrected sets of drawings. Drawings shall be wet-stamped, signed and dated by a State of Utah licensed Architect or Engineer and submitted for approval by the University or State Building Official. One set to be retained by the University (or DFCM for DFCM managed projects), the other set to be given to the General Contractor and kept at the construction site.

ADDED:

b. Bid Due Dates

For University managed projects, dates for advertising, walk-through, prior approvals, and the due date for bids will be established by the University.

c. “Boiler Plate”
For University managed projects, the University's general requirements "boiler plate" section will be added to the front of the project specifications by the University.

d. Advertisement (University Managed Projects)

(1) Projects to be bid will be advertised if the construction cost estimate reaches or exceeds a threshold established by University / DFCM procurement rules. If advertising is required, the University will post the boilerplate, specifications and drawings into the University’s Internet based bid system where the project will be visible to all contractors.

(2) Projects with estimates below the advertising threshold may similarly be entered into the Internet based bid system; however, visibility and access may be limited to specific contractors invited to bid. No other contractors will see the project on the web site.

e. Issuing Bid Documents

For University managed projects, contract documents and associated addenda for bidding will be distributed by the University on its Internet based bid system. The A/E will generally download the final documents from the University’s Internet based bid system to print sets for the University.

f. Furnishings, Fixtures and Equipment

For University managed projects, furnishings and equipment bidding documents will require coordination between the A/E, the University Project Manager and the University’s Purchasing Department before preparing documents. Begin this process with abundant lead time prior to the intended bid. The A/E may be required to prepare the specifications using the form and layout provided by Purchasing. The University will add a title sheet and legal bidding information to the front of the A/E’s specifications. University Purchasing will issue bidding documents to vendors / suppliers via the University’s Internet based bid system.

g. Contractor / Vendor Questions

Contractor/vendor questions will be directed to the A/E, who will prepare an addendum for review and issuance by the University through the University’s Internet based bid system. See “j” below.

h. Pre-Bid Meeting

For University managed projects, any pre-bid meeting will generally be conducted by the A/E and assisted by the University Project Manager. Contractor questions which result in clarifying or project altering
responses will require an addendum. A mandatory pre-bid meeting will require an addendum listing the attending contractors.

i. Addenda to Bid Documents

For University managed projects, addenda to the bidding documents will be prepared by the A/E, then submitted via simultaneous email to the University Project Manager and pre-identified members of the Facilities Business Services Contracts (“Contracts”) staff. The email is to be sent to the Project Manager and identified Contracts staff at the same time to allow the University Project Manager to verify content while the Contracts staff verifies compliance with procurement rules. The last addendum must allow all contractors/subcontractors/vendors adequate time to adjust their bids. If addendum release is too close to bid day, the Contracts staff may require an extension of the bid due date.

j. Submission of Bids

For University managed projects, the A/E is not permitted to receive bids. Bids are submitted through the University’s Internet based bid system for receipt by the University.

k. Bids Over Budget

The A/E must revise specifications and drawings upon request at no cost to the University/DFCM, if the lowest responsive bid exceeds the total construction budget. If a professional estimator is used by the A/E, the A/E retains responsibility for the estimate and design revisions.

l. Award and Notice to Proceed

Following the bid opening, the A/E may be asked to assist the University/DFCM in evaluating the bids and preparing for award. The University/DFCM will control the advertising, bid opening, publishing of bid results, awarding of the contract, securing the contract, etc.

I. Stage 6 – Pre-Construction

Pre-Construction Stage

2. Pre-Construction Meeting

REVISED:

a. The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) shall arrange for a preconstruction meeting. The A/E will assist during the preconstruction meeting to clarify the line of communication, establish inspection criteria, coordinate staging space; and, present the rules for document interpretation, change orders, etc. Shop drawing scheduling shall be coordinated so that the information is available for each discipline and trade to review and coordinate prior to the Pre-installation conference.
**ADDED:**

J. Stage 7 – Construction

Specific Construction Stage Requirements for University Managed Projects

1. Shop Drawings / Submittals

   A concurrent review by Facility Operations is required. Provide a copy of each submittal to the University Project Manager for distribution. The University Project Manager is responsible to establish review deadlines for each applicable Facility Operations shop, and respond to the A/E with timely review comments within the time limits provided in the Contract Documents.

2. Substitution Requests

   The University Project Manager will obtain Facility Operations’ approval / rejection of materials and equipment included in any substitution request after the A/E has reviewed the request.

3. Substantial Completion

   a. Per the landscape design requirements in *Design Requirements*, projects with landscape irrigation require the Contractor to obtain a CLIA Audit prior to the Substantial Completion Inspection (the CLIA Audit report must be acceptable to the University before authorizing a Substantial Completion Inspection).

   b. A set of as-built control drawings are to be accessible during the walk-through.

4. University As-Built Documents Requirements

   a. Furnish to the University within 60 days of the completion of the project, a complete set of “Record As-Built” drawings and project documents.

      (1) Security System As-Built Submittal

      “Record As-Built” drawings and project documents prepared by the installing contractor of the security system will be submitted directly to the University’s UCard main office. This information must be kept confidential and must be submitted as one bound hard copy and one electronic copy. No other entity will receive a copy of security system “as-built” drawings and project documents.

      b. The “Record As-Built” submittal is to include:

         (1) Two "as-built" original tracings on bond (re-plotted CAD drawings).
(2) One electronic copy of the Revit model if designed in Revit.

(3) One electronic copy of CAD “as-built” drawings, specifications, addenda, change orders, cost estimates, design calculations, balancing information, field notes, meeting minutes, submittals, warranties, operation & maintenance manuals, and images. The electronic copy is to include drawings in AutoCAD and PDF formats. Any other documents provided on the disk are also to be in PDF.

(a) The electronic copy shall be on compact disk with the following label information:

(i) DISK LABEL:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- A/E BUSINESS NAME
- A/E’S PROJECT NUMBER
- SUBMITTAL DATE

(ii) CASE EDGE LABEL:
- UNIVERSITY OF UTAH
- UNIVERSITY PROJECT NUMBER

(iii) CASE COVER LABEL:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- A/E BUSINESS NAME
- A/E’S PROJECT NUMBER
- SUBMITTAL DATE

(iv) CASE INSIDE COVER:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- DISK CONTENTS, FILE TREE, FILE NAMES
  - Drawings (AutoCAD)
  - Drawings (Adobe PDF)
  - Specifications
  - Addenda
  - Change Orders
  - Cost Estimates
  - Design Calculations
  - Balancing Reports
  - Field Notes
  - Meeting Minutes
  - Submittals
  - Warranties
  - O&M Manuals
  - Images
5.0 DFCM QUALITY ASSURANCE REQUIREMENTS

5.1 General

REVISED:
A. Interdisciplinary Coordination
DFCM has determined that many of the Quality Control problems can be reduced by a structured approach to interdisciplinary coordination and integration. The A/E shall integrate the drawings and specifications of all disciplines. The A/E shall inform the University (or DFCM for DFCM managed projects) of the process they will implement with the design team for dimensional control and comprehensive coordination of all elements of each of the following:

6.0 COST MODEL REQUIREMENTS

6.1 General

REVISED:
A. Goal of Cost Model Requirements
The goal of the Cost Model Requirements is to provide clear criteria which the cost models and bids for a facility must meet to achieve DFCM’s and the University’s requirements for the project to be considered successful.

REVISED:
B. Defined in A/E Agreement
The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) shall define in the “Agreement between the University / DFCM and A/E” the Cost Model submittals required by the A/E. Unless otherwise indicated in the “Agreement Between University / DFCM and A/E,” Cost Models are submitted at the following phases:

REVISED:
C. Cost Model at Each Design Phase
The A/E shall prepare a Cost Model at each phase of the Design which identifies a sub-cost model for each discipline. Based upon this Cost Model, the A/E with each of the Design Subconsultants shall summarize in the Cost Model narrative what can be constructed in accordance with the Cost Model. Document any variances that do not comply with the Design Process, Facility Program, or Agency University Requirements. Prepare design document submittals that comply with the Cost Model.

On projects where a CM/GC has been selected the CM firm will…
6.2 Standards

A. Cost Model Preparation
   The Cost Model shall be prepared according to the…
   
   \textit{REVISED:}
   2. Exception: a proprietary Cost Estimating data base may be utilized when
      validated by objective evidence and approved by the University Project Manager
      (or DFCM’s Designated Representative for DFCM managed projects).

6.3 Cost Model Report Table of Contents

A. Executive Summary
   
   \textit{REVISED:}
   4. DFCM or University Furnished Cost Model (Lump Sum, Cost/gross sf);

7.0 PROJECT MANUAL REQUIREMENTS

7.1 General
   
   \textit{REVISED:}
   C. A/E Addresses Instructions to Contractor
      The only parties to the construction contract are the DFCM \textit{(or University of Utah for University managed projects)} and Contractor. The A/E shall therefore address all
      instructions to the Contractor. Do not address individual subcontractors or trades.
      
   \textit{ADDED:}
   F. Specifications Requirements
      Specifications Requirements for University of Utah Projects:
      1. Boiler Plate
         a. The A/E will coordinate with the University Project Manager to provide
            project specific information for the following “boiler plate” documents
            which are placed at the beginning of project specifications:
            
            (1) Title Page
            (2) Table of Contents
            (3) Notice to Contractors
            (4) Instructions to Bidders
            (5) Bid Response Form
            (6) Bid Bond Form
            (7) Subcontractors List Form
            (8) Sample Contractor's Agreement
            (9) Performance / Payment Bond Forms
2. Coordination

Drawings and specifications shall coordinate with each other. All items described in the specifications shall be referenced in the drawings. Avoid duplication and conflict between the various drawings and specifications sections. In project specifications, do not repeat requirements described in the General Conditions. The A/E will be liable for all costs attributable to change orders resulting from coordination conflicts within the Contract Documents. This will include coordination of all portions of the documents prepared by subconsultants as well.

3. Accurate, Detailed Documents

A fundamental requirement is that drawings and specifications be complete, detailed, and accurate enough such that all bidders may prepare estimates on exactly the same work, and that construction may proceed with no misunderstanding of the work to be done.

4. Unusual Materials

Avoid the use of unusual materials or items not readily available locally. Where materials may not be well known, include the name and address of either the manufacturer or local supplier.

5. University Approved Manufacturers

Certain items identified in the “Design Requirements” University of Utah Supplement are identified as “approved manufacturers”. Where this occurs, no other manufacturer is acceptable without written approval from the University Project Manager prior to the bid due date. Approval by the A/E of any other manufacturer as a substitute without such written notice is not acceptable and the A/E will be liable for all costs incurred in obtaining acceptable equipment for the project.

7.2 Preferred Source Documents

*REvised:*

A. Manufacturer’s Written Specifications

The University / DFCM requires written disclosure and project manager approval if specifications are prepared by a manufacturer. Manufacturer written specifications generally should not be used in order to avoid unfair influence by a manufacturer in the procurement process.
**REVISED:**

B. Comply with CSI / Documented Quality Process

The University / DFCM requires that specifications be prepared in compliance with CSI requirements and that the specification masters be prepared using a documented quality process.

7.3 Construction guarantees and warranties shall:

**REVISED:**

A. Protect

Protect DFCM and the University against faults, defects, or failure, in spite of technical compliance with the terms of the contract.

**REVISED:**

B. Extend Warranty on Selected Items

Extend the manufacturer’s responsibility beyond the end of the one year guarantee period on selected items as approved by DFCM (or the University as applicable).

7.4 Product and Service Life Cycle Requirement:

A. Assure High Value

Assure there is a high value for the cost by:

**REVISED:**

1. Maximize competition consistent with the purpose. In addition, minimize sole source procurements (Refer to http://www.rules.utah.gov/publicat/code/r023/r023-001.htm). Provide a minimum of three manufacturers for each material or installation, except where authorization from the University Associate Vice President – Facilities Management (or Director of DFCM for DFCM projects) has been obtained for sole source procurements. The use of an “or equal” clause in the specifications…

2. In order to avoid excessive addition and replacement costs, use open source and open protocol systems when possible.

**REVISED:**

a. Where proprietary software and service organizations are required to service a component, obtain price information for DFCM (as applicable) and the Agency University identifying the long term cost (10 years) in order to include this in the evaluation.

7.5 Materials **REVISED:**

A. Specify New Materials / Standards Certification

Specify materials which are new, unless approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). Provide certification or label with the name of the manufacturer or supplier and the approved testing laboratory where consensus based standards have been developed.
8.0 CAD REQUIREMENTS

8.1 General

**REVISED:**
B. Produce all University Drawings in CAD
   For DFCM managed projects, coordinate with DFCM’s Designated Representative to determine the drawing format. For University projects, the consultant shall produce all drawings in a CAD format with a specific coordinate system as described in 8.2. C.1.

**ADDED:**
1. The consultant shall provide drawings for University projects in either .dwg or .rvt format.
2. Consultants shall select the project drawing format using the following guidelines:
   a. Anticipated project construction cost less than $2.5 million: .rvt or .dwg format.
   b. Anticipated project construction cost $2.5 million or more: .rvt format.
3. The consultant shall prepare civil site drawings in .dwg format regardless of the anticipated project construction cost.
4. The consultant shall provide all survey data collected in the field in either .csv or .txt format, including associated coordinates and coding, within 30 days of collection.

**REVISED:**
C. Approval to Vary from CAD Standards
   The performance requirements are given as appropriate as minimum criteria to allow flexibility within the constraints of the CAD Standards. If a variance from the standard is desired, the approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) is required.

8.2 Standards

B. CAD Software

**REVISED:**
2. Microstation, current version (not allowed on University projects)

**ADDED:**
C. Required University Coordinate System
   Coordinate System Requirements for all University of Utah Projects
   1. The consultant shall prepare all drawings with the following coordinate system:
      a. Horizontal: NAD 1983 UTM Zone 12N feet
b. Vertical: NAVD 1988 feet

2. The consultant shall utilize this coordinate system in all submitted drawings (site plans, floor plans, ceiling plans, mechanical, electrical, elevations, etc.).

D. GIS for University of Utah Projects

1. The consultant shall provide the University with all survey data collected in the field during design and construction within 30 days of collection. The survey data shall be in either .csv or .txt format and shall include all associated coordinates and coding.

2. The consultant shall provide the University with all underground utility information collected during design and construction within 30 days of collection. The utility information shall include location of existing utilities as well as expected location of utilities planned for installation.

8.3 Guidance

A. Assumptions

**REVISED:**

1. The consultant shall bind xrefs in all .dwg drawings.

**ADDED:**

E. Specific University of Utah drawing requirements:

1. Use the University’s standard title sheet, standard “sheet two” and the Design Code & Criteria for code summary and design parameters. Each template will be provided by the University Project Manager.

2. Use simple keyed notation for items pertaining to each individual sheet. Do not use keyed notes referencing specification section numbers.

3. Redundancy of dimensions, brand names, specification oriented notes, etc. is prohibited.

4. Nomenclature of systems, assemblies, items, etc. must agree with the specifications. For example, usage of trade/brand names such as "Drivit" in lieu of "Exterior Insulation and Finish System" is not acceptable. Another example is "Sheet Rock" in lieu of "Gypsum Board".

5. Once University-assigned room numbers have been provided, only the University room numbers should appear in submitted drawings. This transition must occur by the Construction Documents phase and Contract Documents must reflect University-assigned room numbers.

6. Include exact locations for existing features and conditions which surround or traverse the project site. Include buildings (with critical grades, elevations, heights, floor levels, views), landscape (with exact locations of trees), utilities, drainage, lighting, walks, roads, parking, etc. Coordinate the site plan(s) scale with the University Project Manager. Note that the University does not
warrant the accuracy or completeness of its Utility Base Maps. To the extent that survey information, or the University’s utility location maps, may be incomplete or inaccurate as to the actual size and location of site utilities, topography, existing landscape, or structures, the A/E is required to determine the information needed for accurate development of the Project.

a. No structure will be allowed to be built over existing underground utilities without prior approval from the University at design conception. The University is required to prior-approve appropriate budget / funding for complete utility relocation / restoration.

8.4 CAD Layer Guidelines – Supplemental Requirements

B. Identify user-defined layers using standard alphanumeric format.

**ADDED:**

1. For all University projects, in order to facilitate the preparation of floor plans and the conversion of floor plans into GIS format, the layers containing walls (both exterior and interior), windows, doors, and University-assigned room numbers must contain only these elements. Submittals must clearly identify which layers contain this floor plan information.

2. Drawing elements should be grouped in appropriate layers. Drawing elements within a categorized grouping should be represented in one layer only. Minimize unnecessary duplication of elements for purely graphic purposes.

3. Separating old and new elements of the same type. Drawings may contain separate layers differentiating between existing objects and the new objects that are to be installed or constructed, as long as the layer names are clear and each layer actually contains only that type of object, and this same type of object does not appear arbitrarily throughout other layers. For example, curb lines may be separated into two layers representing existing curbs and new curbs.

4. Unacceptable Conditions. Digital site plan drawings containing conditions such as the following will not be accepted: 1) Layers identified by numbers alone, for example ‘20300012’; or layers identified by very general terms, such as 'LINEWORKP1'; or layers identified by terms that are not easily understood; 2) Common elements, for example, the surrounding sidewalks, represented in multiple layers.

5. Use simple, straight forward layer names and ensure that the contents of layers are consistent. Use the layering guidelines in the National AIA CAD Standard as adopted by DFCM. Layering of the drawing shall be arranged such that each layer contains one, and only one, type of real world object. Layer names are expected to be relatively intuitive and/or explicit in describing the content of each layer. If the layer name is "cryptic", e.g. simply a series of numbers, then include a simple list of layer names (electronic, on the same disk as the referenced files) and a description of what each layer contains. It is
preferable to have the real world elements separated more or less according to the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROADS</td>
<td>all roads elements (including curbs)</td>
</tr>
<tr>
<td>SIDEWALKS</td>
<td>all sidewalk elements</td>
</tr>
<tr>
<td>BUILDING</td>
<td>all building footprints and elements</td>
</tr>
<tr>
<td>OTHER</td>
<td>other, non-building elements like walls, concrete, and rock</td>
</tr>
<tr>
<td>LIGHT POLES</td>
<td>light poles, power poles, bollards, and other point elements</td>
</tr>
<tr>
<td>UTILITY</td>
<td>all buried utility line elements</td>
</tr>
<tr>
<td>LANDSCAPE</td>
<td>all landscaping elements like trees, shrubs, etc.</td>
</tr>
<tr>
<td>CONTOUR</td>
<td>all contour line work and elevation info</td>
</tr>
<tr>
<td>SURVEY</td>
<td>all survey and/or grid referencing elements like bench marks</td>
</tr>
<tr>
<td>PAINT</td>
<td>all paint line elements like red curbs, striping, etc.</td>
</tr>
<tr>
<td>GRAPHIC</td>
<td>all other purely graphic elements</td>
</tr>
</tbody>
</table>

8.5 Uniform Drawing Standards – Supplemental Requirements

A. Drawing Set Organization

REVISE

D:

3. File Naming Convention: DFCM’s preference is to use two character discipline designators. One character discipline designators may be used for sheets that apply to all the drawings in a discipline or if the project is small. For small projects, the use of one character discipline designators must be approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) for the project.

B. Sheet Organization

REVISE

D:

2. Obtain written approval, prior to submitting sheets that vary from this standard, from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). Request shall be in writing and include a justification for the variance.

REVISED:

D. Drafting Conventions

Comply with Drafting Conventions Module 04 for both DFCM and University projects. Use University supplied sheets for University projects. Where approvals are required per instructions below, University projects will require approval from the University Project Manager.
**REVISED:**

H. Code Conventions
   Provide the code information as required in the design process and in paragraph 4.1.C.4 in this University of Utah Supplement (or DFCM cover sheet templates for DFCM managed projects).

**ADDED:**

I. Building Performance Parameters
   For University of Utah projects, include a summary of building performance parameters (design temperatures for spaces, humidity control set-points, special ventilation requirements, lighting levels for spaces, etc.) with the code summary.

8.6. Construction Phase

   1. General
      The consultant shall update the project drawings every 30 days to show changes made through change orders or recorded on red-line drawings kept by the contractor.

   2. Shop drawings
      The contractor shall submit fabrication models, coordination models, and shop drawings in the same format (.dwg or .RVT) as the project drawings. These drawings shall reflect the exact geometric properties of the materials and systems being submitted.

8.8 Project Close-out

   The Design team shall coordinate preparation and submittal of the following close-out documents:

   1. The consultant shall deliver submittals and record drawings (.rvt or .dwg and .pdf format) within 45 days of substantial completion.

   2. The contractor shall deliver scanned as-built drawings (.tif format) within 45 days of substantial completion.

   3. The contractor shall deliver O&M manuals and warranty information to the consultant for review following substantial completion. The contractor shall incorporate the consultant’s comments in the O&M manuals and warranty information and submit the final version (2 hard copies in three-ring binders and one .pdf version) to the University within 45 days of substantial completion.

*End of University of Utah Supplement – Design Process*
GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Process” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated March 15, 2006, is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:
The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University policies, procedures, and requirements which pertain to the construction of new and remodeled facilities.

This supplement is an essential tool and guide to be used by the A/E through all phases of project development. It is not meant to dictate design solutions, but rather guide design decisions to be in harmony with University standards.

ADDED:

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>8.0</td>
<td>CAD Added new requirements</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapter 1 “General Guidelines” has been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 has been placed in the “Design Process” supplement while other portions have become supplemental text to the other two volumes, “Programming Standards” and “Design Requirements.” Chapter 1 text which duplicates DFCM or A/E</td>
</tr>
</tbody>
</table>
Revisions Summary (continued)

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Campus Design &amp; Construction. CD&amp;C has changed to Construction Project Delivery</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Facilities Planning. Facilities Planning has changed to Campus Planning</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Business Services. Business Services has changed to Facilities Business Services</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Plant Operations. Plant Operations has changed to Facility Operations</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>O&amp;M Manuals. Removed Chapter 1 O&amp;M manual requirements which are now located in the Supplemental General Conditions for University of Utah Projects</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Printed Bid Sets to University. Removed the requirement for 5 bid sets delivered to the Project Manager. No hard copy sets of bidding documents are needed unless requested by the Project Manager. Building Official reviews are now accomplished in electronic format.</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>8.3 / A. / 1.</td>
<td>XREFs. Submitted CAD drawings using xrefs to have xrefs bound</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>8.1 / B. / 2.</td>
<td>Revit. Revit drawings to be converted to CAD for submittals</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / F. / 5. / b.</td>
<td>GIS. DD Phase Submittals are to comply with GIS requirements</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / a. / (3)</td>
<td>XREFs. As-Built Drawings using xrefs to have xrefs bound</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / c. / (1)</td>
<td>“As-Built” Tracings. Two As-Built original tracings required (previously one)</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.4 / J. / 12. / c. / (2)</td>
<td>Revit. One electronic copy of Revit model is required if designed in Revit</td>
</tr>
</tbody>
</table>
1.0 GENERAL

1.1 General

**REVISED:**

A. Design Process

The Design Process applies to the capital development and capital improvement activities of DFCM, and the design of construction projects at the University of Utah. It contains specific information for the preparation of contract documents administered by the Division of Facilities Construction and Management or University of Utah Facilities Management. It delineates and supplements (either directly in the document or indirectly by reference) codes, industry recognized standards, and guide specifications. Many of the criteria are based upon the experience of DFCM and the University and the input of professional and industry representatives.

**REVISED:**

B. Performance Evaluation

Each entity which has a contract with DFCM or the University of Utah will be evaluated on its performance in accordance with the Design Process which includes both self-performed work and the performance of its subconsultants. As a result, it is critical that the A/E, which is in contract with DFCM or the University of Utah, communicate to its subconsultants the requirements of the Design Process and that the subconsultants communicate to the A/E and DFCM / University any deviations from the Design Process.

**ADDED:**

C. A/E Selection

DFCM (assisted by the University) selects and manages A/Es for University projects administered by the State. University of Utah Facilities Management selects and manages A/Es for University administered projects.

D. Projects Over $10 Million

Projects larger than $10 million are generally administered by DFCM. For DFCM managed projects, DFCM will issue contracts, authorize payments, manage change orders, etc., until completion, whereupon the University will occupy, operate, and maintain the new or remodeled facility. Though managed by DFCM, the University will participate in the development and management of the project. This includes design reviews and approval of each design phase before further progress is authorized.

E. Delegation / Designing University Projects

The State has delegated to the University the authority to manage construction projects costing less than $10 million and may also delegate larger projects on a project specific basis. Facilities Management will manage all aspects of these projects (contracts,
authorize payments, manage change orders, etc.) and is directly responsible to University Administration, the Board of Trustees, the DFCM, and the State Building Board.

1. Designing University of Utah Construction Projects
   a. Point of Contact

   Facilities Management is generally the A/E’s only authorized contact with the University on project related items.

   b. Direction from Facilities Management Only

   The A/E and Contractor are cautioned to take no action on directions issued by other University staff or departments until approval is obtained from Facilities Management, because any cost to the designer or Contractor, either by the action itself or subsequent repair or realignment to the project scope, will not be compensated by project funds, Facilities Management, nor by DFCM.

2. The role of Facility Operations

   The Facility Operations department is responsible for the operation and maintenance of most campus buildings, systems, and grounds; and, participates in the development of the University’s "Design Standards". Project information needed from Facility Operations is to be requested through the University Project Manager.

3. The role of Campus Planning

   The Campus Planning department identifies the site for each new building and manages the program phase of design. This department is responsible for continuity in campus development.

4. The role of the University Purchasing Department

   The Purchasing department oversees bidding on projects administered by the University. The procurement processes for A/E services and construction are managed and conducted by Facilities Management (Facilities Business Services). Procurement processes for material purchases are generally managed and conducted by Purchasing.

5. The role of the A/E

   a. DFCM (assisted by the University) selects and manages A/Es for campus projects administered by the State. Facilities Management selects and manages A/Es for University administered projects.

   b. Design A/Es and their subconsultants must be licensed or permitted as required by pertinent Utah State laws. Subconsultants must be identified in the fee proposal before contractual agreements are processed.
c. Creativity and innovation, which encourage a fresh review of University direction, are openly welcomed.

6. University Hospital / Clinic Facilities Design and Construction

a. Construction projects in the University Hospital and some surrounding buildings are handled differently than other buildings on campus. Understanding the reasons for these differences will help clarify the intent of the University’s policies. Specific differences include:

(1) Accreditation

Construction and maintenance work in the hospital and associated buildings is required to meet the stringent requirements of the JCAHO. These requirements will affect project design.

(2) Construction Activity

Construction activity will be affected by patient care concerns. Noise, dust, contamination, electrical outages, and similar problems could severely compromise patients’ welfare. Therefore, construction activity will often require special schedules and techniques.

(3) Timely Performance

Timely performance of design and construction is a constant concern. University Hospital functions as a teaching institution as well as a patient care facility and is a self-funding institution. Revenue generated by the hospital is critical to maintaining quality of care. Excessive lead time for construction materials or down time for site renovation negatively affects patient care, teaching schedules, and lost revenue for the facility.

(4) Utility Systems

Hospital utility systems serve several buildings. Work on the utility systems may adversely affect other buildings and must be carefully monitored and controlled.

b. The Hospital Department of Facilities and Engineering (or “Hospital F&E”) consists of project supervisors, designers, draftsmen, estimators, maintenance, and construction personnel.

(1) Hospital F&E may contract directly with A/E's up to a delegated threshold limit. When the construction cost estimate exceeds a certain threshold, Facilities Management will bid the construction via the University’s Internet based bid system.
Projects in the hospital area of the campus will often require joint coordination with Hospital F&E and Facilities Management. For such projects, the A/E will primarily work with both a Hospital F&E designer and a Hospital F&E project supervisor, and secondarily with a University Project Manager assigned by Facilities Management who will organize the bidding process.

1.2 Related Documents

**REVISED:**

A. Documents incorporated by reference.

The Design Process (refer to [http://dfcm.utah.gov/](http://dfcm.utah.gov/) for DFCM managed projects and [http://www.facilities.utah.edu/designstandards](http://www.facilities.utah.edu/designstandards) for University managed projects) includes the following documents which are incorporated herein by reference:

**REVISED:**


**REVISED:**

2. Design Requirements documents DFCM requirements which have resulted from DFCM’s expertise and experience from previous projects. Design Requirements, University of Utah Supplement, details specific University requirements accumulated from University experience. Refer to [http://dfcm.utah.gov/](http://dfcm.utah.gov/) for DFCM managed projects and [http://www.facilities.utah.edu/designstandards](http://www.facilities.utah.edu/designstandards) for University managed projects. Both documents are required for University projects.

B. DFCM incorporates by reference Codes, Standards, Rules…

**ADDED:**

1. Refer to the University of Utah Facilities Management Web Site ([www.facilities.utah.edu](http://www.facilities.utah.edu)), Departments, Building Official for current code information required for University of Utah project design.

C. Date of Applicable Documents

**ADDED:**

2. The A/E shall insure that all applicable requirements of both the DFCM Design Manual and the University of Utah Supplement are included in the A/E’s design.

   a. To ensure compliance with the latest version of the DFCM Design Manual and the University of Utah Supplement, the A/E shall incorporate any revisions of these documents up to the date of the University’s approval of the A/E’s submitted design development documents.
b. To ensure compliance with the latest requirements for specific products and vendors in the DFCM Design Manual and the University of Utah Supplement, the A/E shall include any revisions of these documents regarding such items up to the submittal of Contract Documents for Contractor bidding.

1.3 Communication

REvised:
A. Project Manager
    DFCM’s Designated Representative or the University Project Manager shall arrange for implementing an effective process for communicating with the University for the purposes of determining facility requirements, Agency’s University inquiries, and concerns related to the project.

1.4 Conflicts, Exclusions, Omissions, and Revisions

A. Conflicts

REvised:
2. In cases where references in the Design Process have changed or are otherwise incorrect, document issues to DFCM’s Designated Representative for DFCM managed projects.

ADDED:
  a. For Design Manual or supplement conflicts on University of Utah projects, any anticipated change to, or variance from any portion of the DFCM Design Manual and its associated supplements will require a review by the University Design Standards Committee. Each request for change or variance must be submitted to the Committee on the appropriate form found herein and on the Facilities web site. Document the issue on the appropriate form and route the completed form through the University Project Manager to Facilities Business Services.

B. Exclusions

REvised:
1. Where any requirement cannot be applied due to project specific requirements that conflict with the Design Process, they will be considered for exclusion. A requirement may be excluded only when the exclusion may not affect DFCM’s or the University’s ability to deliver high quality facilities and does not absolve DFCM or the University, or entities which contract with DFCM or the University, from the responsibility to provide facility realization services that comply with the Design Process.

REvised:
2. DFCM’s Designated Representative is responsible for submitting exclusions from the Design Process for a specific project to the Director of DFCM for DFCM managed projects. For University of Utah projects, managed either by DFCM or the University, proposed exclusions to the DFCM Design Manual and its University of Utah Supplement for University Projects shall be documented on a University of Utah Design Standards “Project Variance Request Form” and
routed through the University Project Manager to the University’s Design Standards Committee for review. The Director (DFCM) has the responsibility and authority for examining whether the proposed exclusions are appropriate and for approving them on DFCM managed projects. University’s Design Standards Committee has the responsibility and authority to evaluate University specific issues.

ADDED:

C. Change and Variance Forms.
The University of Utah Design Standards “Change Request Form” and “Project Variance Request Form” are provided on the following two pages.

Intentionally left blank.
## CHANGE REQUEST FORM

### UNIVERSITY OF UTAH DESIGN STANDARDS

#### CHANGE REQUEST FORM

<table>
<thead>
<tr>
<th>Section of the Design Standards Being Considered</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requested By</th>
<th>Requestor’s Office / Shop Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brief Description of the Current Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested Wording for the Proposed Addition / Deletion / Change (attach additional document(s) for lengthy changes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Committee Review Date</th>
<th>Committee Decision / Action Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**VARIANCE REQUEST FORM**

<table>
<thead>
<tr>
<th>UNIVERSITY OF UTAH DESIGN STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT VARIANCE REQUEST FORM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>University Project Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Project Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requested By</th>
<th>Requestor’s Office / Shop Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Design Requirement (Reference the Applicable Design Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brief Description of the Problem (Include the Proposed Addition / Deletion / Change to the Design Requirement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Committee Review Date</th>
<th>Committee Decision / Action Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Design Process – University of Utah Supplement


2.0 PROJECT SPECIFIC REQUIREMENTS

2.1 Image to Public and Occupants

A. General

**REVISED:**

2. Provide facilities that are aesthetically compatible with the function and importance of the facility. Obtain permission from DFCM’s Designated Representative / University Project Manager to expose facility components which detract from the aesthetic quality of the facility.

**REVISED:**

3. Review aesthetic features, which are defined as architectural elements other than finishes that are not required for the facility to function efficiently for the Agency University, with the DFCM’s Designated Representative / University Project Manager. Examples of aesthetic features are: atriums, fountains, skylights, spaces with excessive volume, and exterior free standing architectural elements.

B. Appearance and Image of the Facility

**REVISED:**

1. Determine, with the University Project Manager (and DFCM’s Designated Representative where applicable), the required appearance and image of the facility.

2.2 Budget

**REVISED:**

A. Services within Budget

Provide Design Services that do not exceed the project budget in the Agreement with either DFCM or the University of Utah.

B. The project budget, which must not be exceeded...

**REVISED:**

1. In projects where the services of an A/E are procured, the A/E with the University (or DFCM for DFCM managed projects) shall develop a cost model within the budget for the construction of the project. The different portions of the cost model will be assigned to the A/E and the Design Subconsultants for identifiable elements of the project. Refer to the Cost Model Requirements for additional requirements.

C. Alternates

**REVISED:**

1. Obtain approval from the University Project Manager (or DFCM’s Designated Representative as applicable) for any alternates prior to advertisement. Do not exceed six alternates, unless approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects).
**ADDED:**
6. For University managed projects, alternates shall be listed in ranked priority. The determination of the low bidder must be based on the base bid plus any alternates awarded in the order in which they were ranked.

### 2.3 Schedule

**REVISED:**
A. Complete Services on Schedule
Provide Design Services that are completed on schedule as documented in the Agreement with the University or DFCM for the specific project.

**REVISED:**
1. Written approval of any changes in the schedule is required from the University Project Manager or DFCM’s Designated Representative for DFCM managed projects.

### 2.4 Agency Related Requirements

**REVISED:**
A. Constraints to Design Services
Provide Design Services, within the constraints of the Design Process and other DFCM and University specified constraints, which meet requirements specified by the Agency University, requirements not stated by the Agency University but which are necessary for the intended use, statutory and regulatory requirements, and additional requirements specified by the participants in the Facility Program (if one is prepared).

**REVISED:**
1. Minimize the disruption of the Agency’s University’s mission.

### 3.0 REGULATORY, STANDARDS, AND DFCM REQUIREMENTS

#### 3.1 General

**REVISED:**
A. Document Design Assumptions
Document in the Basis of Design the assumptions utilized in the design, including codes and other regulatory requirements (including dates and amendments), consensus based standards, and DFCM / University requirements.

**ADDED:**
1. The A/E will comply with the program/scope document as a contractual obligation. Design progress is to be reviewed with the University Project Manager in an ongoing dialogue intended to aid the A/E in achieving a design solution appropriate to meet the needs of the University.

2. There are master plans which govern the development of all projects within the University's jurisdiction. The A/E is to follow these guidelines.
C. Utilize design practices…

1. Exceptions

*REVISED:*

a. If a proposed system is not designed in accordance with a consensus based standard, notify the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). This requirement provides the University or DFCM the opportunity to determine whether the risk of an option that does not comply with a consensus based standard is acceptable.

### 4.0 PROJECT PROCESS

#### 4.1 General

*REVISED:*

A. CSI Project Development Stages

This section defines, in general, the stages in the facility life cycle based upon the Construction Specification Institute’s Project Resource Manual. The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) has the flexibility to adapt or combine stages to the needs of the project subject to DFCM / University processes and procedures.

C. Documentation Requirements

*REVISED:*

1. **Document Submittals**

For non-University projects, DFCM encourages document submittals to be submitted in digital pdf format; however, provide paper copies in accordance with agreements and as required to fulfill requirements. Copies in digital format may be transmitted by email, except for copies which shall become a permanent record which shall be submitted in DVD format.

*ADDED:*

a. For University of Utah projects, managed either by DFCM or the University, and in addition to the requirement for CAD formatted drawings, submit electronic review drawings and specifications in Bluebeam PDF searchable format with drawing sheet identifiers in accordance with the National Cad Standard using the specific University approved parent-child format for discipline designators. Request these Bluebeam PDF formatting requirements from the University Project Manager well in advance of design phase review submittals.
REVISED:

2. Permanent Record Documents

Design for most projects is developed in five stages. Each design stage is submitted for review. Revision comments and approval to proceed are directed to the A/E. Some projects will not require all five stages, and for such projects the A/E should clearly understand which submittals are required. Permanent Record Documents…

REVISED:

3. Digital Documents

For non-University projects, Digital Documents in pdf, DWG, DGN, DOC, XLS, and similar formats. Specific digital document requirements for University of Utah projects are described below.

REVISED:

a. For all projects, provide documentation of Virus Free Format: Virus Scanning Software, Version, Date; Scan Date.

ADDED:

4. Code Summary

For all University of Utah projects, managed either by DFCM or the University, include a code summary placed on the second drawing sheet following the title sheet. The code summary form is located on the University of Utah Facilities Management Web Site (www.facilities.utah.edu), Building Official (under “Departments”).

5. Performance Parameters

For all University of Utah projects, managed either by DFCM or the University, include a summary of building performance parameters (design temperatures for spaces, humidity control set-points, special ventilation requirements, lighting levels for spaces, etc.) with the code summary.

D. Verification

REVISED:

1. Both DFCM and the University of Utah expects that each project task can be completed right the first time. In order to meet this expectation, the goal is to eliminate nonconformity by concentrating the efforts of all participants necessary to contribute to proper planning. Without proper planning, rework absorbs resources that often results in compressing the schedule which can increase costs, cause additional schedule compression, and reduce quality. To avoid rework, both DFCM and the University require that each member of the A/E team is expected to verify that their work is complete prior to submitting it for observation by DFCM, the University or its their agents. The DFCM’s / University verification process shall not be a substitute for the verification process required by the parties in contract with DFCM or the University and shall not relieve these parties of their responsibilities.
REVISED:
b. Notwithstanding this expectation, it is understood that the planning, programming, and design services develop through an iterative process; however, it is expected that the deliverables required at each phase of the process shall be substantially complete prior to obtaining approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) to proceed to the next phase of the process. The reason for this requirement is to avoid compressing the schedule which contributes to poor quality. Major changes in approved documents shall be avoided and require approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects).

E. Validation.
The A/E shall fully cooperate in providing information required to validate the design.

REVISED:
1. Either DFCM or the University may validate, or arrange to have validated, that the work process and the facility complies with the Design Process, the Facility Program (if prepared), and other Agency University Design Criteria. Refer to the related documents for Design Requirements.

REVISED:
2. Either DFCM or the University may arrange for the validation of the Structural Design by a Structural Engineering Peer Review. The Structural Engineering Peer Review shall be performed by a Utah registered SE experienced in similar project types.

REVISED:
3. Either DFCM or the University may arrange for the validation of the Energy Design for conformance with DFCM’s energy conservation requirements by a Utah Professional Engineer specializing in mechanical engineering.

REVISED:
4. Either DFCM or the University may arrange for the validation of the Irrigation Design for conformance with DFCM’s water conservation requirements by a certified Landscape Irrigation Auditor.

4.2 Project Conception Stage

REVISED:
A. Need Statement
All DFCM / University projects start off as a need statement…

ADDED:
1. A need statement (scope statement) describes the basic requirements, goals, design objectives, etc. of the project. The University Project Manager may prepare a scope statement or assign this task to the A/E. The scope of a project defines the design and construction limits for the intended work.

2. The A/E will comply with the program / need / scope document as a contractual obligation. Design progress is to be reviewed with the University Project
Manager in an ongoing dialogue intended to aid the A/E in achieving a design solution appropriate to meet the needs of the University.

3. There are master plans which govern the development of all projects within the University's jurisdiction.

4. The A/E is to follow these guidelines.

**REVISED:**

B. Steering Committee

DFCM or the University shall assemble a steering committee which includes the appropriate representation from DFCM / the University and the Agency appropriate University entities to provide guidance to the design team throughout the process.

**REVISED:**

C. Funding

DFCM / The University shall allocate the funding in accordance with its procedures and prepare a schedule documenting the major milestones for the funded portions of the project. DFCM / The University shall define project quality by requiring compliance with the Design Process and other specific requirements necessary for project success.

4.3 Project Delivery Stage

**REVISED:**

A. Delivery Method

The University (or DFCM for DFCM managed projects) shall determine the project delivery method and selection procedures. The project delivery method…

B. Construction Delivery Methods:

**REVISED:**

1. Construction Management/General Contractor (CM/GC)

   This method of construction is the preferred construction delivery method for the State development projects. University of Utah projects over $2.5 million will be evaluated to determine the better procurement method between CM/GC and 2-step low bid. The CM/GC assists the A/E by…

**REVISED:**

3. Design-Build

DFCM or the University contracts with a single-entity for the complete design and construction of a project. The selection of this delivery method requires approval of the Director (for DFCM managed projects) or the Associate Vice President, Facilities Management (for University managed projects). Either the Single Bid or Multiple Bid Procurement methods are acceptable in this construction delivery method.
4.4 Design Stages

**REVISED:**

Note: If the project is small and uncomplicated the different design stages may be combined with approval of the [University Project Manager](#) (or DFCM Designated Representative for DFCM managed projects).

B Expectations of Design Team.

**REVISED:**

1. Both DFCM and the University expects that the A/E, together with its subconsultants, have responsible charge of the Design. The A/E shall designate the person who is in responsible charge of a specific design service for a specific project and through a qualification’s process assure DFCM / the University that the person is qualified legally and by experience to perform the specific design service. This designated person shall be…

**REVISED:**

2. The goal is a quality coordinated design that minimizes the need for RFI’s or change orders, and achieves a high value for cost. It is necessary that drawings, notes, and specifications be coordinated so as to minimize conflicting provisions. A design that relies upon a preponderance of vendor expertise and design effort, generally, will not accomplish this goal. Include the necessary expertise in your A/E team. Obtain permission from DFCM / the University for the use of any performance specifications which do not show the extent of the work on the drawings and which are significantly a product of vendor input. Coordinate all work between disciplines.

**REVISED:**

3. Either DFCM or the University may utilize the services of an independent commissioning agent. The A/E shall coordinate with the selected commissioning agent to incorporate the commissioning requirements in to the specification. The commissioning agent shall provide the information that must be included in the specification. The goal of the commissioning agent is to focus on key systems identified with DFCM / the University that, from past experience, have been problematic. The commissioning agent validates that the key systems will comply with the Design Process, DFCM’s / the University’s Project Constraints, and the Basis of Design at each phase of the project after their services have been procured.

**REVISED:**

C. Cover Sheets

DFCM has established cover sheets for the drawings for each design phase of DFCM managed projects. These are available through the DFCM web site. Utilize these cover sheets for each submittal phase to DFCM.

**ADDED:**

1. The University has likewise established cover sheets for project drawings. Use University of Utah cover sheets for each phase submittal to the University.

D. Stage 1 – System Selection

System Selection Design Phase
1. In the System Selection Design phase (at approximately 50% to 75% completion of Schematic Design), the A/E shall confirm the facility program requirements defined in the facility program document or as otherwise defined by the University (or DFCM as applicable).

2. The A/E shall document its Basis of Design including any design assumptions, and confirm the assumptions with the authorities having jurisdiction, the University Agency and DFCM where applicable.

3. The A/E shall provide the University, DFCM, steering committee (as applicable) with system options and evaluate the impact of each. Adjust the allocation of resources within the cost model, without exceeding the budget, based upon the direction from the steering committee or University as applicable. Obtain mutual agreement in order to proceed.

ADDED:

a. For University projects, describe design alternatives with an economic analysis, if requested. Such design alternatives might include one level versus multi-level construction, glass fiber reinforced concrete versus brick veneer, steel versus concrete, or chilled water versus DX systems.

(1) If requested, submit the following considerations with recommendation for:

(a) Alternative Structural Systems (including seismic)

(b) Alternative Mechanical Systems

(i) Heating

(ii) Air conditioning

(iii) Ventilation

(iv) Controls

(v) Plumbing (if specialized)

(vi) Fire protection

(c) Alternative Electrical Systems

(i) Power

(ii) Lighting

(iii) Fire notification

(d) Alternative Acoustical Systems

(e) Energy Saving Considerations

b. For University projects, when an economic analysis is requested, include life cycle costs in which initial investment, operation, and maintenance
costs are considered during the economic life of the structure. The economic analysis shall be prepared in accordance with generally accepted practice.

4. System Selection Submittal Requirements:

   b. Drawings Requirements

   **REVISED:**

   (1) Use the University / DFCM provided cover sheets and input the required information.

   (4) Architecture

   **REVISED:**

   (a) Architectural Drawings: should include floor plans and room names, exit pathways and exterior rough elevations to show the essence of the building material types. Note that room numbers on University projects are assigned by the University and provided to the A/E at the design development stage of design.

E. Stage 2 – Schematic Design
   Schematic Design Phase

2. In the Schematic Design phase, the A/E documents…

   **ADDED:**

   a. Schematic Design Drawing

   (1) For University projects, the schematic design is generally presented in a "single-line" type drawing showing the type of construction and materials to be used and a visual organization of the total facility and site.

   (2) This stage of the design should include the site plan, floor plans, building cross sections, elevations as required, mechanical systems, electrical systems, and a CSI outline specification.

   b. Site Drawing

   For University projects, the site drawing is to include proposed adjacent development as well as existing buildings, landscape, trees, walks, plazas, roads, parking, utilities, etc., all properly oriented with the coordinate requirements for University projects described in CAD Requirements 8.2.C herein. This is intended to provide a clear understanding of all influences affecting the building design.

   c. Existing Utilities

   For University projects, special attention must be given to existing utilities. The A/E is responsible for the identification and impact
assessment of the numerous underground utilities in and around the project site. Consideration of future utility development is also required. The University Project Manager can assist in utility identification and future development plans. Field verification should be considered with the University Project Manager.

d. Value Management Session

For University projects, the schematic design may be evaluated in a value management Session where additional alternatives may be considered. The A/E will be expected to implement approved design change proposals identified by the value management team.

**REVISED:**

3. The A/E shall be responsible to communicate with the State Fire Marshall’s Office to receive any direction required to move to the next phase of design. On University managed projects, the A/E shall be responsible to communicate with the University Building Official and University Fire Marshall as appropriate.

4. Schematic Submittal Requirements:

a. Written Requirements.

**REVISED:**

(2) Updated Cost Model

Note: The A/E is not to proceed unless the cost estimate is within the budget.

**ADDED:**

5. Schematic Design Review and Approval on University Managed Projects

a. The schematic design (including the cost estimate) is to be submitted for review. The University Project Manager will coordinate the review of the mechanical and electrical portion with Facility Operations. The A/E is responsible for coordinating code reviews with the Fire Marshal for compliance with Life Safety, ADA, Board of Health, and OSHA requirements. The A/E should plan to present the schematic design at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

(1) The schematic design submission must be within budget. The University reserves the right to verify the estimate. A submission not within the project budget will be returned to the A/E without review, will be considered incomplete, and will not meet contractual scheduled submission deadlines.

**F. Stage 3 – Design Development**

Design Development Phase

1. Continue to Develop and Refine the Schematic Design Requirements

**REVISED:**
2. After written approval of Schematic Design has been obtained from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects), the A/E shall proceed with the design development phase of the project upon receipt of written confirmation to initiate the next phase of design. The design development phase fixes and describes the size and character of the entire project. Submittal drawings should have enough detail with a scale large enough to show furnishings, equipment, and all elements necessary for the proper function of the facility and the spaces within. In order for the project design to be considered successful, only minor modifications to the location of the facility on the site, the floor plans, and facility sections should be required during the Construction Documents Stage.

**REVISED:**

3. The A/E shall be responsible to communicate with the State Fire Marshall’s Office to receive any direction required to move to the next phase of design. On University managed projects, the A/E shall be responsible to communicate with the University Building Official and University Fire Marshall as appropriate.

**REVISED:**

4. Design Development Plan Review. The DD Design (including the cost estimate) is to be submitted for review. The A/E is responsible for coordinating code reviews with the Building Official and the State Fire Marshal for compliance with Life Safety, ADA, Board of Health, and OSHA requirements. For University managed projects, the A/E should plan to present the design development submittal at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

   e. Typical floor plans

   **ADDED:**

   (1) Electronic Submittal for Room Numbering (all University projects):

   (a) When the design of a project includes the addition or deletion or relocation of walls, the design development submittal shall include an electronic version of the design development drawings in accordance with Section 8.0 “CAD Requirements” herein AND include PDF formats. The revised floor plan will be used for room numbering by the University.

   **ADDED:**

   f. The design development submission must be within budget. The University reserves the right to verify the estimate. A submission not within the project budget will be returned to the A/E without review, will be considered incomplete, and will not meet contractual scheduled submission deadlines.

5. Design Development Submittal Requirements:

   a. Written Requirements:

   **REVISED:**
(2) Updated Cost Model

The cost estimate must include the current CSI divisions with detailed quantities and unit costs.

(3) Project Manual (refer to CSI Project Resource Manual)

**ADDED:**

(a) For University managed projects, the University's general requirements "boiler plate" section is not to be included with the specifications for this submittal.

(b) For University managed projects, the specification should include a summary of recommendations concerning the general type, quality, and character of building systems and materials included in the project.

b. Drawing Requirements:

**ADDED:**

For the DD submission on all University projects, the following specific requirements for campus GIS must be followed. These requirements apply to every type of delivery method (design-bid-build, design-build, or CM/GC) and are applicable to every bid package submitted for DD review.

(1) Include electronic copies of the ACAD drawings and PDFs of the DD drawings.

(a) ACAD DD Drawings

(i) Provide all civil, landscape, architectural and structural drawings.

(ii) Civil drawings are to show the utility information leading up to the building.

(b) PDF DD Files

Provide a PDF set of files containing all DD drawings.

**REVISED:**

Continue to update and refine what was previously shown and add the following information. **Submittal drawings should have enough detail with a scale large enough to show furnishings, equipment, and all elements necessary for the proper function of the facility and the spaces within.**

G. Stage 4 – Construction Documents

Construction Documents Phase

**REVISED:**
1. After written approval of the Design/Development Documents has been obtained from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects), the A/E shall proceed with the construction documents phase of the project. The construction documents are…

**ADDED:**

a. Project Review Meeting

For University managed projects, the A/E should plan to present the completed construction documents submittal at a project review meeting set by the University Project Manager and attended by Facilities Management staff and user departments.

**REVISED:**

2. Coordinate requirements for the following items with the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) and assist the University / DFCM as needed.

**REVISED:**

d. Obtain list of contractors from the University Project Manager (or DFCM's Designated Representative for DFCM managed projects), if applicable.

**ADDED:**

i. Material and Equipment Selections

For University managed projects, material and equipment selections used in the completed design are to be reviewed with the University Project Manager and approved before the final review submittal.

**REVISED:**

3. The University (or DFCM for DFCM managed projects) will initiate and prepare, with assistance as required from A/E, the following standard documents.

   a. Notice to Contractors
   b. Bid Form
   c. Bid Bond (DFCM)
   d. Bidder’s Proposed Subcontractors (DFCM)
   e. Contractor Agreement Form (DFCM / University of Utah)
   f. Payment Bond (DFCM)
   g. Performance Bond (DFCM)
   h. Certificate of Substantial Completion (DFCM / University of Utah)
   i. General Conditions (DFCM / University of Utah)
   j. Supplementary Conditions (DFCM) / Supplemental General Conditions for University of Utah Projects (University of Utah). The University of Utah General Conditions and Supplemental General Conditions for University of Utah Projects are available at [http://www.facilities.utah.edu/contractdocuments](http://www.facilities.utah.edu/contractdocuments).
4. Construction Documents Submittal Requirements

**REVISED:**

a. Written Requirements

Submit a detailed cost estimate. This estimate shall include a careful take-off and breakdown of trades, quantities, labor, material, profit, overhead, contingencies, architect's fees, furnishings, equipment, etc., and shall include all design changes made up to the estimate date. The University may choose to verify the estimate. If so, the A/E will be required to meet with the University’s estimator to reconcile differences between the two estimates.

**REVISED:**

b. Drawing Requirements

For University managed projects, the A/E is to submit six hard-copy sets and one electronic CAD drawing and PDF of drawings and specifications for construction (or furnishings/equipment installation) that depict and define complete requirements for the facility. The University Project Manager will distribute copies internally, including one set to the University’s Environmental Health and Safety Department. Complete, coordinated drawings ready for final review and comment by DFCM (as applicable), the Agency University and Authorities having jurisdiction include the following:

**REVISED:**

(1) Project Title Page: Template provided by the University (or DFCM for DFCM managed projects).

**ADDED:**

d. Specific University of Utah review requirements:

(1) **Budget**

A submission not within the project budget will be returned to the A/E without review.

(2) **Site Plan**

When a site plan is applicable to a project, or when the footprint of an existing building changes, an electronic drawing (in accordance with Section 8.0 “Cad Requirements” herein) and PDF of the project site plan showing the building footprint, including extensions, awnings, connecting bridges, etc., in relation to the surrounding environment shall accompany the construction document Submittal for review.

(3) **Special Events Affecting the Construction**
The University of Utah operates 365 days per year, 24 hours per day. On occasion, there are a number of special events which may have an adverse effect on the construction schedule for any project. The most prominent of these are the annual commencement ceremonies, but there may be other such events. It is the responsibility of the A/E to specifically identify those events, and to clearly delineate them in the contract documents, if such events may cause construction efforts to be halted, delayed, or modified. Such wording must enable the bidding Contractor to anticipate shutdown costs and schedule delays in its bid.

(4) Inspection Checklist

The A/E shall prepare a comprehensive inspection checklist comprised of specifications requirements to be published as part of the specifications package. The checklist will be used later during project inspections and systems commissioning. This checklist should be organized to follow the specifications numbering system and shall include all sections.

H. Stage 5 – Contract Documents
Contract Documents Phase

**REvised:**
1. Written Approval to Proceed

After the construction documents have been modified to comply with requirements of the authorities having jurisdiction and requirements of the steering committee written approval by DFCM’s Designated Representative (for DFCM managed projects) or the University Project Manager (for University managed projects) is required to issue the Contract Documents.

**Revised:**

a. Building Official Plan Sets

Provide two complete and corrected sets of drawings. Drawings shall be wet-stamped, signed and dated by a State of Utah licensed Architect or Engineer and submitted for approval by the University or State Building Official. One set to be retained by the University (or DFCM for DFCM managed projects), the other set to be given to the General Contractor and kept at the construction site.

**AddEd:**

b. Bid Due Dates

For University managed projects, dates for advertising, walk-through, prior approvals, and the due date for bids will be established by the University.

c. “Boiler Plate”
For University managed projects, the University's general requirements "boiler plate" section will be added to the front of the project specifications by the University.

d. Advertisement (University Managed Projects)

(1) Projects to be bid will be advertised if the construction cost estimate reaches or exceeds a threshold established by University / DFCM procurement rules. If advertising is required, the University will post the boilerplate, specifications and drawings into the University’s Internet based bid system where the project will be visible to all contractors.

(2) Projects with estimates below the advertising threshold may similarly be entered into the Internet based bid system; however, visibility and access may be limited to specific contractors invited to bid. No other contractors will see the project on the web site.

e. Issuing Bid Documents

For University managed projects, contract documents and associated addenda for bidding will be distributed by the University on its Internet based bid system. The A/E will generally download the final documents from the University’s Internet based bid system to print sets for the University.

f. Furnishings, Fixtures and Equipment

For University managed projects, furnishings and equipment bidding documents will require coordination between the A/E, the University Project Manager and the University’s Purchasing Department before preparing documents. Begin this process with abundant lead time prior to the intended bid. The A/E may be required to prepare the specifications using the form and layout provided by Purchasing. The University will add a title sheet and legal bidding information to the front of the A/E’s specifications. University Purchasing will issue bidding documents to vendors / suppliers via the University’s Internet based bid system.

g. Contractor / Vendor Questions

Contractor/vendor questions will be directed to the A/E, who will prepare an addendum for review and issuance by the University through the University’s Internet based bid system. See “j” below.

h. Pre-Bid Meeting

For University managed projects, any pre-bid meeting will generally be conducted by the A/E and assisted by the University Project Manager. Contractor questions which result in clarifying or project altering
responses will require an addendum. A mandatory pre-bid meeting will require an addendum listing the attending contractors.

i. Addenda to Bid Documents

For University managed projects, addenda to the bidding documents will be prepared by the A/E, then submitted via simultaneous email to the University Project Manager and pre-identified members of the Facilities Business Services Contracts (“Contracts”) staff. The email is to be sent to the Project Manager and identified Contracts staff at the same time to allow the University Project Manager to verify content while the Contracts staff verifies compliance with procurement rules. The last addendum must allow all contractors/subcontractors/vendors adequate time to adjust their bids. If addendum release is too close to bid day, the Contracts staff may require an extension of the bid due date.

j. Submission of Bids

For University managed projects, the A/E is not permitted to receive bids. Bids are submitted through the University’s Internet based bid system for receipt by the University.

k. Bids Over Budget

The A/E must revise specifications and drawings upon request at no cost to the University/DFCM, if the lowest responsive bid exceeds the total construction budget. If a professional estimator is used by the A/E, the A/E retains responsibility for the estimate and design revisions.

l. Award and Notice to Proceed

Following the bid opening, the A/E may be asked to assist the University/DFCM in evaluating the bids and preparing for award. The University/DFCM will control the advertising, bid opening, publishing of bid results, awarding of the contract, securing the contract, etc.

I. Stage 6 – Pre-Construction
   Pre-Construction Stage

2. Pre-Construction Meeting

   **REVISED:**

   a. The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) shall arrange for a preconstruction meeting. The A/E will assist during the preconstruction meeting to clarify the line of communication, establish inspection criteria, coordinate staging space; and, present the rules for document interpretation, change orders, etc. Shop drawing scheduling shall be coordinated so that the information is available for each discipline and trade to review and coordinate prior to the Pre-installation conference.
ADDED:

J. Stage 7 – Construction
Specific Construction Stage Requirements for University Managed Projects

1. Shop Drawings / Submittals

A concurrent review by Facility Operations is required. Provide a copy of each submittal to the University Project Manager for distribution. The University Project Manager is responsible to establish review deadlines for each applicable Facility Operations shop, and respond to the A/E with timely review comments within the time limits provided in the Contract Documents.

2. Substitution Requests

The University Project Manager will obtain Facility Operations’ approval / rejection of materials and equipment included in any substitution request after the A/E has reviewed the request.

3. Substantial Completion

a. Per the landscape design requirements in Design Requirements, projects with landscape irrigation require the Contractor to obtain a CLIA Audit prior to the Substantial Completion Inspection (the CLIA Audit report must be acceptable to the University before authorizing a Substantial Completion Inspection).

b. A set of as-built control drawings are to be accessible during the walk-through.

4. University As-Built Documents Requirements

a. Furnish to the University within 60 days of the completion of the project, a complete set of “Record As-Built” drawings and project documents.

(1) Security System As-Built Submittal

“Record As-Built” drawings and project documents prepared by the installing contractor of the security system will be submitted directly to the University’s UCard main office. This information must be kept confidential and must be submitted as one bound hard copy and one electronic copy. No other entity will receive a copy of security system “as-built” drawings and project documents.

b. The “Record As-Built” submittal is to include:

(1) Two "as-built" original tracings on bond (re-plotted CAD drawings).
(2) One electronic copy of the Revit model if designed in Revit.

(3) One electronic copy of CAD “as-built” drawings, specifications, addenda, change orders, cost estimates, design calculations, balancing information, field notes, meeting minutes, submittals, warranties, operation & maintenance manuals, and images. The electronic copy is to include drawings in AutoCAD and PDF formats. Any other documents provided on the disk are also to be in PDF.

(a) The electronic copy shall be on compact disk with the following label information:

(i) DISK LABEL:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- A/E BUSINESS NAME
- A/E’S PROJECT NUMBER
- SUBMITTAL DATE

(ii) CASE EDGE LABEL:
- UNIVERSITY OF UTAH
- UNIVERSITY PROJECT NUMBER

(iii) CASE COVER LABEL:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- A/E BUSINESS NAME
- A/E’S PROJECT NUMBER
- SUBMITTAL DATE

(iv) CASE INSIDE COVER:
- PROJECT NAME
- UNIVERSITY PROJECT NUMBER
- DISK CONTENTS, FILE TREE, FILE NAMES
  - Drawings (AutoCAD)
  - Drawings (Adobe PDF)
  - Specifications
  - Addenda
  - Change Orders
  - Cost Estimates
  - Design Calculations
  - Balancing Reports
  - Field Notes
  - Meeting Minutes
  - Submittals
  - Warranties
  - O&M Manuals
  - Images
5.0 DFCM QUALITY ASSURANCE REQUIREMENTS

5.1 General

REVISED:

A. Interdisciplinary Coordination
DFCM has determined that many of the Quality Control problems can be reduced by a structured approach to interdisciplinary coordination and integration. The A/E shall integrate the drawings and specifications of all disciplines. The A/E shall inform the University (or DFCM for DFCM managed projects) of the process they will implement with the design team for dimensional control and comprehensive coordination of all elements of each of the following:

6.0 COST MODEL REQUIREMENTS

6.1 General

REVISED:

A. Goal of Cost Model Requirements
The goal of the Cost Model Requirements is to provide clear criteria which the cost models and bids for a facility must meet to achieve DFCM’s and the University’s requirements for the project to be considered successful. 

REVISED:

B. Defined in A/E Agreement
The University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) shall define in the “Agreement between the University / DFCM and A/E” the Cost Model submittals required by the A/E. Unless otherwise indicated in the “Agreement Between University / DFCM and A/E,” Cost Models are submitted at the following phases:

REVISED:

C. Cost Model at Each Design Phase
The A/E shall prepare a Cost Model at each phase of the Design which identifies a sub-cost model for each discipline. Based upon this Cost Model, the A/E with each of the Design Subconsultants shall summarize in the Cost Model narrative what can be constructed in accordance with the Cost Model. Document any variances that do not comply with the Design Process, Facility Program, or Agency University Requirements. Prepare design document submittals that comply with the Cost Model.

On projects where a CM/GC has been selected the CM firm will…
6.2 Standards

A. Cost Model Preparation
The Cost Model shall be prepared according to the...

REVISEd:
2. Exception: a proprietary Cost Estimating database may be utilized when validated by objective evidence and approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects).

6.3 Cost Model Report Table of Contents

A. Executive Summary

REVISEd:
4. DFCM or University Furnished Cost Model (Lump Sum, Cost/gross sf);

7.0 PROJECT MANUAL REQUIREMENTS

7.1 General

REVISEd:

C. A/E Addresses Instructions to Contractor
The only parties to the construction contract are the DFCM (or University of Utah for University managed projects) and Contractor. The A/E shall therefore address all instructions to the Contractor. Do not address individual subcontractors or trades.

ADDED:

F. Specifications Requirements
Specifications Requirements for University of Utah Projects:

1. Boiler Plate

a. The A/E will coordinate with the University Project Manager to provide project specific information for the following “boiler plate” documents which are placed at the beginning of project specifications:

(1) Title Page
(2) Table of Contents
(3) Notice to Contractors
(4) Instructions to Bidders
(5) Bid Response Form
(6) Bid Bond Form
(7) Subcontractors List Form
(8) Sample Contractor's Agreement
(9) Performance / Payment Bond Forms
2. Coordination

Drawings and specifications shall coordinate with each other. All items described in the specifications shall be referenced in the drawings. Avoid duplication and conflict between the various drawings and specifications sections. In project specifications, do not repeat requirements described in the General Conditions. The A/E will be liable for all costs attributable to change orders resulting from coordination conflicts within the Contract Documents. This will include coordination of all portions of the documents prepared by subconsultants as well.

3. Accurate, Detailed Documents

A fundamental requirement is that drawings and specifications be complete, detailed, and accurate enough such that all bidders may prepare estimates on exactly the same work, and that construction may proceed with no misunderstanding of the work to be done.

4. Unusual Materials

Avoid the use of unusual materials or items not readily available locally. Where materials may not be well known, include the name and address of either the manufacturer or local supplier.

5. University Approved Manufacturers

Certain items identified in the “Design Requirements” University of Utah Supplement are identified as “approved manufacturers”. Where this occurs, no other manufacturer is acceptable without written approval from the University Project Manager prior to the bid due date. Approval by the A/E of any other manufacturer as a substitute without such written notice is not acceptable and the A/E will be liable for all costs incurred in obtaining acceptable equipment for the project.

7.2 Preferred Source Documents

**REVISED:**

A. Manufacturer's Written Specifications

*The University* / DFCM requires written disclosure and project manager approval if specifications are prepared by a manufacturer. Manufacturer written specifications generally should not be used in order to avoid unfair influence by a manufacturer in the procurement process.
**REVISED:**

B. Comply with CSI / Documented Quality Process

The University / DFCM requires that specifications be prepared in compliance with CSI requirements and that the specification masters be prepared using a documented quality process.

7.3 **Construction guarantees and warranties shall:**

**REVISED:**

A. Protect

Protect DFCM and the University against faults, defects, or failure, in spite of technical compliance with the terms of the contract.

**REVISED:**

B. Extend Warranty on Selected Items

Extend the manufacturer’s responsibility beyond the end of the one year guarantee period on selected items as approved by DFCM (or the University as applicable).

7.4 **Product and Service Life Cycle Requirement:**

A. Assure High Value

Assure there is a high value for the cost by:

**REVISED:**

1. Maximize competition consistent with the purpose. In addition, minimize sole source procurements (Refer to http://www.rules.utah.gov/publicat/code/r023/r023-001.htm). Provide a minimum of three manufacturers for each material or installation, except where authorization from the University Associate Vice President – Facilities Management (or Director of DFCM for DFCM projects) has been obtained for sole source procurements. The use of an “or equal” clause in the specifications...

2. In order to avoid excessive addition and replacement costs, use open source and open protocol systems when possible.

**REVISED:**

a. Where proprietary software and service organizations are required to service a component, obtain price information for DFCM (as applicable) and the Agency University identifying the long term cost (10 years) in order to include this in the evaluation.

7.5 **Materials REVISED:**

A. Specify New Materials / Standards Certification

Specify materials which are new, unless approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). Provide certification or label with the name of the manufacturer or supplier and the approved testing laboratory where consensus based standards have been developed.
8.0 CAD REQUIREMENTS

8.1 General

**REVISED:**

B. Produce all University Drawings in CAD

For DFCM managed projects, coordinate with DFCM’s Designated Representative to determine the drawing format. For University projects, the consultant shall produce all drawings in a CAD format with a specific coordinate system as described in 8.2. C.1.

**ADDED:**

1. The consultant shall provide drawings for University projects in either .dwg or .rvt format.

2. Consultants shall select the project drawing format using the following guidelines:
   a. Anticipated project construction cost less than $2.5 million: .rvt or .dwg format.
   b. Anticipated project construction cost $2.5 million or more: .rvt format.

3. The consultant shall prepare civil site drawings in .dwg format regardless of the anticipated project construction cost.

4. The consultant shall provide all survey data collected in the field in either .csv or .txt format, including associated coordinates and coding, within 30 days of collection.

**REVISED:**

C. Approval to Vary from CAD Standards

The performance requirements are given as appropriate as minimum criteria to allow flexibility within the constraints of the CAD Standards. If a variance from the standard is desired, the approval of the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) is required.

8.2 Standards

B. CAD Software

**REVISED:**

2. Microstation, current version (not allowed on University projects)

**ADDED:**

C. Required University Coordinate System

Coordinate System Requirements for all University of Utah Projects

1. The consultant shall prepare all drawings with the following coordinate system:

   a. Horizontal: NAD 1983 UTM Zone 12N feet
b. Vertical: NAVD 1988 feet

2. The consultant shall utilize this coordinate system in all submitted drawings (site plans, floor plans, ceiling plans, mechanical, electrical, elevations, etc.).

D. GIS for University of Utah Projects

1. The consultant shall provide the University with all survey data collected in the field during design and construction within 30 days of collection. The survey data shall be in either .csv or .txt format and shall include all associated coordinates and coding.
2. The consultant shall provide the University with all underground utility information collected during design and construction within 30 days of collection. The utility information shall include location of existing utilities as well as expected location of utilities planned for installation.

8.3 Guidance

A. Assumptions

REVISED:
1. The consultant shall bind xrefs in all .dwg drawings.

ADDED:

E. Specific University of Utah drawing requirements:

1. Use the University’s standard title sheet, standard “sheet two” and the Design Code & Criteria for code summary and design parameters. Each template will be provided by the University Project Manager.

2. Use simple keyed notation for items pertaining to each individual sheet. Do not use keyed notes referencing specification section numbers.

3. Redundancy of dimensions, brand names, specification oriented notes, etc. is prohibited.

4. Nomenclature of systems, assemblies, items, etc. must agree with the specifications. For example, usage of trade/brand names such as "Drivit" in lieu of "Exterior Insulation and Finish System" is not acceptable. Another example is "Sheet Rock" in lieu of "Gypsum Board".

5. Once University-assigned room numbers have been provided, only the University room numbers should appear in submitted drawings. This transition must occur by the Construction Documents phase and Contract Documents must reflect University-assigned room numbers.

6. Include exact locations for existing features and conditions which surround or traverse the project site. Include buildings (with critical grades, elevations, heights, floor levels, views), landscape (with exact locations of trees), utilities, drainage, lighting, walks, roads, parking, etc. Coordinate the site plan(s) scale with the University Project Manager. Note that the University does not
warrant the accuracy or completeness of its Utility Base Maps. To the extent that survey information, or the University’s utility location maps, may be incomplete or inaccurate as to the actual size and location of site utilities, topography, existing landscape, or structures, the A/E is required to determine the information needed for accurate development of the Project.

a. No structure will be allowed to be built over existing underground utilities without prior approval from the University at design conception. The University is required to prior-approve appropriate budget / funding for complete utility relocation / restoration.

8.4 CAD Layer Guidelines – Supplemental Requirements

B. Identify user-defined layers using standard alphanumeric format.

ADDED:

1. For all University projects, in order to facilitate the preparation of floor plans and the conversion of floor plans into GIS format, the layers containing walls (both exterior and interior), windows, doors, and University-assigned room numbers must contain only these elements. Submittals must clearly identify which layers contain this floor plan information.

2. Drawing elements should be grouped in appropriate layers. Drawing elements within a categorized grouping should be represented in one layer only. Minimize unnecessary duplication of elements for purely graphic purposes.

3. Separating old and new elements of the same type. Drawings may contain separate layers differentiating between existing objects and the new objects that are to be installed or constructed, as long as the layer names are clear and each layer actually contains only that type of object, and this same type of object does not appear arbitrarily throughout other layers. For example, curb lines may be separated into two layers representing existing curbs and new curbs.

4. Unacceptable Conditions. Digital site plan drawings containing conditions such as the following will not be accepted: 1) Layers identified by numbers alone, for example '20300012'; or layers identified by very general terms, such as 'LINEWORKP1'; or layers identified by terms that are not easily understood; 2) Common elements, for example, the surrounding sidewalks, represented in multiple layers.

5. Use simple, straight forward layer names and ensure that the contents of layers are consistent. Use the layering guidelines in the National AIA CAD Standard as adopted by DFCM. Layering of the drawing shall be arranged such that each layer contains one, and only one, type of real world object. Layer names are expected to be relatively intuitive and/or explicit in describing the content of each layer. If the layer name is "cryptic", e.g. simply a series of numbers, then include a simple list of layer names (electronic, on the same disk as the referenced files) and a description of what each layer contains. It is
preferable to have the real world elements separated more or less according to the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROADS</td>
<td>all roads elements (including curbs)</td>
</tr>
<tr>
<td>SIDEWALKS</td>
<td>all sidewalk elements</td>
</tr>
<tr>
<td>BUILDING</td>
<td>all building footprints and elements</td>
</tr>
<tr>
<td>OTHER</td>
<td>other, non-building elements like walls, concrete, and rock</td>
</tr>
<tr>
<td>LIGHT POLES</td>
<td>light poles, power poles, bollards, and other point elements</td>
</tr>
<tr>
<td>UTILITY</td>
<td>all buried utility line elements</td>
</tr>
<tr>
<td>LANDSCAPE</td>
<td>all landscaping elements like trees, shrubs, etc.</td>
</tr>
<tr>
<td>CONTOUR</td>
<td>all contour line work and elevation info</td>
</tr>
<tr>
<td>SURVEY</td>
<td>all survey and/or grid referencing elements like bench marks</td>
</tr>
<tr>
<td>PAINT</td>
<td>all paint line elements like red curbs, striping, etc.</td>
</tr>
<tr>
<td>GRAPHIC</td>
<td>all other purely graphic elements</td>
</tr>
</tbody>
</table>

8.5 Uniform Drawing Standards – Supplemental Requirements

A. Drawing Set Organization

REVISE

D:

3. File Naming Convention: DFCM’s preference is to use two character discipline designators. One character discipline designators may be used for sheets that apply to all the drawings in a discipline or if the project is small. For small projects, the use of one character discipline designators must be approved by the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects) for the project.

B. Sheet Organization

REVISE

D:

2. Obtain written approval, prior to submitting sheets that vary from this standard, from the University Project Manager (or DFCM’s Designated Representative for DFCM managed projects). Request shall be in writing and include a justification for the variance.

REVISED:

D. Drafting Conventions

Comply with Drafting Conventions Module 04 for both DFCM and University projects. Use University supplied sheets for University projects. Where approvals are required per instructions below, University projects will require approval from the University Project Manager.
REVISED:

H. Code Conventions
Provide the code information as required in the design process and in paragraph 4.1.C.4 in this University of Utah Supplement (or DFCM cover sheet templates for DFCM managed projects).

ADDED:

I. Building Performance Parameters
For University of Utah projects, include a summary of building performance parameters (design temperatures for spaces, humidity control set-points, special ventilation requirements, lighting levels for spaces, etc.) with the code summary.

8.6. Construction Phase

1. General
The consultant shall update the project drawings every 30 days to show changes made through change orders or recorded on red-line drawings kept by the contractor.

2. Shop drawings
The contractor shall submit fabrication models, coordination models, and shop drawings in the same format (.dwg or .RVT) as the project drawings. These drawings shall reflect the exact geometric properties of the materials and systems being submitted.

8.8 Project Close-out

The Design team shall coordinate preparation and submittal of the following close-out documents:

1. The consultant shall deliver submittals and record drawings (.rvt or .dwg and .pdf format) within 45 days of substantial completion.

2. The contractor shall deliver scanned as-built drawings (.tif format) within 45 days of substantial completion.

3. The contractor shall deliver O&M manuals and warranty information to the consultant for review following substantial completion. The contractor shall incorporate the consultant’s comments in the O&M manuals and warranty information and submit the final version (2 hard copies in three-ring binders and one .pdf version) to the University within 45 days of substantial completion.

End of University of Utah Supplement – Design Process
DESIGN REQUIREMENTS

1.0 GENERAL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:
The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:
The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University requirements which pertain to the construction of new and remodeled facilities.

ADDED:
REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 November 2013</td>
<td>1.5</td>
<td>Approved Equal. Added “Approved Equal” Requirements</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 have been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 11s included in the “Design Process” supplement while other chapters have become supplemental text in the “Design Requirements” volume.</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td>General. Several revisions made to reflect current University procedures</td>
</tr>
</tbody>
</table>
1.2 Procedure

**REVISED:**
A. Request Changes to Design Requirements
Complete the Design Requirement/Variance Form for DFCM managed projects, or the Change Request Form / Project Variance Request Form located in Design Process (University Supplement) for University managed projects to make recommendations for additions, deletions, and changes to the Design Requirements.

**REVISED:**
B. Request Variance from Design Requirements
Complete the Design Requirement/Variance Form to request approval by the Director for DFCM managed projects, or the University forms identified in A above for approval by the University to vary from these Design Requirements based upon the specific project needs.

**REVISED:**
C. Approval of Design Requirement Modifications
All Design Requirement modifications require approval by the Director for DFCM managed projects. All Design Requirement modifications for University managed projects require approval by the University’s Design Standards Committee. The following procedures apply to DFCM managed projects only.

1.3 Hierarchy of Requirements

A. Hierarchy
The hierarchy of requirements is as follows:

1. Comply with the minimum requirements of all applicable laws, rules, and regulatory requirements.

**REVISED:**

a. Exceptions to applicable laws, rules, and regulatory requirements:
Wherever there are practical difficulties involved in carrying out these provisions, the State Building Official for DFCM managed projects with the approval of the Director of DFCM and/or the State Fire Marshall shall have authority to grant modifications. For University managed projects, the University Building Official and/or the University Fire Marshall shall have modification approval authority. DFCM The modifications granted by the State Building Official shall be documented in this standard under the heading “Design Requirements.”
1.4 Changes and Additions to Design Requirements

**REVISED:**

(1) Instructions for Change or Variance
Complete the following document for DFCM managed projects, or the Change Request Form or the Project Variance Request Form (located in “Design Process, DFCM Design Manual, University of Utah Supplement”) for University managed Projects and submit it to the person to whom you are responsible to (the University Project Manager for University Projects) for ultimate decision by the Director (DFCM) or the Design Standards Committee for University managed projects, for requested changes/additions to the Design Requirements.

1.5 Approved Equal

(1) The materials, products, and equipment described in the University of Utah Design Standards establish the standard of required function, dimension, appearance, durability, warrantee, maintainability and quality to be met by any proposed alternative. A/Es may submit an approved equal product for consideration by Facilities Management through the University Project Manager if they believe that a product meets or exceeds the current University Design Standards.

The definition of "Approved Equal" throughout the University Design Standards shall be as follows: Material, equipment, or method of construction that has been approved by the University as an acceptable alternative to that specified in the University Design Standards.

The Design Professional shall submit proposed approved equal products to the University Project Manager for review and approval by the Design Standards Committee as a Variance Request prior to final inclusion in contract documents. Use the University of Utah Project Variance Request Form. The approved equal submittal shall include an analysis and recommendation by the design professional. This must be submitted in a timeframe that allows for a 30-day review period by the University prior to the time that a decision must be made in the design process. An exception to the 30-day review period may be made for substitution requests submitted by contractors during bidding. Potential actions in response to substitution requests during bidding include (but are not limited to): approval, denial, extension of bidding to allow for review, and denial for that specific bid due to time constraints while initiating a separate review for consideration of modifying the University’s design standards. Prior to making a decision regarding “approved equal” requests, the Design Standards Committee shall seek input from appropriate parties within Facilities Management or elsewhere in the University.

*End of 1.0 General*
DESIGN REQUIREMENTS

2.0 CODES, LAWS, RULES AND REGULATORY REQUIREMENTS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:
The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University requirements which pertain to the construction of new and remodeled facilities.

ADDED:
REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted Text and Numbering revised.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 have been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 is included in the “Design Process” supplement while other chapters have become supplemental text in the “Design Requirements” volume.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>2.11 / A. / (4)</td>
<td>Salt Lake City / County Building or Zoning Codes. This paragraph was revised to current requirements.</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td>General. Several revisions made to reflect current University procedures</td>
</tr>
</tbody>
</table>
2.0 CODES / LAWS / RULES AND REGULATORY REQUIREMENTS

2.1 General

REVISED:
A. Building Official Submittal
Comply with adopted State Codes and all other applicable Standards and Codes at the
time submitted to the State Building Official for DFCM managed projects or the
University Building Official for University managed projects, including but not limited to
Section 0 through Section 0:

ADDED:

2.11 Minimum Codes, Ordinances, Industry Standards, etc., for University Projects

A. Minimum Codes and Ordinances
The design and construction of University projects must likewise comply with latest
adopted laws, rules, regulations, codes and ordinances of the state of Utah and its
jurisdictions. The A/E is responsible for compliance to these laws, rules, regulations,
codes and ordinances. The following and the requirements listed above represent the
minimum codes and ordinances for which projects must comply (conflicts must follow
the most stringent).

(1) The following represent the minimum codes and ordinances for which projects
must comply (conflicts must follow the most stringent).

(a) Boiler and Pressure Vessel Regulations, State of Utah

(b) Federal Manufactured Housing Construction and Safety Standards Act
(HUD), as approved per the Utah Administrative Code R156-56

(c) International Building Code (IBC), approved version per the Utah
Administrative Code R710-4, and as amended by Utah Administrative
Code R156-56

(d) International Energy Conservation Code (IECC), approved version per
the Utah Administrative Code R156-56

(e) International Fire Code (IFC), approved version and amended per the
Utah Administrative Code R710-4

(f) International Fuel Gas Code (IFGC), approved version per the Utah
Administrative Code R710-4
(g) International Mechanical Code (IMC), approved version per the Utah Administrative Code R710-4 and as amended by R156-56

(h) International Plumbing Code (IPC), approved version per the Utah Administrative Codes R710-4 and R156-56

(i) International Residential Code (IRC), approved version per the Utah Administrative Code R156-56

(j) Life Safety Code (LSC), as approved and amended in the Utah Administrative Code R710-4

(k) Model Energy Code

(l) National Electrical Code (NEC), approved version per the Utah Administrative Code R156-56

(m) National Fire Protection Code (NFPA), as approved and amended in Utah Administrative Code R710-4

(n) Pipeline Safety Regulations, Parts 191 & 192, Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety

(o) Planning & Design Criteria to Prevent Architectural Barriers for the Aged and Physically Handicapped

(p) Salt Lake City Ordinances (Where Applicable, i.e. Research Park and off-Campus Locations)

(q) Standard for Energy Efficiency in New State Buildings

(r) University of Utah Design Standards (DFCM Design Manual, University of Utah Supplement)

(s) Utah Occupational Safety and Health Rules & Regulations (UOSH)

(t) Utah State Building Board

(u) Utah State Fire Marshal Requirements

(v) Utah State Department of Health Requirements

(w) All applicable rules of the Utah Administrative Code

(2) The following are added to the lists above to represent industry standards for which projects must comply (conflicts must follow the most stringent).

(a) Air Conditioning and Refrigeration Institute (ARI)

(b) Air Diffusion Council (ADC)
(c) Air Movement and Control Association (AMCA)
(d) American Concrete Institute (ACI)
(e) American Concrete Research Institute (ACRI)
(f) American Gas Association (AGA)
(g) American Institute of Steel Construction (AISC)
(h) American National Standards Institute (ANSI)
(i) American Public Works Association (APWA)
(j) American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE)
(k) American Society of mechanical Engineers (ASME)
(l) American Society for Testing and Materials (ASTM)
(m) American Water Works Association (AWWA)
(n) Associated Air Balance Council (AABC)
(o) Cooling Tower Institute (CTI)
(p) ETL Testing Laboratories (ETL)
(q) Heat Exchange Institute (HEI)
(r) Hydraulic Institute (HI)
(s) Hydronics Institute (HI)
(t) Industrial Ventilation, A Manual of Recommended Practice (ACGIH)
(u) Institute of Electrical and Electronic Engineers (IEEE)
(v) International Society of Arboriculture (ISA)
(w) Irrigation Association
(x) Masonry Institute of America (MIA)
(y) Questar-Recommended Good Practices for Gas Piping and Appliance Installations
(z) National Electrical Manufacturers Association (NEMA)
(aa) Scientific Apparatus Makers Association (SAMA)

(bb) Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA)

(cc) Thermal Insulation Manufacturers Association (TIMA)

(dd) Tubular Exchanger Manufacturers Association, Inc. (TEMA)

(ee) Underwriters Laboratories (UL)

(ff) United States of American Standards Association (USAS)

(3) Other codes, regulations, etc., not listed here may be required due to the nature of certain projects' funding, grant, or licensing requirements. The A/E has the responsibility for compliance with these code requirements.

(4) Construction projects on the University campus are not subject to Salt Lake City or County building or zoning codes. When designing construction in Research Park or other non-campus locations where property is leased for University use, the several requirements of local jurisdictions applicable to the construction site are the responsibility of the A/E.

(5) All University remodeling and new construction projects must comply with the Americans With Disabilities Act, Title II. More specifically, the design must adhere to the "AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES FOR BUILDINGS AND FACILITIES (ADAAG), (Appendix A to 28 CCFR part 36), or the Uniform Federal Accessibility Standards (UFAS).

End of 2.0 Codes / Laws / Rules and Regulatory Requirements
3.0 DFCM REQUIREMENTS

3.1 GENERAL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED" and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University requirements which pertain to the construction of new and remodeled facilities.

ADDED:

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.1 / B. / (3)</td>
<td>Accessible paths of Travel  Added standard to include ADA Access in the Scope of Work.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.1 / J. / (13)</td>
<td>University Design Requirements  Added Hospital / Clinics / SOM Special Design Requirements.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.1 / J. / (6) / (a)</td>
<td>Emergency Phones  Updated requirement for Emergency Phones</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.1 / J. / (7)</td>
<td>General Utilities  Moved from Architectural Section</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.1 / J. / (5)</td>
<td>Buried Pipe Trace Wire, Warning Tape, Sand Cover  Added requirements for all buried piping</td>
</tr>
<tr>
<td>Date</td>
<td>Reference</td>
<td>Details</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>15 June 2012</td>
<td>3.1 / J. / (6)</td>
<td><strong>Emergency Phones.</strong> The requirement for RAMTEL equipment was removed.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>University Design Standards.</strong> The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.1 / J. / (4), 3.1 / J. / (10), 3.1 / J. / (11)</td>
<td><strong>Plant Operations.</strong> Plant Operations has changed to <em>Facility Operations</em></td>
</tr>
<tr>
<td>25 January 2011</td>
<td>3.1 / J. / (11)</td>
<td><strong>Roof Access.</strong> Added requirements for access to University roofs</td>
</tr>
<tr>
<td>02 July 2010</td>
<td>3.1 / J. / (10)</td>
<td><strong>Demolition.</strong> Added expectations of the A/E’s design for Demolition</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td><strong>General</strong> Several revisions made to reflect current University procedures</td>
</tr>
</tbody>
</table>
3.1 General

A. Enhanced Accessibility

REvised:

(1) “It is the policy of the Utah State Building Board that, when appropriate for the intended use of the building and achievable within the project budget, the following accessibility enhancements beyond those required by the Americans with Disabilities Act be provided for in state owned buildings and buildings leased by DFCM or the University: (1) powered door openers for the primary entrance designated for use by people with disabilities, and (2) powered door openers for one uni-sex restroom or for one male and one female restroom in the building unless restrooms with a door-less entry are provided. This policy is not intended to limit the use of powered door openers to the standard set forth herein. This policy applies to the construction or major renovation of state-owned facilities and new leases where the entire building is being leased by DFCM or the University. This policy is not intended to create any rights to any third parties.

REvised:

(2) Determinations that one or both of these enhancements are not appropriate for the intended use of the building or not possible within the project or lease budget shall be made by the Director or his designee for DFCM managed projects, or the appropriate director in Facilities Management for University managed projects. Determinations of whether this enhancement to accessibility is appropriate should consider the potential of access by people with disabilities. The Director may determine that powered door openers are appropriate for the primary entrance while not warranted or not possible within the budget for access to restrooms. The Director may also determine that one or both of these enhancements are not feasible in (a) the renovation of an existing building due to its design or configuration or (b) in a leased facility due to the nature and circumstances of the lease.”

ADDED:

(3) University of Utah projects managed either by DFCM or the University of Utah shall include in the project's scope of work the construction of primary or secondary accessible paths of travel, or improvements to existing primary/secondary accessible paths of travel. The intent of this requirement is to enhance and provide consistency with the network of accessible pathways throughout the University campus or University owned properties. This requirement shall apply to new buildings, additions to existing buildings, site landscaping, civil or utility infrastructure improvements which interface with or impact the primary and secondary accessible routes as shown in the Accessible Paths of Travel Study.
The University Project Manager or Project Planner shall determine the extent of this requirement during the planning or programming phase. The A/E shall provide design solutions as guided by the Accessible Paths of Travel Study a copy of this Study will be provided by the University Project Manager or Planner.

D. Hazardous Materials

**REVISED:**
(1) DFCM (for DFCM managed projects) or the University (for University managed projects) shall procure a qualified abatement consultant during the Schematic Design phase of the Design stage. The abatement consultant shall survey all renovation and demolition projects for hazardous materials such as asbestos-containing building materials, lead-based paint, mold, universal wastes such as PCBs, CFCs, mercury, household/janitorial cleaning products, identified/unidentified containers of chemicals or products, or any other materials or waste that may be environmentally unsafe.

**REVISED:**
(3) DFCM (for DFCM managed projects) or the University (for University managed projects) shall procure a qualified abatement contractor to remove all hazardous materials prior to the beginning of any building demolition or renovation.

**ADDED:**
J. University Design Requirements
   University of Utah Design Requirements in General

(1) Water Conservation, Storm Water

   (a) Water Conservation

       Water conservation measures are to be designed into, and implemented on all new construction or substantial remodeling projects. No project is to increase the quantity of water consumed; indeed; water consumption should decrease with the completion of each project.

   (b) Storm Water Run-Off

       Furthermore, projects which add impervious surfaces and storm water run-off must include storm-water control systems that will not increase flow into the University’s (and consequently Salt Lake City’s) storm-water system. Specific retention design requirements for construction projects are provided in 3.2 Civil of these Design Requirements, University of Utah Supplement.

   (c) A/E Selection

       A/E’s who demonstrate ability and experience in energy and water conservation will receive favorable consideration.
(2) Projects Using or Feeding Salt Lake City Public Utilities

(a) Any construction project (either new or remodel) which affects Salt Lake City public utilities (sanitary sewer, storm drainage, or domestic supply water) by either feeding or using these utilities, must include coordination with Salt Lake City.

(b) The A/E is to include in the specifications that the Contractor is expected to provide all required information needed by Salt Lake City for review, and pay for and secure subsequent permits. The General Contractor will then be required to conform to the jurisdiction’s requirements for subsequent inspections and certificates of occupancy for the utility portion of the project.

(3) Energy Management Plan Buildings

Many buildings on campus have been retrofitted with energy efficient equipment as part of an energy management plan. When remodeling any building, the energy efficiency and operating characteristics of existing and new equipment must not be diminished by the building revisions.

(4) Underground Utility Depth & Separation Standard

The extension of buried utility systems on campus must conform to the University’s Utility Master Plan to maintain minimum depth of bury and service clearances from underground structures and other utilities. Deviation from the master plan, as summarized in the following graphic, may only occur after review and approval from Facilities Management (the University Project Manager must review any proposed deviation with Facility Operations).

Utility Corridor
### Easement Matrix for Existing Utilities

<table>
<thead>
<tr>
<th>Minimum Depth</th>
<th>HTW</th>
<th>Chilled Water</th>
<th>Sanitary Sewer</th>
<th>Storm Sewer</th>
<th>Water</th>
<th>Gas</th>
<th>Power</th>
<th>Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6'</td>
<td>4'</td>
<td>4'</td>
<td>4'</td>
<td>5'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
</tr>
<tr>
<td><strong>HTW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>6'</td>
<td>10'</td>
<td>10'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>4'</td>
<td>6'</td>
<td>10'</td>
<td>10'</td>
<td></td>
</tr>
<tr>
<td><strong>Chilled Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>4'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>10'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td></td>
</tr>
<tr>
<td><strong>Sanitary Sewer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>8'</td>
<td>8'</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>8'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td></td>
</tr>
<tr>
<td><strong>Storm Sewer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>8'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>4'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td></td>
</tr>
<tr>
<td><strong>Gas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>6'</td>
<td>4'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>4'</td>
<td>4'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>6'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td></td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>4'</td>
<td>1'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>10'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>1'</td>
<td></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>10'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>4'</td>
<td>1'</td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>10'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>3'</td>
<td>1'</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Any crossings of high temperature water mains closer than shown on chart will require a heat sink dissipation plate.

(5) Buried Site Piping, Trace Wire, Warning Tape, Sand Cover Over Pipe

(a) All underground conduit and pipe exterior to the building 4” diameter and larger shall be installed with an 18 gage continuous copper wire 8” over the pipe to serve as trace wire.

(b) See 3.2 CIVIL / L. SITE UTILITIES FOR CAMPUS PROJECTS / (3) for specific design instructions including warning tape, approved methods for trace wire terminations, testing requirements, buried plastic or natural gas piping, sand cover, etc.
(6) Emergency Phones

(a) The decision to install emergency phones as part of a construction project will be by the University. The University Project Manager will obtain University approval to include E-phones in the project design; and, obtain approved equipment specifications through the Managing Director of Environmental Health & Safety and Emergency Management, and the University Chief of Police.

(b) Facilities management, through the University Project Manager, will provide to the A/E:

(i) Guide specifications for approved emergency phone devices.

(ii) Specific E-phone functionality and operational characteristics required by University Public Safety.

(iii) Contractor instructions for equipment connections.

(7) General Utilities

(a) General

(i) Facilities Management through the University Project Manager will provide all utility information available concerning the project work and surroundings.

(ii) The A/E shall evaluate the utility information available against the project needs.

(iii) If exact elevations and locations are deemed necessary or desirable, the University will uncover the utilities and make the necessary surveys required (upon request from the A/E). Requests for this special information should be made to Facilities Management through the University Project Manager.

(iv) Consult Facilities Management through the University Project Manager concerning utility connection points, capacities, etc. Coordination between the A/E, the Contractor and the University will be the responsibility of the University Project Manager.

(v) During the design development stage of the project, the A/E (or its consulting engineer) shall identify all potential power or utility shutdowns including the following information:

1) Duration of projected shutdown.

2) Methods and materials to be used in the shutdown.
3) Impact of the shutdown on adjacent facilities.

4) Temporary service provision to be provided during the shutdown.

(vi) On non-state funded projects only, construction utility metering (per University meter specifications) for water, electrical and natural gas is required (this does not include high temperature water which shall not be used nor activated until directed by the University). Instruct the Contractor to purchase the meters and either install them at locations directed by the University, or pay the University to install the meters. During construction, the Contractor will be invoiced for utilities used. Metering is not required on projects with State funding.

(b) Heating

Heating for all new buildings shall be provided by the high temperature water (HTW) system of the campus, except as directed otherwise. The connection to the heating system shall be coordinated with Facilities Management through the University Project Manager, who will arrange all necessary contacts with the system consulting engineers. Guidelines and an outline specification for connections and minimum standards entitled are contained in 3.5 Mechanical Part 3. Provision must be made for connection to the campus computer control system.

(c) Air Conditioning

All new buildings shall be air conditioned unless otherwise instructed. Consideration must be given in the design to a possible future connection of all buildings to a central air conditioning system. Special features or room considerations will be expressed in the building design program and/or discussed as the building design progresses.

(d) Electrical

(i) The electrical system shall be tied into the electrical distribution system of the campus. Special electrical distribution concepts will be essential in all heavily used technical areas.

(ii) Emergency lighting should be provided on all floors below grade or where light must be provided to assist in evacuation of unlighted interior areas of the building in case of an emergency. Refer to 3.5 Electrical for further information.

(e) Outdoor Lighting

Adequate outdoor lighting must be provided in parking lots and walkways within the contract limit lines. Fixture placement and lighting patterns must conform to the criteria established for the particular area involved by the master plan for the campus. Harmony with the
surrounding established features is emphasized. See typical outdoor light fixture details in 3.5 Electrical.

(f) Water

Sources of water include University owned and operated wells on campus and Salt Lake City water. Because of the nature of this water, water softeners are required for the hot water systems in each project. Connection fees are paid by the University. See 3.2 Civil for details.

(g) Sanitary Sewer

The University sanitary sewer system drains into the Salt Lake City sanitary sewer system; therefore codes applicable to that system must be followed. Consultation with Facilities Management through the University Project Manager is necessary before any connection to the sewer system can be made. See 3.2 Civil for details.

(h) Area Storm Drainage

The storm drainage system should be coordinated with the campus drainage system which empties into the Salt Lake City storm drainage system. The A/E is to coordinate all such connections with Facilities Management through the University Project Manager. See 3.2 Civil for details.

(i) Telephone and Security

All building telephone and security systems are to be coordinated through the University Project Manager. See 3.5 Electrical for space and other requirements.

(j) Natural Gas System

(i) When work is required on any gas line, require the Contractor to submit for prior approval worker qualification sheets for each worker in accordance with Pipeline Safety Regulations Part 191 and Part 192, published by The Department of Transportation Research and Special Programs Administration, Office of Pipeline Safety, current edition.

(ii) Require the Contractor to submit qualification sheets to the A/E, then the A/E shall submit two sets to the University Project Manager, who will submit one set to the supervisor of the Plumbing Shop for review and approval.
(8) Sediment Control at Open Utilities

For projects where open utilities will be necessary during construction, require the Contractor to protect the University’s utility systems by installing sediment control devices at each open utility, similar to Royal InfraSafe Sediment Control Barrier (manufactured by Royal Environmental Systems, Inc.). Require the Contractor to install the devices in accordance with the manufacturer’s recommendations.

(9) Utility Metering

(a) Construction Utilities

For non-State funded projects, specify construction utility metering per University meter specifications for water, electrical and natural gas (this does not include high temperature water which shall not be activated nor used until directed by the University). The Contractor will purchase the meters and either install them at locations directed by the University, or pay the University to install the meters. During construction, the Contractor will be invoiced for utilities used. This is only applicable to non-State funded projects where all the monies for construction come from University or donated sources.

(b) University Auxiliaries, Dining Facilities, State Supported O&M Facilities, etc.

Design the utilities such that water, natural gas, and electricity can be separately metered for auxiliary functions within a University building. Include overall building meters, as well as sub-meters for utilities used by the auxiliary function. Coordinate with the University Project Manager to determine which end user activities will require metering. Specify metering equipment in accordance with this DFCM Design Manual, University of Utah Supplement.

(10) Grounds Storage Closet

Each new building and each remodel, where applicable, is to include a storage closet for University Landscape Maintenance Department equipment and supplies, accessible from the exterior. Coordinate with the University Project Manager who will contact the Landscape Maintenance Department for specific design criteria. Generally, each storage closet should be at least 6’ x 6’ and 7’ high (unobstructed), with general lighting, electrical outlets, and sufficient heat to prevent freezing.

(11) Demolition – Expectations of the A/E’s Design

(a) Prior to Design Development Submittal

During the design of the project (before submission of the design development documents for review), the A/E, together with its sub consultants, shall identify furnishings, accessories, equipment, material,
systems, etc. which will be affected or removed by demolition. The A/E and sub consultants as appropriate shall meet with the University Project Manager, shop representatives of Facility Operations, and a representative of University Surplus and Salvage. This focus of this meeting will be to determine final ownership of all of removed items; and, for those items returned to the University, any required preparation and/or delivery / transfer instructions.

(i) Items which will remain the property of the University shall be clearly identified and listed for inclusion in the Contract Documents. Generally all fire alarm components will remain the property of the University. The disposition of removed fire alarm wiring and conduit will be considered on a project by project basis.

1) Include instructions to the Contractor for preparations and delivery of each of the removed items to the University (safety preparations, coiling, packaging, palletizing, cleaning, prior notification, delivery location, etc.).

2) The A/E may be asked to tag or otherwise identify specific items at the site before demolition to aid the Contractor’s awareness and protection of University property.

(ii) Remaining items which will become the property of the Contractor shall likewise be included in the Contract Documents, allowing the Contractor to include salvage value in his/her bid. This may be a general summarization of all remaining demolition, or specific items or systems.

(iii) Include both declarations in the design development review documents as they are intended to appear in the bidding documents.

(iv) Include salvage value in the detailed cost estimate.

(b) Site Visit Reports

Include the disposition of items which are identified to be returned to the University in site visit reports.

(12) Access to University Roofs

(a) Keys

Roof access keys must be obtained from the University Project Manager.
(b) Roof Safety

Roof safety is the responsibility of the A/E and includes any individual working for or contracting with the A/E.

(c) Access Procedures

Individuals intending to access a roof must first follow roof access procedures described on the University’s Facility Operations web site.

(d) Roof Damage

The A/E will be required to agree to accept responsibility for any damage to the roof caused by the A/E, the A/E’s employees or sub consultants.

(13) University Hospitals / Clinics / School of Medicine – Special Design Requirements

(a) University of Utah Health Care (or “UUHC”)

UUHC operates University hospitals, clinics, and other facilities throughout the State.

(b) UUHC Department of Facilities & Engineering (or “Hospital F&E”)

Hospital F&E manages some projects under delegation from U of U Facilities Management.

(c) Adherence to Design Standards

All requirements described in the DFCM Design Manual and University of Utah Supplement (Programming Standards, Design Process, and Design Requirements) apply to all UUHC projects. The UUHC Hospital Design Standards and the UUHC Contractor Handbook supplement, but do not replace A/E requirements for design described in the DFCM Design Manual and University of Utah Supplement.

(d) Include Special Contractor Requirements in A/E’s Design

(i) UUHC Hospital Design Standards

Special design requirements for UUHC construction are described herein below and in the UUHC Hospital Design Standards. The UUHC document is available from Hospital F&E through the University Project Manager. UUHC standards may be applicable to the Project for hospital grade materials and finishes, and/or non-patient care construction requirements. Where UUHC Hospital Design Standards are silent on any design issue, the instructions provided in the DFCM Design Manual and this Supplement shall apply.
(ii)  UUHC Contractor Handbook

Special Contractor requirements are described in the Contractor Handbook for UUHC Construction Projects (or “Handbook”) available on the University’s FM web site (http://facilities.utah.edu/project-resources/documents-standards/design-standards.php). The Handbook shall be included in the A/E’s project specifications, either in print or by reference. The A/E’s specifications shall require the Contractor to print the Handbook for use during construction.

(iii) Parking, Staging Areas

1) The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine appropriate staging and parking areas for the Project, and include this information in the Project design drawings or specifications.

2) Include a warning that emergency access to UUHC facilities, and patient, staff, fire lane, and handicapped parking is critically important to UUHC operations, and must not be impeded, even temporarily.

(iv) Stair / Elevator Access

The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify appropriate routes for Contractor access to the work site, including selected stairwells and elevators for the transport of materials. This information shall be included in the Project design drawings or specifications and describe or show any areas to be avoided by construction workers.

(v) Special Working Hours

The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine the need for special working hours, and certain hours when noise transmission must be limited. Any special requirements must be included in the Project design drawings or specifications.

(vi) Restroom Limitations

The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine the limitations to be imposed on the use of restrooms in the facility. Unless approved otherwise, the A/E shall specify that the Contractor shall provide hand washing and restroom facilities for its personnel, separate from UUHC restrooms.
(vii) Dumpsters

The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine approved locations for the Contractor’s dumpsters / trash receptacles, and show these on the Project drawings.

(viii) Requirements for Interim Life Safety Measures (ILSM)

1) The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor for a site review meeting held with the Hospital Fire Marshall, the infection control team, and any other applicable safety team to conduct an assessment of the proposed construction to identify any possible compromise to the building’s life safety system.

2) The A/E shall keep accurate minutes of the meeting. Documents provided by UUHC life safety staff for use on the Project shall be combined with applicable items in the A/E minutes to form an “ILSM Project Plan.” A specific form or format will be required by UUHC.

3) The ILSM Project Plan must include the Statement of Conditions fire drawings, including requirements for patching walls, available from the Hospital Fire Marshall or the Hospital F&E Project Supervisor.

4) Insert the ILSM Project Plan, the required ILSM Form, and all terms of the ILSM plan in the Project specifications, including but not limited to assessment summaries, expected UUHC monitoring, the maximum number of expected debrief meetings, any required documentation to be posted and/or kept in a Contractor’s project file on site, any required Contractor reports with expected frequency, any other special procedures, etc.

(ix) Requirements for Infection Control Construction Risk Assessment (or “ICRA”)

1) An ICRA is generally required on all projects affecting or near patient areas. UUHC will initiate the ICRA for each applicable project, and the A/E shall apply the project’s completed ICRA to the drawings and specifications, and require the Contractor to comply with ICRA safety measures and requirements.

2) Include any other project specific requirements directed by the UUHC’s safety team or infection control team (e.g., assessment, documentation, monitoring, reports,
special procedures, pressure / flow indicators, tacky mats, etc.).

(x) Dust, Vapor, Etc., Containment

The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify project requirements for the containment of dust, aerosol, fumes, vapors, etc. (e.g., any required approved plans, Contractor documentation, reports, etc.). Include any requirements in the Project specifications.

(xi) Materials & Equipment Specified for UUHC Projects

1) All materials/equipment specified must be U/L approved. Require independent testing lab sheets with the Contractor’s submittal.

2) For all hospital and clinic designs, material and equipment components are required to be Hospital Grade. Coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine if Hospital certification will be required.

3) Coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify approved finish materials for the Project specifications.

4) The design and resulting construction must meet federal/state/local and UUHC requirements.

5) Only non-asbestos containing materials may be specified.

End of 3.1 General
3.0 DFCM REQUIREMENTS

3.2 CIVIL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
ADDED:
This supplement to the DFCM Manual for civil engineering is intended to acquaint architects and/or engineers working on University projects with standards and requirements of the University with regards to civil engineering related items.

ADDED:

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 November 2014</td>
<td>3.2 / E. / (1), (2), (3)</td>
<td>Storm Water Management Plan New requirements</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.2 / Civil / B. (5)</td>
<td>Digging Permits Removed requirements</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.2 / Civil / E. / (1)</td>
<td>Truck Tire Wash Down Added detail to truck tire wash down</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.2 / Civil / A. Paving / (3) / a.</td>
<td>Sidewalk Requirements on Campus Added requirement for Dowels</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.2 / Civil / C. / (3) / a.</td>
<td>Soils Reports for U projects Removed Sub-Paragraph “a.”</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / A. / (3) / a.</td>
<td>Sidewalk Requirements Added campus sidewalk requirements</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / L. / (3) / a.</td>
<td>Trace Wire, Warning Tape, Sand Cover Trace wire elevated 8” over buried pipe, added requirements for warning</td>
</tr>
<tr>
<td>Date</td>
<td>Section</td>
<td>Action</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / L. / (4) / p.</td>
<td>Storm Drain Camera Inspection</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / L. / (5) / g.</td>
<td>Sanitary Sewer Air Test &amp; Camera Inspection</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / L. / (6) / h. / 7</td>
<td>Domestic Water Valves Below Grade</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.2 / L. / (6) / i. / 2</td>
<td>Domestic Water Sample Tests</td>
</tr>
<tr>
<td>27 February 2012</td>
<td>- - -</td>
<td>Entire Civil Section</td>
</tr>
<tr>
<td>27 February 2012</td>
<td>- - -</td>
<td>3.2 Civil Detail Drawings</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Campus Design &amp; Construction</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Plant Operations</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.2 / C. / (2)</td>
<td>Soils Report</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.2 / G. / (8)</td>
<td>Site Grading</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.2 / H. / (4) / b.</td>
<td>Structural Fill &amp; Compaction</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td>Concrete Flat Work</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.2 / L. / (7)</td>
<td>Natural Gas Systems</td>
</tr>
</tbody>
</table>
3.0 DFCM REQUIREMENTS

3.2 Civil

A. Paving

(3) Concrete – curbs, gutters, sidewalks, exterior flatwork –
Minimum 6” compacted base (96%) or minimum 4-3/4” crushed gravel.

ADDED:

a. Sidewalk Requirements on the University of Utah Campus

(i) Campus sidewalks require extended width and added structural strength to handle heavy vehicular loads without damage. Due to the perimeter road system surrounding the University of Utah campus, campus sidewalks may be the only vehicular access to interior campus buildings and construction sites. All sidewalks on campus shall be designed in accordance with the requirements herein.

(ii) Sidewalks on campus shall be 8’-0” wide (minimum). Central slab thickness shall be 6” thick, and grow to 8” thick at both edges. The width of the thicker edge on each side of the sidewalk shall not be less than 6”. Six inches from the sidewalk edge, the 8” thick concrete shall taper approximately 45° from 8” to the 6” central slab thickness.

(iii) All concrete sidewalk slabs shall be doweled to adjacent slabs with rebar dowels at expansion joints or any break in the pour. Dowels are to be evenly spaced with maximum distance between dowels not to exceed 24”. Rebar dowels must be #4 or larger at least 24” long. Dowels must be embedded at least 3” deep and no closer than 6” from the edge of the slab.

(iv) Require the Contractor to provide 6” compacted road base (untreated) under the central slab, tapering down to match the thickening concrete, to maintain a continuous 6” compacted road base under the full width of the sidewalk.

(v) Backfill for campus sidewalks shall be specified to be laid and compacted in lifts to meet the requirements described in 3.2 CIVIL / H. STRUCTURAL EXCAVATION, BACKFILL, AND COMPACTION / (4) COMPACTION STANDARDS / a. / 2).
Compaction testing shall be specified to meet the test schedule for sidewalks described in 3.2 Civil / H. Structural Excavation, Backfill, and Compaction / (4) Compaction Standards / b. Compaction Testing / 5) Compaction Test Schedule / c).

All sidewalks shall include polypropylene multifilament fiber reinforcement. Additionally, concrete materials are to comply with 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1), with minimum compressive strength no less than the table value provided for “All Other Site Cast Concrete.”

Sidewalk control joints shall be specified or drawn at 5'-0” O.C., and shall be a ¼” score, 1/4th the depth of the slab. For walking surfaces along accessible paths of travel, control joints shall be in accordance with the requirements found in 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1) / h).

Sidewalk expansion joints shall be specified or drawn at 20'-0” O.C. maximum, and shall be dimensioned and tooled in accordance with 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1) / h). The expansion joint shall include asphalt impregnated fiber expansion material. Direct the Contractor to use bond breaker tape with polyurethane joint sealant to a depth of 3/8”.

Direct the Contractor to finish the concrete sidewalk with a tooled 1” edge above grade, and broom surface finish.

**ADDED:**

B. Civil Design Requirements for University of Utah Projects

1. Design Resources

   The A/E is to refer to all specific program requirements, soils reports, master plan, and any other applicable guidelines in designing building and site improvements.

2. Apply APWA Standards

   The most recently published version of the American Public Works Association (“APWA”) Standard Specifications and APWA Standard Plans, as currently adopted by the APWA Utah Chapter, are to be used for the design and construction of all University of Utah Projects. Note: While the APWA standards are to be closely followed, this University supplement contains additional or alternative requirements which must be included in the A/E’s design. In the event of conflict, the DFCM Design Manual and this supplement will govern.
(3) Site Plan

a. Site plans shall be drawn at a scale of 1"=20' or larger.

b. Site grading and drainage shall be designed by a qualified civil engineer, licensed by the State of Utah for such work. The engineer's stamp and dated signature shall appear on each site drawing.

c. Provide the location and elevation of the intended construction bench mark. Assumed floor elevations are not sufficient. Location of campus monuments and their elevations can be obtained from Facilities Management / Land Surveyor through the University Project Manager.

d. Provide both existing and proposed contours with spot elevations. Contours are to extend at least 10' beyond the contract limit line. Spot elevations are to be indicated numerously and frequently.

e. Identify all existing conditions.

f. Identify existing and new utilities.

g. Site Utilities Plan

1) The site utilities plan shall be drawn at a scale of 1"=20" or larger.

2) Site utilities design shall be by a qualified professional engineer, licensed by the State of Utah for the work.

3) Existing utility locations and bury depth shall be provided.

4) Location of new utilities shall be shown with horizontal dimensional ties to landmarks for installation.

5) Profiles shall be provided for sanitary sewer and storm drainage lines (scale 1"=5' vertical and 1"=20' horizontal).

6) For roadways, provide profiles at top back of curb for each side of the roadway (plan scale 1"=20', profile scale 1"=5' vertical and 1"=20' horizontal). Provide stationing at 50.0' maximum with spot elevations at both TBC's and at centerline.

7) All domestic water mains 500 feet or more in length will require a plan review by DEQ (Department of Environmental Quality) Drinking Water Division.
(4) Storm Water Runoff

a. The hydrology associated with new construction projects must mirror predevelopment hydrology of the previously undeveloped site; or, the design must improve the hydrology of a redeveloped site and reduce the discharge of storm water.

b. Specific requirements are described below in 3.2. / L. Site Utilities / (4) Storm Drainage.

(5) Traffic Management Plan

Traffic control is a major concern on campus. Consult with Facilities Management through the University Project Manager to identify procedures to be used in a traffic management plan for the project. The approved plan should be detailed for the Contractor and included as part of the project documents.

(8) Testing

a. Provide a comprehensive testing and inspection schedule, and include details for every test and inspection required on the project (i.e., soils, subgrade, base course, asphalt, concrete, etc.).

b. Include details for the type of each test, its location, and frequency.

c. A separate contract for a testing firm will be arranged by the University Project Manager.

1) Testing services will be requested by the Contractor with payments to the testing firm by the University.

2) Specify that the University will pay for the first test, and any additional test due to test failure shall be paid for by the Contractor.

d. Note: Compaction testing standards are provided below (see H. / 4. Compaction Standards / c. Compaction Testing).

C. Soils Reports for University Projects

(1) All new building, parking or roadway projects shall include soils investigations performed by a professional soils engineering firm qualified and licensed for such work.

a. The A/E shall provide the soils engineering firm with the following items:

1) A preliminary site plan showing new improvement locations with finish floor and finish grade elevations.
2) A general description of the type of structure or facility to be constructed.

3) Pavement locations and instructions for any needed pavement sections.

4) Specific areas where potential infiltration would suggest permeability testing, with specific testing locations and associated depths.

(2) The soils engineering firm shall provide a report of its investigative findings, and shall include all information required by State adopted codes.

a. The report shall contain an evaluation of on-site soils and their suitability for use in construction of the building or other improvements.

1) All on-site material shall be recycled to the greatest extent possible to limit import/export and meet the University’s sustainability goals.

2) The report shall prioritize the use of onsite soils and any soil amendments to reduce import/export.

3) The report shall include recommendations for the modification of non-acceptable soils for reuse on site.

4) The report shall indicate appropriate locations where on-site soils can be used (i.e., trench backfill, etc.).

b. The report shall indicate soil suitability for storm water infiltration and include infiltration rates and recommended methods, if requested, based on permeability testing.

c. The report should contain recommendations for at least one foundation system and describe precautions to be taken for special problems such as expansive soils, collapsible soils, etc.

d. Special attention is to be given to the possibility of expansive soil conditions.

e. In roadway or parking lot areas, the report shall contain recommendations for roadway and parking lot cross sections including asphalt or concrete thickness and thickness of accompanying road base.

1) Pay particular attention to areas where the asphalt or concrete paved surface will be subject to heavy loads. The pavement section may require special design to ensure long use with minimal maintenance. Consult with Facilities Management through the University Project Manager to determine where heavy use design will apply.
f. As an alternate for University consideration, the report shall include at least one pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt or concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include pervious concrete, 4” asphalt over 8” road base, pervious concrete over 18” gravel, etc.

g. The report shall have a specific section addressing site specific sustainability recommendations to support the University’s sustainability goals and climate change concerns.

(3) The A/E shall modify project plans and specifications appropriately to incorporate the soils engineering firm’s recommendations.

D. Surveying on University Projects

(1) Licensed Professional Surveyor

All surveying on campus projects shall be performed by a professional surveying firm qualified for such work and licensed by the State of Utah.

(2) Code Compliance

Surveyors working on campus shall comply with all pertinent surveying codes, regulations, methods and procedures.

(3) Coordinate System

All surveying will be accomplished, and all subsequent drawings will be produced using the following coordinate system (no exceptions):

a. Horizontal: NAD 1983 UTM Zone 12N Feet

b. Vertical: NAVD 1988 Feet

(4) Accuracy

Horizontal accuracy shall be 1:15,000 minimum.

(5) Control Reference Marks

a. The surveyor shall furnish and install reference marks set in concrete or mortar in sufficient number and durability to assure the perpetuation or easy replacement of any survey point, monument or line. Any monuments to be disturbed during construction shall be referenced in
such a manner as to facilitate re-monumentation by the project surveyor at completion of the project.

1) Identify the land surveyor who supervised the setting of reference marks with the land surveyor's license number on all survey monuments set and on the title page of all survey field notes.

2) Require the protection of all bench marks and existing survey work from damage or displacement. Specify requirements for maintaining or replacing survey monuments.

(6) Field Notes and Drawings

a. Submit a good (readable) copy of all survey field notes, raw data, basis of bearing, and drawings in digital format to Facilities Management, particularly Facilities Business Services/Geographic Information Systems, through the University Project Manager as follows:

1) Before Construction

Include any point, monument or line which will be destroyed or disturbed during construction.

2) After Construction

Include all survey field notes, raw data, basis of bearing, and drawings.

(7) Surveyors Working on Campus

a. The University will not provide design surveying. The University will provide horizontal and vertical control information to surveying firms providing design and construction surveying.

b. Requests for information should be made to Facilities Management/Professional Land Surveyor through the University Project Manager.

c. Surveyors intending to do work on campus must contact the University Land Surveyor prior to beginning work. Contact information is provided at the Facilities Management / Facilities Business Services / Land Surveying web site.

d. Submittals shall be AutoCAD Civil 3D (latest version, verified to be compatible with University requirements), and shall be submitted to the University Land Surveyor in digital format.

e. Required Surveyor’s Materials on University Surveys:

1) Survey grade GPS equipment or Total Station.
2) Biodegradable flagging with a life span of 6 months to 2 years.

3) Florescent spray paint, water based, which has a life span of 2 months.

4) Data form and format easily translated into the University’s database.

E. Storm Water Management Plan

(1) General Requirements

a. An approved Storm Water Pollution Prevention Plan (SWPPP) for projects 1 acre or larger will be required prior to obtaining a digging permit.

b. Direct the Contractor to submit the SWPPP to the University Construction Project Delivery Project Manager and the Environmental Health and Safety Department for review.

(2) Maintenance and Escalation of Best Management Practices

The density of developed area and close proximity of impervious surfaces requires proactive storm water protection at the University of Utah. Impermeable surfaces adjacent to construction sites are to be kept free of sediment and construction site debris. The University requires all contractors to ensure that these potential pollutants be controlled to the “Maximum Extent Practicable” (MEP) as defined by the Federal Clean Water Act (CWA) part 402(p)(3)(B)(iii). In situations where the installation of a Best Management Practice (BMP) has proven ineffective (two or more corrective actions issued) the University of Utah will require alternate BMPs.

(3) Long Term Storm Water Controls

The design team must complete the University's Utah Pollution Discharge Elimination System submittal form for Long Term Storm Water control compliance. Describe why the specific long-term storm water controls were selected, the pollutant removal expected from the selected controls and the technical basis that supports the performance claims for the selected controls. For a copy of this form, please see the forms section on the University's Documents and Standards web page.

(4) Job-Site Cleanup Responsibilities

a. Specifications shall identify daily, weekly, and job completion cleanup responsibilities for the removal of garbage, rubbish and unused materials.

1) Require the Contractor to coordinate daily cleanup operations in areas of the jobsite which may be affected by surrounding University activity. Construction activities shall be coordinated
with the University Project Manager to reduce congestion and limit interruption of University traffic, operations, graduation ceremonies, etc.

2) Facilities Management approval, through the University Project Manager, must be included in the final project cleanup process.

F. Erosion Control

(1) Erosion Sensitive Areas

Avoid disturbing areas of high erosion susceptibility, sensitive vegetation areas, and areas with steep slopes.

(2) Steep Slope Control Measures

Provide special erosion control measures on slopes greater than the angle of repose necessary for natural erosion control. Coordinate erosion control measures with the soils engineer.

(3) Erosion Control Plan

a. Create an erosion control and sedimentation plan for all construction activities associated with the entire project site. The plan must incorporate practices for stock piling of top soil for reuse, seeding, grading, mulching, filter socks, stabilized site entrances, protection of drain inlets, preservation of existing vegetation, and any other ‘best management practices’ (“BMP”) needed to control site erosion and sedimentation from storm water runoff.

b. The plan must include a drawing and a complete description of the BMPs that will be implemented to prevent erosion at the site and control sedimentation in storm water runoff. A menu of sample erosion and sediment control BMPs can be found at the EPA’s National Pollutant Discharge Elimination System / National Menu of Storm Water Best Management Practices web site
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

G. Site Grading

(1) Existing Site Utilities

Require the Contractor to locate and protect all existing utilities. Require the Contractor to contact Facilities Management through the University Project Manager to assist in locating campus utilities at the site, and Blue Stakes for other utilities (see the Facilities Management / Construction Processes web site for contact information).
(2) Existing Objects to Remain

Specify that all bench marks, structures, fences, roads, sidewalks, utilities, trees, shrubs, lawns, paving and curbs which are to remain are to be protected. Above or below grade utilities which are to remain are to be located and safeguarded by the Contractor. The Contractor must repair any damage his work causes.

(3) Existing Objects to be removed

a. Require the removal of existing objects, not designated to remain, down to the subgrade. Direct the Contractor to remove designated objects and material from the construction site and University property in a neat, orderly and legal manner.

b. Re-usable top soil should be stripped and stored as directed by the University Project Manager for later use.

c. Materials, objects, excavation export, garbage, residue, etc., which contain hazardous or regulated waste must be properly transported and disposed in accordance with the laws of the State of Utah.

d. On-site burning is not permitted.

(4) Unforeseen Conditions

Upon discovery of unknown utilities or concealed conditions, instruct the Contractor to discontinue work which would affect the utility or concealed condition, and immediately notify both the A/E and the University Project Manager.

(5) Rock Removal

a. Explosives are not to be used without approval from Facilities Management. Any perceived need to use explosives will require extensive review in advance, and must not be organized without written approval from the University Project Manager. If approved, allow ample time for University notices and preparation.

b. Rock/cobbles up to 30-inches in diameter are considered ordinary earthwork. When unexpected rock removal is required, direct the Contractor to notify both the A/E and the University Project Manager.

(6) Re-Use of On-Site Materials

Site grading shall balance on-site material, and import/export shall be minimized to the greatest extent possible. Every effort shall be made to reuse all existing on-site materials, whether native or demolished.

(7) Grading for Storm Water Runoff
Grading shall direct storm water runoff to pervious surfaces and landscaped areas prior to capture in a formal drainage system/structure. The intent is to slow the time of concentration, reduce runoff, improve water quality, and provide supplemental landscape irrigation. See G. / (9) / e. Landscaping Areas below.

(8) Accessible Paths of Travel

Where finish surfaces are to accommodate wheel chair accessible paths of travel, ADA slopes and requirements must be met.

(9) Basic Grading Requirements

a. Finish Floor Elevations

Establish finish floor elevations 6" above the finish grade adjacent to the building.

b. Grade Away from Building

Provide 2% minimum positive grade away from the building for at least 12'.

c. Asphalt Surfaces

1) In general, 2% minimum grade is desired, 1% grade is the absolute minimum.

2) For parking lots, do not exceed 6% maximum grade.

3) For roadways, do not exceed 10% maximum grade except as approved by Facilities Management through the University Project Manager.

4) Asphalt surfaces are not to be used as gutters, or used as channel paths for water unless specifically approved by Facilities Management through the University Project Manager.

5) As an alternate for University consideration, the A/E’s design shall include at least one asphalt pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt, or pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents.

d. Concrete Surfaces

1) In general, 1% minimum grade is desired, 0.5% grade is the absolute minimum.

2) For parking lots, do not exceed 6% maximum grade.
3) For roadways, do not exceed 10% maximum grade except as approved by Facilities Management through the University Project Manager.

4) As an alternate for University consideration, the A/E’s design shall include at least one concrete pavement section that incorporates pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include concrete pavers, etc.

e. Landscaping Areas

1) In general, 2% minimum grade is desired, 1.0% grade is the absolute minimum.

2) Do not exceed 3’ horizontal to 1’ vertical maximum slope except as approved by Facilities Management through the University Project Manager.

3) The A/E’s design shall minimize paved and impervious surfaces, and maximize the use of landscape except for functional requirements.

4) The site grading design shall closely coordinate with the site storm water systems. The A/E shall look for and employ site opportunities to maximize water quality and minimize the quantity of storm water leaving project site.

5) The site grading and landscape design shall reduce the amount of directly connected impervious surfaces, and shall create micro detention and bio retention (bioswale) areas intended to improve water quality and slow the time of concentration.

6) As part of the A/E’s design, the 10 year 2 hour storm shall be retained on site (see L. / (4) Storm Drainage below).

H. Structural Excavation, Backfill, and Compaction

(1) Special Attention Required

a. Structural excavation and backfill is a topic of major concern to the University, and should be given special attention in the preparation of bidding documents.

b. To the greatest degree possible, on-site materials are to be evaluated for suitability as structural backfill. The University desires to use on-site
materials to the greatest degree possible as long as there is no loss of quality or stability.

c. The A/E should carefully define minimum acceptable standards for structural backfill, and quantify on-site sources of acceptable material.

d. Minimize the potential for change order cost issues by including material unit prices on the bid form. These unit cost items should be clearly described in the measurement and payment section of the specifications. Coordinate unit pricing and alternate pricing schemes with Facilities Management through the University Project Manager during design.

(2) Alternate Storage Site

Specify that any excavated soil identified for use as backfill is to be stored at the project site. Where this is not feasible, an alternate temporary storage site should be arranged with Facilities Management through the University Project Manager. Such storage must be discussed and arranged with Facilities Management early in the design process.

(3) Soil Not Usable as Backfill

Direct the Contractor to remove and legally disposed of any excavated soil not identified for use as backfill. There will be no permanent dumping on University property unless so directed by the University Project Manager.

(4) Compaction Standards

a. Specify that backfill shall be properly laid and compacted in lifts to the following standards. Where specific compaction recommendations are included in the soils report for the project, the soils report recommendations shall be followed in lieu of the following standards.

   1) In lawn and landscaped areas: 85% of maximum dry density, 12-inch layers.

   2) In sidewalks, roads, parking areas or under buildings: 95% maximum dry density, 8-inch layers.

b. Compaction testing shall be required. Coordinate the need for anticipated testing with the University Project Manager who will arrange a contract for the services of an independent testing firm.

   1) The A/E shall include testing requirements for the Contractor and the testing firm in the project specifications. Duties of the University’s testing firm should also be made a part of the specifications.

   2) Specifications shall indicate the testing frequency and type.
3) Include in the specifications, “Failure of Facilities Management or the A/E to detect defective work or material does not prevent later rejection of the work, nor obligate the A/E for final acceptance when such defective work or material is discovered.”

4) Include in the specifications a list of informational items required for submittal.

5) A test schedule shall be included in the specifications.
   a) Curb and gutter with grade less than 0.5%: One random test per lift per 200 lineal feet.
   b) Curb and gutter with grade greater than 0.5%: One random test per lift per 400 lineal feet.
   c) Sidewalk: One random test per lift per 400 lineal feet.
   d) Trenches: One random test per lift per 200 lineal feet.
   e) Roadways: One random test per lift per 1000 square yards.
   f) Landscape Areas: No specific requirements.

6) Cooperate with the testing firm hired for compaction testing.  
   Note: The first test will be provided by the University, but any retesting due to test failure will be at the Contractor's expense.

I. Soil Stabilization

(1) Slope Standards
   a. Soil stabilization is a particular concern on University projects and will require special attention. Review all areas of concern with Facilities Management through the University Project Manager during design and well before the project is released for bidding.
   b. Slopes steeper than 3:1 are only to be used when no other option is available and only with prior approval from Facilities Management through the University Project Manager.
   c. When slopes steeper than 3:1 are unavoidable, require seeded slopes or blanket type slope protection.

(2) Soils Engineering

The A/E shall include soil type and classification in the design. Soil that is susceptible to slippage shall be properly engineered to prevent movement. Materials that are loose, wet, soft, or frozen will require special attention.
J. Dewatering and Drainage Control

(1) The A/E shall consider possible needs for dewatering and drainage control. When needed, include mitigation measures in the design to prevent erosion (i.e., seeding, landscaping, etc.).

(2) Any dewatering system design shall be submitted to the University Project Manager for review and approval by Facilities Management. Dispose site water to an existing underground gravity flow system that is approved by Facilities Management.

(3) Dewatering systems should be of the gravity underground type, but may be pumped or flow overland if prior approved by Facilities Management through the University Project Manager.

(4) Require that all dewatering systems be maintained and operated by the Contractor during the entire construction of the project. The system is not to be shut down or interrupted without Facilities Management approval.

(5) Sub-Drainage Systems

a. Approved sub-drainage systems are traditional building perimeter foundation and under floor drainage networks with gravity outfall systems.

b. Containment sub-drainage systems shall not be used (i.e., sumps, pits, detention, or other containment systems) without prior approval of Facilities Management through the University Project Manager.

K. Underground Utility Conflicts

(1) Crossing Limits

a. Where piping systems (i.e., sewer, water, irrigation, drainage, chilled water, etc.) must unavoidably cross structures (i.e., footings, walls, concrete ducts, tunnels, etc.) that are more than 4 feet wide and 5 or more feet deep; and, where direct access to the piping is limited and will not comply with OSHA trench standards, design the crossing with either a casing pipe that extends a minimum of five (5) feet beyond the structure, or require a 20 foot (minimum) section of ductile iron pipe.

b. See 3.8 HVAC for special requirements at buried HTW crossings.

(2) New Above Grade Structures

a. Any new above grade structure which will be located over any existing utility will require one of the following design options:

   1) Relocate all utilities.
2) Design a tunnel, chase way, pipe sleeve, or other suitable access for any utility being crossed by, or in the “near vicinity” of footings, retaining walls, staircases, or other concrete structures 8” thick or greater. “Near vicinity” means a lateral distance 1 ½ times the depth of the utility, from each side of the pipe or conduit. This will allow for excavations to comply with OSHA trench standards and eliminate the need for costly concrete demolition and replacement during utility failures. The chosen access must extend a minimum of 2’ past each side of the concrete structure.

3) Use an alternative design approved by the Design Standards Committee.

L. Site Utilities for Campus Projects

(1) Available Utility Information
   a. Facilities Management will provide any available utility information for the project upon request.
   b. The project A/E shall evaluate the utility information available against the project needs.

   1) If exact elevations and locations are needed but not available from Facilities Management; and, if this information is deemed necessary for the design of the project, the A/E shall request an excavation to expose the utility. The University will excavate and expose each requested utility (except the high temperature water system) and perform necessary surveys to obtain the information requested. Requests for this special information are to be made to Facilities Management through the University Project Manager. Requested information will be provided only upon request. If no request is received, the University will assume that the A/E has adequate information for the design.

(2) Utility Layout, Capacity, Connection Points
   a. Coordinate with Facilities Management through the University Project Manager concerning utility connection points, capacities, crossings, etc.

   1) Computer models of campus utility systems shall be used to evaluate the impact of new systems on existing pipe sizes and capacities.

   2) The proposed system layout shall be optimized by model analysis.

   3) Submit the proposed system layout with a complete report, including calculations, to the University Project Manager for
Facilities Management review. The A/E is responsible for the accuracy of the submittal and subsequent design. University approval of the submittal shall not be considered a verification of the data, nor verification of the workability of the proposed design.

(3) Trace Wire, Warning Tape, Sand Cover Over Pipe

a. All underground conduit and pipe 4” diameter and larger shall be installed with an 18 gage continuous copper wire 8” over the pipe to serve as trace wire.

1) Plastic Pipe

Whenever plastic pipe is used, direct the Contractor to install 2 feet of sand over the pipe and include a yellow warning tape with the trace wire at 8” over the pipe.

2) Buried Natural Gas Pipe

For buried natural gas piping, in addition to the trace wire described above, natural gas lines shall be installed with 2 feet of sand covering the pipe, and yellow warning tape 8” over the sand layer routed along the entire length of the pipe.

b. Direct the Contractor to test and verify continuity of trace wire at the terminal end points prior to backfill. Also direct the Contractor to verify continuity again after backfill using the installed termination end points.

c. The A/E shall show the location for each trace wire termination end point on the drawings.

1) Each trace wire is to be terminated in the interior of an irrigation valve box or manhole. If no suitable box or manhole exists at the termination point, instruct the Contractor to install an irrigation valve box for the trace wire.

2) Where underground pipe penetrates the building, the trace wire shall be terminated and secured in a box or manhole at the building exterior over the pipe penetration.

3) Instruct the Contractor to complete each termination with a screwed connection to the side of the box or manhole, conveniently located for easy access. Excess wire may be coiled in place beyond the screwed attachment.

4) As-built drawings shall show the actual location of each trace wire termination box or manhole, and note the pipe or conduit it serves.
(4) Storm Drainage

a. Engineer Qualifications

Storm drainage design shall be performed by a qualified civil engineer, licensed to perform such work by the State of Utah.

b. BMP and Pollutant Calculations

The design shall incorporate both water quality and water quantity best management practices (BMP) and pollutant concentration calculations.

c. Submit Design Calculations and Drawings

Storm drainage calculations and drawings are to be submitted to the University Project Manager for review and approval. The submittal shall include the engineer's stamp and dated signature.

d. Storm Runoff Design Criteria

1) Provide on-site detention of storm water runoff to detain the 100 year, 24 hour storm, with 0.20 CFS/Acre run-off rate. Show calculations for detention volume requirement.

2) Provide on-site retainage for a 10 year 2 hour storm.

   a) If a 10 year 2 hour storm cannot be retained on the project site, design a modification to the University’s storm water system which will accommodate an equivalent retention of the 10 year 2 hour storm. The modification could include bio retention (bioswale), pervious pavement, etc.

e. Piping Connections

Coordinate all connections to the University storm drainage system with Facilities Management through the University Project Manager.

f. Concrete Pipe

Gravity flow storm drainage systems shall be reinforced concrete or non-reinforced concrete pipe as specified by the A/E and approved by Facilities Management through the University Project Manager. Non-reinforced concrete pipe shall only be used where load requirements permit.

g. Minimum Pipe Size

Minimum pipe size for storm drainage lines shall be 12" diameter.
h. Minimum Slope

Minimum slope for storm drainage lines shall be 0.5%.

i. Manhole or Cleanout Spacing

Maximum distance between manholes or cleanouts shall not be greater than 300 feet.

j. Changes in Direction and Lateral Tie-In's

Manholes, catch basins or cleanouts shall be provided at every change in direction and every lateral tie-in point.

k. Minimum Pipe Cover

Minimum allowable cover over the top of pipe shall be 3'-0" to grade. Facilities Management through the University Project Manager shall be consulted if minimum cover is not achievable. Special design considerations will be required when minimum cover is not maintained.

l. Limit Impervious Surfaces

Every effort shall be made to minimize and disconnect impervious surfaces, slow the time of concentration, and improve water quality through the use of micro detention, bio retention (bioswale), etc. Convey runoff in surface conveyances to the greatest extent possible.

m. Roof Runoff Capture

The A/E’s design shall include an evaluation of an option to capture the roof runoff for beneficial reuse (either for outdoor landscaping or indoor toilet flushing) to reduce potable water use, slow the time of concentration, and reduce the size of storm drainage facilities.

n. No Direct Roof Drain Connections

No roof drains may be directly connected. All roof drains must drain to a pervious area or be captured for reuse.

o. Runoff First to Pervious Surfaces or Landscape

The A/E’s design shall direct the runoff onto pervious surfaces or landscaped areas prior to capture in a formal drainage system/structure to slow the time of concentration and increase water quality, and provide supplemental irrigation for landscaped areas.

p. Camera Inspection

If the new storm drainage piping system fails during testing, require a camera inspection to identify the location and extent of failure. Failed or
damaged portions of the new piping system shall be excavated and repaired. Require repeat test(s) until the system is proved.

(5) Sanitary Sewer Piping

a. Salt Lake City Codes Apply

The University sanitary sewer system drains into Salt Lake City’s sanitary sewer system; therefore, codes applicable to that system must be followed. Consultation with Facilities Management through the University Project Manager is necessary before considering any change to the University’s sewer system.

b. Minimum Pipe Size

The minimum lateral size outside a building shall be 6" diameter. The minimum main size shall be 8" diameter.

c. Minimum Design Slope

The minimum design slope for a 6" lateral is 1.0%. The minimum design slope for an 8" main is 0.5%. The design for larger piping shall include 2.0 feet per second minimum velocity.

d. Manhole Spacing

The maximum distance between manholes shall not exceed 300 feet. Manholes shall be provided at every change of direction.

e. Minimum Pipe Cover

The minimum allowable cover over the top of pipe shall be 3'-0" to grade. Facilities Management through the University Project Manager shall be consulted if the minimum cover cannot be maintained.

f. Grease Interceptors

1) University buildings which will include food service facilities shall have a grease interceptor installed in the immediate location of that building.

2) Drawings shall clearly show the location and design of the grease interceptor. Prior to design, the proposed location of the grease interceptor shall be reviewed with Facilities Management through the University Project Manager.

g. Additional Testing Requirements

In addition to standard testing requirements, direct the Contractor to verify continuity of the piping with an air test between manholes. If the air test fails, require the Contractor to provide a camera inspection to
identify the leak. Failed or damaged portions of the new sewer line shall be excavated and repaired. Require the Contractor to provide air testing until the piping is proved air tight.

(6) Domestic Water

a. Source

The source of the University’s domestic water distribution system is Salt Lake City’s water supply system.

b. University Water Distribution System

The building water supply for each project shall be taken from the University water distribution system. Connections to the water system are to be coordinated with Facilities Management through the University Project Manager.

c. Fire Suppression Systems

Hydraulically calculated fire suppression systems shall include a water system computer analysis to provide water pressure information.

d. Minimum Pipe Size

Water lines that are part of the campus water distribution system or branches shall not be smaller than 8” in diameter. All lines supplying fire hydrants shall not be smaller than 6” in diameter.

e. Three Valves at Tees and Crosses

All tees, crosses and connections to water mains will have valves installed on all branches of the fittings.

f. Minimum Pipe Cover

Minimum allowable cover over the top of pipe shall be 3'-0" to grade.


g. System Design Pressure

1) All components of the water system shall be designed for a 200 psi working pressure.

2) Thrust blocks shall be designed to withstand the forces exerted by 200 psi working pressure utilizing 2,000 pounds per square foot soil bearing pressure, unless the soil conditions dictate less in the best judgment of the A/E.

3) Where soils engineering has been performed at the project site, the soil bearing pressure provided in the soils report shall be used.
h. Valves for Domestic Water

1) Approved Valve Types

Valves approved for use are gate, butterfly, ball, air and vacuum, pressure and check type. Review all proposed valves with Facilities Management through the University Project Manager for additional requirements.

2) Gate Valves

Gate valves shall be resilient wedge in accordance with AWWA C509-80. Valves 12" and smaller shall be bubble tight at 200 psi water working pressure. Include valve box and 2" nuts for buried locations.

3) Butterfly Valves

Butterfly valves shall be AWWA Specification C 504, Minimum Class 150B. Valve bodies shall be cast iron if exposed or in meter vaults. Provide with flanged end connections (125 pound ASA Standard) when buried; otherwise mechanical end connections. Valve disc shall be AWWA C504, Section 3.4. Valve shaft shall be AWWA C504, 18-8 type 304 Stainless Steel. Valve bearings shall be sleeve type, corrosion resistant, and self-lubricating. Testing shall be in accordance with AWWA C504, Section 13. Manual operators shall be AWWA C504.

4) Ball Valves

Ball valves shall be consolidated brass coupling, Conbraco Industries "Apollo" valves are approved, or prior approved equal.

5) Air and Vacuum Valves

Air and vacuum valves shall be DeZurik/APCO, Crispin-Multiplex, G-A Industries, or prior approved equal, and shall be capable of operating up to 300 psi. Drawings should show: (1) Weld-O-Let (for steel pipe only); (2) threaded pipe outlet; (3) corporation cock; (4) gate valve; (5) nipple; and, (6) vacuum and air release valve.

6) Pressure and Check Valves

Pressure valves and check valves should be hydraulically operated globe valves, single seat construction, with replaceable stainless steel seat ring and a reversible inner valve disc. The valves shall have fully supported diaphragm operators.
7) Operator Extensions

Any valve located more than 5 feet below grade shall be installed with a valve operator extension to allow operation from the surface with a 5 foot key.

i. Testing for the Domestic Water System

1) All water mains require testing at 200 psi for two hours in accordance with AWWA Standard C600-93. Each test shall be witnessed by the A/E’s professional engineer and the Facilities Management water distribution specialist.

2) All new water lines shall be chlorinated to 50 ppm or higher and remain in the piping system for a 24 hour period. After 24 hours of holding time, the heavily chlorinated water shall be flushed into a sanitary sewer (do not empty into a storm drain). The Salt Lake City Sewer Department must be contacted prior to discharge. Salt Lake City must be notified that highly chlorinated water is coming to them. Upon refilling the new domestic water system with clean potable water, two bacteriological samples, 24 hours apart, shall be analyzed. After the second sample comes back satisfactory, the system can be connected to the University’s water system. All work shall be inspected by the Facility Operations Plumbing Shop before being concealed or buried, and prior to start-up.

(7) Natural Gas Systems

a. Natural gas systems on campus are University owned. Extensions or connections shall be coordinated with Questar when applicable and Facilities Management through the University Project Manager.

b. During design, notify Questar of any intended construction activity on their main lines, and continue coordination with Questar as the design progresses toward construction.

c. Review all available documentation regarding each natural gas location affecting the project site with the University Project Manager.

d. Identify all actual locations of gas utilities, and clearly mark each system with associated appurtenances on bidding / construction documents.

e. See 3.2 Civil / L. Site Utilities for Campus Projects / (3) Trace Wire for trace wire, warning tape and sand coverage requirements.

End of 3.2 Civil
3.0 DFCM REQUIREMENTS

3.3 ARCHITECTURAL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

This architectural design standard has been produced to provide A/Es with specific requirements and minimum standards acceptable to the University for use in the construction or remodeling of buildings or facilities on campus. The A/E is expected to incorporate these requirements and standards into the project documents to ensure that the finished product meets the specific needs of the University.

If design standard deficiencies in the construction documents are found during bidding or construction administration, it shall be the responsibility of the A/E design team to make corrections to the construction documents and issue and the appropriate change documentation.

It is intended that all new facilities built on the University of Utah campus be compatible with the permanent facilities already in existence. This requires recognition of the characteristics of the surrounding environment and what materials and design characteristics will be compatible with the existing. Each new facility must become an integral and complimentary part of the total campus character and the master plan.

All materials selected by the A/E shall be of a durable, high quality and should require minimum maintenance. Materials selected for remodeling should be of equal or better quality than existing unless otherwise authorized. Changes to University approved materials and/or colors shall be submitted to Facilities Management through the University Project Manager for approval.

Industry standards such as ASTM must be adhered to and inferior workmanship and methods of construction will not be acceptable.
## REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 January 2016</td>
<td>3.3 (4) a., viii</td>
<td>Building Graphics update</td>
</tr>
<tr>
<td>1 May 2015</td>
<td>---</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.3 / 071400</td>
<td>Toilet, Bath and Laundry Infant changing stations</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.3 / EE. 01 55 19</td>
<td>Vehicle Access and Parking Parking plan changes</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.3 / M. / 13170 / i)</td>
<td>Vivarium Added more requirements for Vivariums including referencing the design guide that is to be used in the design and construction of these facilities</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.3 / 015519</td>
<td>Waterproofing Thickness Added back into the standard the requirement for thickness in waterproofing</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.3 / M 015519</td>
<td>Vehicle Parking Access Added new parking plan that will be required by designers to include in all new projects</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.3 / K. / 10 28 00A 2) / a)</td>
<td>Sanitary Napkin Dispensers Deleted requirement and information for Sanitary Napkin Dispensers. No longer provided or maintained by University Facility Operations</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.3 Architectural</td>
<td>Architectural Rewrite Substantial changes have been made throughout the chapter.</td>
</tr>
</tbody>
</table>
ADDED:
(4) See 09 51 00 Acoustical Ceilings herein.

REVISED:
B. New Roofing Requirements
Including Modifications or Additions to Existing Roofs

REVISED:

ADDED:

a. On University roofs, the minimum guarantee period for any type of roofing shall be 20 years from the manufacturer and 5 years weather tightness / workmanship from the general contractor and / or roofing contractor.

b. On University roofs covered by overburden, specify that warranty coverage shall include removal and replacement of overburden, and such removal and replacement shall coincide with the guarantee period described in “a.” above.

REVISED:

REVISED:

This document is a University of Utah Architectural Supplement, user is to also refer to the DFCM Design Requirements.
(3) Comply with Guaranty for Single-Ply Roofing: Include DFCM requirements. Refer to
g%20(final).pdf
http://dfcm.utah.gov/downloads/Roofing/Single%Warranty20%Form%2012-17-

(4) Comply with the list of DFCM approved manufacturers and approved installers.

**ADDED:**

a. Any work on University roofs described herein must be performed by a licensed
roofing contractor.

b. On University roofs, new roof installations or modifications to roofs under
warranty must be performed by a contractor authorized by the roof manufacturer
to perform such work.

c. Modifications shall not negatively impact existing warranties and shall
themselves carry a 5 year workmanship warranty from the roofing contractor.

(9) Do not provide the following components, unless approved by the Director: Other
Roofing Components: ballasted roofs.

**ADDED:**

a. Concrete pavers and gravel are not allowed either as ballast or for aesthetic
purposes on University roofs, unless prior approval is obtained from the Facility
Operations Carpenter / Roofing Shop.

b. Where something other than a single ply roof is desired for aesthetic reasons, the
A/E shall first consider a granulated cap sheet over a built-up roofing system.
This and any other design option shall be discussed with the Facility Operations
Carpenter / Roofing Shop and the University Project Manager during design and
prior to construction.

(11) Minimum 60 mil thickness required for all single ply roofs.

**ADDED:**

a. On University of Utah roofs, single ply roof membrane is the preferred roof
system up to a slope of 2 / 12. Other proposed systems on University buildings
must be reviewed and approved using the Project Variance Request Form during
design and prior to construction.

1) If the building design requires roof areas with slope greater than 2 / 12,
specify an architectural (laminated) shingle or standing seam metal
roofing system.

b. Although minimum thickness of single ply is 60 mil; 80 ml or thicker shall be
used for areas with mechanical equipment or other areas requiring heavier traffic.

1) Georgia-Pacific “DensDeck” roof boards or prior approved equal should
be specified as underlayment between the insulation and the membrane
where more than light or occasional foot traffic is anticipated.
c. University roof areas underneath any overburden such as soil, plantings or concrete shall not be roofed with single ply roofing. Roofing under overburden shall be a built up modified asphalt system as described in (12) below.

**REVISED:**

(12) Minimum 4-ply, type VI felts with type III asphalt for all built-up roofs apply to DFCM projects and not to University of Utah roofs. For all University of Utah projects where overburden will be applied over the roof structure, adhere to the following requirements.

**ADDED:**

a. University roof areas underneath any overburden such as soil, plantings or concrete shall be a built-up modified asphalt system such as Hydrotech Garden Roof (American Hydrotech, Inc.) or prior approved equal.

b. The built-up modified asphalt system under overburden must include appropriate protection boards, drainage layers and drain protection methods.

c. Overburden materials shall not obstruct any roof drain and shall be kept clear of drain sump areas by use of appropriate stops or barriers, compatible with the roofing system.

d. Overburden areas shall be clearly separated from any single ply roofed area by a capped curb wall system.

(14) Provide reasonable access to all roof levels for maintenance personnel.

**ADDED:**

a. All University roof areas must be accessible via secured walk door or secured fixed ladder access. All means of roof access shall be keyed to the University of Utah roof master key. Coordinate this requirement with the University Project Manager and Facility Operations Key Shop.

1) Such access may be from a custodial closet, mechanical room, stairwell, or other readily accessible area. Do not design a roof access location in any area that might pose a restriction, such as an office space, lab, restroom, conference room, class room, etc.

2) Walk out access (i.e., from the top of a stairwell) is preferred and is strongly encouraged as the most practical, safest, and most readily secured manner of roof access.

3) Roof hatches must have a metal safety rail secured to the hatch on the sides not used for egress or otherwise shielded by the open hatch cover. The maximum roof access hatch size is 36” x 36”.

b. On University roofs, walk pads must be installed at all roof entry points including the tops and bottoms of ladders between levels, at roof access doors, at the front edge of roof hatches, around all equipment on the roof, and along the route connecting the roof access point to equipment or other traffic required routes.
1) Georgia-Pacific “DensDeck” roof boards or prior approved equal should be specified as underlayment between the insulation and the membrane where more than light or occasional foot traffic is anticipated.

**ADDED:**

(17) The University Project Manager and Carpenter / Roofing Shop Supervisor must be notified prior to installing or placing anything on a roof area and must pre-approve the proposed details for such placements.

(18) Do not allow sleepers, ballasted curbs, or any equipment to sit on the roof surface, other than for a temporary purpose pre-approved by the University Project Manager and Carpenter / Roofing Shop Supervisor.

a. Conduit and Pipe Supports

1) Exposed wood is not allowed on roof areas. Roof mounted pipe and conduit runs must be supported on blocking manufactured for this purpose (U.V. resistant with integrated clamping and protective padding equal to “PipePier” by PipePier Support Systems).

2) Conduit and pipe runs should be limited to 10’ or less, with longer runs made on the interior of the building whenever possible.

(19) On University roofs, the termination (top edge) of the roofing membrane must be at least 8” above the roof surface in the immediate vicinity. Single ply membrane shall wrap over the top of parapet walls (beneath the parapet cap). Where it cannot wrap over the top of a curb or wall, the termination must be mechanically fastened, with water cut off mastic behind the termination and silicone caulk sealant (equal to Dow 795, 790) at the top of the termination bar or counter flashing. The top bend on counter flashing shall return to the wall rather than projecting outwards. Parapet cap metal shall have positive slope (1/4” per foot) back to the interior (roof) side of the parapet wall. Cap metal shall be standing seam, with corners caulked using silicone as specified above.

(20) Roof Drainage

a. Roof drain domes must be metal. Acceptable brands are Zurn, Wade, Smith, and Josam.

b. Primary drains must be sumped below the main roof drainage plane. Primary drainage via scuppers, downspouts, and gutters is discouraged and must be approved during design by the University Project Manager and Carpenter / Roofing Shop Supervisor. If these non-standard methods of primary drainage are approved, the design shall include heat trace equipment.

c. Secondary drainage must be provided per State adopted code.

d. Areas of standing water are not permitted.
e. Drain sumps shall not be obstructed by equipment, overburden, or pavers.

(21) Roof Penetrations

a. Individual penetrations such as conduits and pipes should be separated by at least 12” (24” if penetrations are greater than 6” in diameter).

1) Where tighter clusters of penetrations are necessary (such as condensing unit line sets), pitch pans may be utilized. Pitch pans must be filled with two component sealant or self-leveling silicone sealant (Dow 890 or prior approved equal) made for this purpose (do not allow pitch or other asphaltic material). Insulation on line sets must not be continuous through pitch pans or other flashing (i.e., the seal must affix to the pipe, not to insulation).

2) Electrical lines through the roof or adjacent walls must be via rigid conduit, not flex.

(22) Mechanical Units, Curbs and Other Roof Top Equipment

a. Mechanical units and other roof top equipment on University roofs shall be designed to be installed in a location and manner that readily allows repair or replacement of the roof system without removal or disconnection of the equipment.

b. On University roofs, all equipment and installations must be mechanically attached to the structural roof deck, parapet, or other structural element of the building using round flashable pipe supports.

c. Equipment curbs are to be fully wrapped where feasible and capped with a metal cap. Joints in the cap must be standing seam and be accessible for maintenance. The cap design shall allow free drainage of water from the cap surface.

1) Equipment shall mount to roof curbs via structural elements equal to Unistrut which bear on top of the metal curb cap but attach through the side of the curb cap (the top of the curb cap shall not be penetrated by fasteners). Where possible, do not allow conduit or line set penetrations to be routed through a curb cap – specify or detail separately flashed routing through membrane.

2) If conduits or line sets must be routed through the curb cap, they must do so through an appropriate flashing or pitch pan, and must not be obstructed by the equipment itself.

d. Where equipment is supported on two or more posts or post mounted curbs, specify or detail a minimum of 24” clearance beneath the equipment.

e. Equipment installation shall not be located in a valley or drainage plain, or where an installation will block access to essential roof system components such as parapets, drains, or other equipment.
f. Curbs, equipment, and roof penetrations shall be far enough from each other, and from other obstructions, so as to be readily accessible for inspection and maintenance.

g. Guy lines must anchor to building structural elements which extend above the roof plane. Structural elements may be rigid posts installed for this purpose or existing elements. Guy lines shall not be connected to the building structure through pitch pans or directly through the roof membrane.

h. Roof mounted solar racking and arrays shall comply with above and other requirements in this standard, including the establishment and maintenance of access to other roof top equipment, clearance under equipment to roof surface, and compliance with roofing manufacturer's warranty requirements.

(23) Labeling of all Roof Mounted Equipment Installed by End User University Departments

a. All equipment installed by or for end user University departments on University roofs, parapets, etc., are to have been clearly labeled by others. Require the roofing contractor to request clarification and direction from the University Project Manager and the Carpenter / Roofing Shop when roof mounted equipment lacking labeling is encountered. Such equipment may be subject to removal and disposal (exception is Facility Operations equipment serving a building operations function).

b. The roofing contractor should expect each label to clearly indicate ownership, contact information, purpose, and expected duration of installation.

(24) See 07 72 00 Roof Accessories and 08 60 00 Roof Windows and Skylights for Skylight requirements herein.

Added:
C. Roofing Requirements

For replacement and/or modification of University roofs, comply with C. New Roofing Requirements above. Any proposed variation is to be coordinated with the University Project Manager and Carpenter / Roofing Shop Supervisor during design. Any work involving the creation of new roof areas, the modification or penetration of an existing roof area, or placement of any equipment on an existing roof requires written notice to the University Project Manager and Carpenter / Roofing Shop. For partial replacement or extension of an existing roof, perform the following tasks and present a summary of findings with design recommendations to the University Project Manager and Carpenter / Roofing Shop Supervisor.

ADDED:

(7) For built-up roof (“BUR”) systems on University roofs:

a. The termination (top edge) of the roofing plies must be at least 8” above the roof surface in the immediate vicinity.

b. All transitions from horizontal to vertical in the roofing plies or cap sheets of a BUR system require the use of cant strips to eliminate 90 degree bends. To
further avoid such bends, BUR plies and cap sheets shall not be wrapped over the top of curbs or parapets unless specifically designed for this purpose by the manufacturer.

c. All materials used in the creation of a BUR system, detail, or tie in must be protected from U.V. exposure by the use of aluminized roofing paint (silver coat), or properly imbedded granules, or the use of a compatible and purpose-made foil flashing.

d. Any exposed mastic must be finished to a smooth surface and feathered edges.

e. Areas of standing water are not permitted. Projects which modify or extend existing roof areas shall include an evaluation of corrections needed to resolve standing water issues on areas of the roof which are not initially included in the modification or extension.

D. Waterproofing and Sealants

ADDED:

(1) See 07 10 00 Dampproofing and Waterproofing for Waterproofing and 07 14 00 for Fluid Applied Waterproofing System herein.

E. Acoustical Quality

ADDED:

(1) See 09 51 00 Acoustical Ceilings herein.

ADDED: UNIVERSITY OF UTAH REQUIREMENTS

F. Project Construction.

(1) Integrity of Fire Rated Partitions.

a. The University has experienced a problem in many buildings where projects resulted in unprotected penetrations of fire rated partitions. The designer is to include drawing details describing the sealing of such penetrations for the wall types found on the project. Also, the designer is to specify the avoidance of any hole, cut, or any other type of penetration in any floor slab, partition above the ceiling, or any otherwise concealed partition. If construction requires such penetrations at locations other than identified in the design, the construction documents are to require the Contractor to notify the University Building Official of every such occurrence. Further, prior to covering concealed locations, and prior to Substantial Completion, the Contractor is to be directed to arrange for Code required inspections. The purpose of this notification and subsequent inspection is to enable the University to verify that each such penetration is properly sealed, using ‘tested’ and ‘approved’ assemblies, devices, and materials according to the requirements of current State adopted codes. When the project is complete, the University requires all penetrations of fire rated partitions to be fire-sealed in accordance with code.
(2) Exterior Insulation & Finish Systems (EIFS)

a. The application of EIFS systems is not allowed on campus, nor will the University consider upgrades to traditional EIFS systems. Portland cement stucco may be considered if a recommendation for its use is submitted to the University early in the design of a building. The use of stucco on campus buildings is generally discouraged and will only be allowed upon approval of Facilities Management through the University Project Manager, who will include a review by Facility Operations.

G. Site Considerations

(1) Development

a. The site confines for the project will be determined in consultation with Facilities Management through the University Project Manager. Topography, orientation, public access, service access, and existing underground utilities in the area must be carefully considered and acknowledged. Specific information concerning these subjects is to be received from Facilities Management through the University Project Manager. Adjacent conditions must be shown on all drawings so that proper coordination is possible.

(2) Topographic Information

a. The University may provide topographic information concerning the project site when available. Requests for specific information required should be made to the University Project Manager.

b. The A/E shall evaluate the project needs against the topographical information and make a recommendation concerning the topographic requirements.

c. See 3.2 Civil for specific survey requirements.

(3) Subsurface Exploration

a. A subsurface exploration survey shall be made for each new building. File a copy of the report with Facilities Management through the University Project Manager and the Utah Geological and Mineralogical Survey office, University of Utah Research Park. A digging permit for such subsurface exploration must be obtained from Facilities Management (refer to the Supplemental General Conditions for University of Utah Projects). Refer to the 3.2 Civil for further information.

(4) Landscaping

a. Landscaping included in the project will be in areas as directed. The design shall conform to 4.0 Landscape and Irrigation Standards, the Campus Master Plan, and the recommendations of the University. Approval will be necessary on all proposed designs.
(5) Parking and Service Access

a. Consideration for parking and service access must be given in the site development for the project. Provide service area for a minimum of two trucks adjacent to each building and provide space for trash containers which will be picked up by a truck lift. See L. 4. “Trash Disposal Requirements” below for further information.

(6) Handrails and Guardrails

a. Handrails and guardrails shall be all stainless steel pipe with stainless steel anchor pipe, fabricated as shown in the detail drawings contained in this supplement. No horizontal aircraft cable or pipe railing will be allowed for the “in field” area of the guard railing. Design and placement shall comply with current codes.

(7) Site Furniture (Benches, Bike Racks, Waste Receptacles, and Urns)

a. Specify all site furniture in accordance with 4.0 Landscape and Irrigation Standards.

(8) ADA Curb Ramps

a. Where detectable warning surfaces are installed, the surfaces and locations shall comply with the requirements of the latest edition of the ICC-A117.1, ADA standards and Federal Highway Administration (FHWA) for public right-of-way elements.

b. The detectable warning surface system shall be an approved replaceable polymer concrete or plastic homogenous color product which color is a reddish hue.

c. The detectable warning surface system shall be recessed and wet-set in new concrete. No surface mounted applications on existing concrete surfaces shall be approved.

d. Approved manufacturers: Armorcast Products Company; or approved equal.

(9) New Above Grade Structures

a. For any new above grade structure located above existing utilities, one of the following options shall be implemented (see also 3.2 Civil):

1) Relocate utilities.

2) A tunnel, chaseway, pipe sleeve or other suitable access must be provided for any utility being crossed by, or in the “near vicinity” of
footings, retaining walls, staircases, or other concrete structures 8” in thickness. “Near vicinity” is described to mean a lateral distance 1 ½ times the depth of the utility, from each side of the pipe or conduit. The chosen access must extend a minimum of 2’ past each side of the concrete structure.

3) Use an alternative design approved by Facilities Management through the University Project Manager.

H. Special Considerations

(1) Vending Machines

Each building shall include a separate room or alcove for vending machines. Coordinate with Facilities Management through the University Project Manager for number and type of machines to be installed. Space for trash containers shall also be provided.

(2) Provisions for Persons with Disabilities

Meet all applicable federal, state and local accessibility codes and guidelines.

(3) Trash Disposal Requirements

a. Dumpsters

1) The University uses the dumpster system of trash removal. This consists of metal containers placed outside each building (one per building is usually required) in which the trash is deposited.

2) All dumpsters are to be enclosed in an appropriate enclosure and screening device appropriately located on the site. The design for the approach to the enclosure shall be reviewed with Facilities Management prior to going to bid.

(4) Building Graphics

a. Include the following graphics in the design of all new and existing buildings:

1) Exterior Building Graphics

   a) This shall include letters on the building, if the building has been officially named, and building I.D. sign or signs. Include the building locator address (street coordinates provided by Facilities Management through the University Project Manager) on at least one exterior location with these graphics.

   b) The building name is to be installed with individual letters placed directly on the building.
c) Sign letters are to be cast bronze with a dark patina finish.

d) Letter style is to be Helvetica medium.

e) Letter height is to be proportional to the location where the letters are placed on the building.

f) Place the building name at main public entrances.

g) Sign letters should be installed with stainless steel studs to prevent rust stains under the sign.

h) Letters are to be spaced approximately ½” from the building surface to allow for irregularities in the building wall and to add further protection against rust stains.

2) Interior Building Graphics

a) This item includes room numbers, room names and a bronze building dedication plaque.

ADDED:

b) Academic Branding. If the building interior is designed using a coordinated functional branding theme, room identification graphics, way finding graphics, International Building Code, ADA, directional graphics, etc., will require review and approval by Facilities Management early in the design. Consideration will be given to materials, aesthetic coordination, size and serviceability of the proposed graphics by the University Sign Shop.

c) Standard University Interior Graphics.

(i) Interior graphics on campus have been standardized for buildings which will not have a coordinated functional theme.

(ii) Specify sign panels to be ADA compliant, raised character, acrylic multipolymer sign panels with square edges and Braille (acrylic beads), tactile text shall include painted acrylic backers and square edges.

(iii) Require copy / typographic letterforms and symbols to be router cut using multipolymer engraving stock, appliquéd with permanent, proven adhesive specified by the product manufacturer and rated for exterior environments. Text shall be 1/32” thick or as noted in current ADA standards. Braille text shall utilize
individual clear acrylic beads. Note: Router cut Braille text is not acceptable.

(iv) Panel and sign backer thickness, sizes and finishes are to be noted on the project drawings. All panels are to be specified to be precision cut and finished. Low gloss finish shall be ADA compliant (20% reflectance is desired).

(v) Coordinate the intended method of sign mounting with the University Project Manager and University Sign Shop (Plant Operations).

(vi) Sign panels with changeable paper inserts shall be specified with square edge sign face and clear acrylic window panel to accommodate changeable, laser / color printed paper sign inserts. Note: The initial paper inserts are to be provided and installed by the installing supplier/contractor. The acrylic top layer shall have a precision cut window to expose the bottom layer. The sign face sizes and thicknesses shall be scheduled on the drawings.

(vii) Require the supplier/contractor to submit final layouts and text as well as symbol locations to the designer and University Project Manager for approval prior to fabrication or installation of any signs. Signs shall conform to applicable code requirements. Life safety maps and related signage are subject to Fire Marshal review and approval, and shall conform to Fire Marshal’s requirements. When signs are initially installed – and when changeable insert messages are not ready or finalized – the supplier/contractor shall insert heavy blank paper (black in color) into the paper message signs to provide a complete and finished appearance (unless the background area behind the sign window is already black).

(viii) The following are examples of the University of Utah standard for interior sign graphics:

Sign Type A1/00 – Small Door ID Sign.
Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.

Sign Type A3/00 - Large Door ID Sign.
Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.
Sign Type A4/00 – Small Door ID / Changeable.
Painted acrylic backer with square edges and multi-layered modified acrylic sign face with square edges, routed window and Braille beads and applied machine engraved tactile graphics. Window for printed paper insert.

Sign Type A5/00 – Medium Door ID / Changeable.
Painted acrylic backer with square edges and multi-layered modified acrylic sign face with routed window and square edges, Braille beads and applied machine engraved tactile graphics. Window for printed paper insert.

Sign Type A7/00 – Restroom ID / Women.
Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.

Sign Type A11/00 – Stair Code Sign.
Modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.

Sign Type A12/00 - Single use Restroom (family or assisted use) Sign. Lettering shall state “All Gender Restroom”. Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics. Corners may be radius or square to match other sign types.
(5) Clocks

a. All new buildings are to include clocks as outlined in 3.6 Electrical Part 1. This requirement must be coordinated with Facilities Management through the University Project Manager.

b. All clocks are to be specified as an auto-correcting clock. Coordinate with the instructions in 3.5 Electrical; only specify approved manufacturers (clocks to match existing systems on campus only).

(6) Custodial Closet Requirements

a. General
1) The design for new construction, building alterations or building additions shall comply with custodial closet requirements provided herein.

2) Square or rectangular closets are required. Proposed exceptions must be submitted early in the design process using a Project Variance Request Form submitted through the University Project Manager for review and approval by the Design Standards Committee.

3) Space for three separate custodial closet functions shall be included in every building. Individual rooms shall be provided for one or more wet closets, one or more dry closets, and one office closet. The minimum requirement for the number of wet and dry closets is determined by building floor area as described herein.

4) For existing buildings, the A/E’s design responsibilities for building alterations and/or additions shall include a review of the entire building’s custodial conditions with regard to the requirements described herein. The project scope for the remodel and/or addition shall include additional custodial space where needed to meet the building’s overall custodial space requirements as defined in this University supplement.

5) Access to each custodial closet / office shall be along a direct route from a main hallway.

6) Each custodial closet / office door shall have means to hold the door in the open position (i.e., door stops, or closers with a 'hold-open’ feature) as allowed by code.

7) Closet floors shall be quarry or ceramic tile (preferred); or, shall be concrete with an appropriate sealed surface treatment.

b. Wet Closets

1) Each wet closet shall be centrally located in its service area.

2) Minimum Size for Each Wet Closet

The minimum footprint for each wet closet shall be no less than 100 square feet with the shortest wall length no less than 6 feet.

3) Minimum Door Width and Door Swing

a) The door width for each wet closet shall be 36” unless requested otherwise by Campus Custodial Services. All wet closet doors shall swing out, not into the custodial space.

4) Number of Required Wet Closets
a) For floor areas per level equal to, or less than 20,000 gross square feet, provide one wet closet per floor level.

b) For floor areas per level greater than 20,000 square feet, the project design must include additional wet closets (one for each 20,000 gross square feet or portion thereof).

c) When multiple wet closets are provided on a floor level, divide the floor into equal service area segments and locate each closet centrally in its service area.

5) Each wet closet shall contain the following:

a) One Service Sink (Contractor furnished and installed)
   
   (i) The design shall include a floor mounted service sink with a minimum size of 15 square feet. The edge of the sink shall be no higher than 6 inches above the finished floor.

b) One Wet Mop Hanger Rack (Contractor furnished and installed)
   
   (i) The design shall include a wall mounted hanger rack for wet mops (minimum of four hangers) which shall be installed over the service sink.

c) One Chemical Dispensing System (University furnished and installed)
   
   (i) The design shall include adequate wall space for a chemical dispensing system which will be located over the service sink. Minimum wall space required is 2’ x 2’, located directly over the hose bibs.

d) Utility Hangers (University furnished and installed)
   
   (i) The design shall include adequate clear wall space (at least 5 lineal feet) for hangers to store brooms, ladder, etc.

e) Shelving (Contractor furnished and installed)
   
   (i) Installed along one wall of the closet, the design is to include a minimum of five (5) adjustable height shelves (adjustable from floor to ceiling). Shelves shall be 14” deep. Do not locate the shelving system behind a door.

f) Electrical Outlet (Contractor furnished and installed)
(i) Include a minimum of one electrical outlet in each wet closet, installed in an approved location.

c. Dry Closets

1) Each dry closet shall be centrally located in its service area.

2) Minimum Size for Each Dry Closet

a) The minimum footprint for each dry closet shall be no less than 200 square feet with the shortest wall length no less than 8 feet.

3) Minimum Door Width and Door Swing

a) The door width for each dry closet shall be 42” unless requested otherwise by Campus Custodial Services. All dry closet doors shall swing out, not into the custodial space.

4) Number of Required Dry Closets

a) For floor areas per level equal to, or less than 150,000 gross square feet, provide one dry closet per floor level.

b) When the floor level exceeds 150,000 gross square feet, a second dry closet of the same size shall be provided. Divide the floor into equal service area segments and locate each dry closet centrally in its service area.

5) Each dry closet shall contain the following:

a) Utility Hangers (University furnished and installed)

The design shall include adequate clear wall space (at least 6 lineal feet) for hangers to store brooms, equipment, ladder, etc.

b) Shelving (Contractor furnished and installed)

(i) Installed along two adjoining walls of the closet, the design is to include a minimum of five (5) adjustable height shelves (adjustable from floor to ceiling), suitable for storing heavy items.

(ii) Facilities Management through the University Project Manager will provide to the A/E the required shelf depth for each dry closet, as directed by Campus Custodial Services (depth will generally be either 14” or 18”).

(iii) Each wall’s installation of the two adjoining shelving systems shall be no less than 6 feet long.

(iv) Do not locate the shelving system behind a door.
c) One Chemical Storage Cabinet (Contractor furnished and installed)

(i) The design is to include a 6’ high x 5’ wide x 14” deep (minimum size) lockable cabinet that is designed specifically to store and secure cleaning chemicals.

d) Electrical Outlets (Contractor furnished and installed)

(i) Include two (2) GFCI fourplex electrical outlet boxes located in approved locations. These outlets require dedicated circuits due to the nature of their use.

d. Custodial Office

1) Each building shall have one custodial office.

2) Minimum Size for the Custodial Office

a) For floor areas per level equal to or less than 150,000 gross square feet, the minimum footprint for the custodial office shall be no less than 120 square feet with the shortest wall length no less than 8 feet.

b) For floor areas per level equal greater than 150,000 gross square feet, obtain the required minimum space dimensional requirements from Facilities Management through the University Project Manager, who will coordinate with the Associate Director of Campus Custodial Services. This information must be obtained early in design to avoid space and usage conflicts as the building floor plans are developed.

3) The custodial office shall contain the following:

a) One Desk (Contractor / Supplier furnished and installed)

(i) The design is to include either a built-in desk or sufficient room for a 60” X 30” desk with a three drawer filing cabinet, furnished and installed as part of the project.

b) One Shelf (Contractor furnished and installed)

(i) The design is to include a shelf installed on the wall above the desk. The shelf shall be 48” long and 12” deep. Do not locate the shelf where it will conflict with the door.
c) Staff Locker System (Contractor furnished and installed)

(i) The design is to include a wall mounted staff locker system in the custodial office.

(ii) For buildings with an overall floor area (the sum of all levels) up to 20,000 gross square feet, specify four (4) full height wall mounted staff lockers in the design.

(iii) For buildings with an overall floor area greater than 20,000 gross square feet, specify ten (10) half-height lockers in a wall mounted system.

d) Electrical Outlets (Contractor furnished and installed)

(i) Include electrical outlets located in approved locations for computers and electronic equipment.

e) IT / Communications Outlets (Contractor furnished and installed)

(i) The design is to include wall connections for computers, internet access, and phone service.

4) Approval for Custodial Office / Dry Closet Adjoining Spaces

a) The custodial office may be located adjacent to a dry closet if approved by Facilities Management and the Associate Director of Campus Custodial Services, through the University Project Manager.

b) This arrangement will require separation by a wall and a door, with each space forming a complete dry closet and a complete custodial office. Each space must meet all requirements described herein for each room type.

c) Any consideration for adjacency must be submitted to Facilities Management through the University Project Manager early in design. A proposed layout and location for this arrangement shall be reviewed in a meeting between the A/E, the University Project Manager, and the Associate Director of Campus Custodial Services.

(7) University General Conditions

a. On University managed projects, the University’s General Conditions will be referenced in the Project Manual as general conditions of the contract. The University will reference the Supplemental General Conditions for University of Utah Projects as special conditions of the contract. The reference is included in
b. On projects under jurisdiction of the DFCM, DFCM’s General Conditions will be referenced in the Project Manual, and University of Utah will reference the Supplemental General Conditions for University of Utah Projects as special conditions of the contract.

(8) High Temperature Water Equipment Rooms

a. See 3.4 Structural / B. University of Utah Requirements / (2) Design Criteria / f. High Temperature Water Equipment Rooms for special design requirements.

(9) Lactation Rooms

a. The design for new construction, major building alterations or major building additions (defined as having a total project budget of $10 million or more) shall comply with the lactation room requirements provided herein.

b. One lactation room shall be provided on the first floor of each building.

c. Access to the lactation room shall be along a direct route from a main hallway.

d. Minimum Size for Each Lactation Room

   Then minimum footprint for each lactation room shall be no less than 9’ x 6’.

e. Doors shall be equipped with a privacy lockset.

f. Walls shall be insulated for sound.

g. Finishes

   1) Flooring shall be carpet

   2) Walls are to be painted

   3) A countertop 2’ in depth shall be provided along one wall. The space beneath the countertop shall be open.

h. Electrical Requirements

   1) Lighting levels shall be between 30 and 50 foot candles

   2) A 110v GFI outlet shall be provided at the countertop and at the wall nearest the chair placement.
i. Plumbing Requirements

A hand sink shall be provided in the countertop.

j. Furnishings and Equipment

Each room should have the following furnishings and Equipment:

1) One Upholstered non-caster chair with arms
2) A wall mounted mirror above the counter
3) Soap and Paper Towel dispensers
4) Waste Receptacle
5) Wall Mounted Clock
6) Wall or Door Mounted Robe Hook

k. Door Signage shall be a room number

I. Additional University of Utah Design Standards for Architecture:

(1) The following information is provided for additional University of Utah Design Standards not included in the DFCM Requirements.

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00 Summary of Work

01 14 00 Work Restrictions

A. The A/E is to work with Facilities Management through the University Project Manager to establish the limits of construction during the design development stage to include the area which is affected by the work. If possible, this is to include areas affected by the shutdown of the landscape irrigation.

01 14 13 Access to Site - Site Examination

A. Describe access routes to the job site through the campus for concrete trucks, delivery trucks and other vehicles concerned with the project. Include a traffic plan in the bidding documents.
B. Facilities Management through the University Project Manager will provide the A/E with available survey bench marks.

C. Elevations of survey monuments on University maps and drawings are based upon U.S. Geodetic Surveys and not Salt Lake bench marks. (Salt Lake City surveys read 26.88 feet higher than corresponding U.S.G.S. bench marks).

01 14 19 Contractor's Use of Building Equipment

A. Include provisions for the Contractor to use equipment such as electric motors, blowers, heat exchangers, filters, lighting fixtures, etc., with the written permission of the University. As each piece of equipment is used (such as electric motors and blowers), require the Contractor to follow maintenance procedures approved by the manufacturer. Require the Contractor to maintain a careful record of the time used, maintenance procedures followed, and any difficulties experienced with the equipment. These contractors' records on the equipment are to be submitted to the University upon acceptance.

B. For extended projects, require the Contractor to replace used expendables of the equipment with new replacements which meet equipment and project specifications (i.e., belts, filter media, fluorescent lamps, bearings, etc.). Require these items to be inspected just prior to acceptance. Any excessive wear noted during the inspection shall require replacement. Require the guarantee period for equipment to begin with Substantial Completion acceptance by the University. Coordinate these items with Facilities Management (especially Facility Operations) through the University Project Manager.

01 50 00 Temporary Facilities and Controls

01 51 00 Temporary Utilities

A. If connection to non-university utility systems is required, include provisions for the Contractor to make arrangements with proper authority for temporary utility connections and to bear all costs for these utilities.

B. High Temperature Hot Water is not to be used for temporary heating, and is not to be activated without direction and assistance from the HTW Plant Supervisor.

01 52 00 Construction Facilities (Where Applicable)

01 55 19 Vehicle Access and Parking

A. A Project Parking Plan shall be developed to establish the parking impact during and after a construction Project. This Plan is to be done during the design process to provide direction in the contract documents that will inform the bidding and successful contractor what parking will be available to the project during construction. This plan is to be developed jointly by the Design
Team, University Project Manager, University Project Planner, and University Commuter Services. Once prepared, the Parking Plan form is to be included with the design documents when they are submitted for plan review, preferably at DD review, but no later than CD. The Plan must be approved during the plan review process and the information then included in the bid contract documents. Copies of the Plan form can be downloaded from:
http://facilities.utah.edu/project-resources/documentsstandards/forms.php

01 56 00  Temporary Barriers and Enclosures

A. Include provisions for a construction area fence and gate at least 6'-0" high.

01 56 16  Temporary Dust Barriers

A. Require the Contractor to provide dust and noise barriers in all remodeling areas.

01 56 29  Temporary Protective Walkways. Perimeter Walkways

A. Where construction sites interrupt existing pedestrian pathways (determined by consultation with Facilities Management and Environmental Health and Safety officials through the University Project Manager), such pathways shall be replaced with temporary walks to circumvent the interrupted areas. Damage to existing walkways shall be restored at the completion of construction at Contractor’s expense whether inside or outside (adjacent to) the construction site.

B. The A/E is to specify and delineate requirements for the Contractor to provide adequate outdoor lighting along walkways and around the perimeter of construction site. Such lighting shall be operational for all hours of darkness during extent of construction.

01 58 13  Temporary Project Signage

A. Temporary Project Sign requirements should be coordinated with Facilities Management through the University Project Manager.

DIVISION 03 – CONCRETE

03 33 00  Cast-In-Place Concrete

03 35 00  Concrete Finishing

A. For exposed concrete to receive a smooth rubbed finish within one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. No cement grout other than that created by the rubbing process will be allowed.
B. Interior concrete floors to be left exposed shall be sealed with a moisture cure urethane.

DIVISION 04 – MASONRY

04 20 00 Unit Masonry

A. Sample

4'x 4' Sample panels of each exposed masonry wall type shall be constructed on-site by the general contractor for review and approval by Facilities Management through the University Project Manager.

04 21 00 Clay Unit Masonry - Campus Face Brick

A. There are three accepted manufactures for face brick, they are:

1) Baja Brown, matte texture as manufactured by Interstate Brick Company of Salt Lake City.

2) Desert Brown, wire cut texture as manufactured by Interpace Industries, Inc.

3) Colorado Rose, as manufactured by Robinson Brick Company.

DIVISION 05 – METALS

05 10 00 Structural Steel Framing

A. In laboratory or shop spaces, where steel framing is exposed, make provision for additional loading of traveling cranes, etc.

05 30 00 Steel Decking

05 31 00 Steel Floor Deck

A. Provide ducts for telecommunications in all offices and classrooms where requested by Facilities Management.

05 40 00 Cold Formed Metal Framing

A. All exterior wall studs shall be minimum 18-gauge galvanized steel. Rough buck openings for door frames shall be constructed with double 18-gauge stud columns extended to structure.

B. Exterior cold formed metal framing to be Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows: Minimum G60 (Z180) or equivalent.
05 50 00  Metal Fabrications
A. All ferrous metal fabrications designed for exterior exposure shall have all surfaces galvanized after fabrication according to ASTM A 123/A 123M. Painting for these items will need to address the problems associated with galvanized metal.

B. Steel Bollards
Steel bollards shall be minimum 6” diameter standard steel pipe, set in minimum 24” diameter x 48” concrete footings, painted black with two rows of white Scotchlite reflective tape spaced 2” apart and placed 4” below the top of the pipe. Pipe shall be a minimum of 48” above finish grade and filled with concrete full height, with concrete mound at top, painted white. Provide sealed expansion joint around steel pipe and asphalt or concrete paving.

05 52 13  Exterior Pipe and Tube Railings
A. Ramp Handrails
1.66” diameter stainless steel handrails are to be anchored to 2 ½” square stainless steel tube posts spaced at a minimum of 4’-0” o.c. to a maximum of 6’-0” o.c. Provide a 1.66” diameter stainless steel bottom rail centered + 4” above finish grade between vertical posts. All connections to be welded. Handrails to be 36” clear between rails. Provide handrail extensions per code and return handrail ends to posts. See detail below.

B. Handrail Post Caps
Anti-Skateboard handrail post caps shall be 3/8” x 2 ½” x continuous stainless steel plate with ¼” radius edges and be welded to a 1.9722” diameter x 3/8” steel tube cap plate welded to a 1.8722” diameter x 0.120 gauge x 2” steel tube welded to a stainless steel cap plate welded to the top of each vertical post. See detail below.

C. Handrail Post Anchoring
2 ½” square stainless steel handrail posts shall be set into 4” diameter x 6” deep core drilled holes in concrete paving with cementitious anchoring compound full height of core drilled hole. Posts shall be set a minimum of 3” back from the paving edge or joint.

D. Handrail Profile
2 1/2” square stainless steel handrail post caps shall extend a minimum of 4” above handrails. Anchor 1.66” diameter stainless steel handrails to posts with ¼” diameter stainless steel rods, welded both ends. Provide handrail extensions beyond vertical posts as required by code and return to vertical posts 12” below top of handrail. Use 3” radius bends at handrail changes of direction. See detail below.
E. Exterior Stair Handrails

1.66” diameter stainless steel stair handrails to be anchored to 2 ½” square stainless steel tube posts at a minimum of 4’-0” o.c. and maximum 6’-0” o.c. Anchor 1.66” diameter stainless steel handrails to posts with ¼” diameter stainless steel rods, welded both ends. Provide handrail extensions beyond vertical posts as required by code and return to vertical posts 12” below top of handrail. Use 3” radius bends at handrail changes of direction. Provide Anti-Skateboard post caps as described above. Set posts in core drilled holes as described above. Provide handrail extensions per code and return handrail ends to posts. See detail below.
DETAIL - PIPE HANDRAIL

2 1/2" BS POST.
166" OD BS RAIL

1/4" OD, BS ROD,
WELDED TO BS POST
GRIND SMOOTH

RETURN RAIL TO POST,
WELDED TO BS POST,
GRIND SMOOTH

This document is a University of Utah Architectural Supplement, user is to also refer to the DFCM Design Requirements.
Design Requirements – 3.3 Architectural – University of Utah Supplement.
DETAIL 'C' - PIPE HANDRAIL POST CAP
DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

06 10 00 Rough Carpentry

A. All interior partitions shall receive a fire treated wood sill except where the finish flooring on both sides of the partition is carpet. In lieu of a fire treated wood sill, sheet metal backing behind the sill may be specified. The sheet metal backer shall be the same gauge thickness used in metal studs and shall extend from the floor to 6” above the floor.

B. Any necessary wood framing, blocking, furring, etc. shall be fire treated.

C. Provide sheet metal backing at sill to 6” above the floor.

D. Standards: AWPA P49, AWPA M2 and AWPA U1.

06 40 00 Architectural Woodwork

06 41 16 Plastic-Laminate-Clad Architectural Cabinets

A. All plastic laminated tops and shelves shall be minimum 1” thick and edge banded.

B. All cabinetry shall be designed and constructed to meet or exceed, the latest AWI Quality Standards, Custom grade or better. The University requires the following upgrades to the AWI Quality Standards:

1) No composite materials (particle board, fiber board, Masonite, OSB, etc.) shall be allowed within 4” of the finish floor in laboratories, classrooms, restrooms, janitorial closets, or any area where water may be present. Specify pressure treated lumber, exterior grade plywood, or lumber rated by AWI for exterior use.

2) All interior joints in cabinets where sinks will be installed shall be caulked.

3) The front bottom edge of countertops and aprons where sinks are installed shall be edged in accordance with one of the following requirements:

   a) The countertop shall have a raised no-drip bullnose edge flush with the front apron.

   b) The countertop shall have a 1 ½” self-edge projecting ¾” beyond the face of the apron.

   c) The countertop shall have a bullnose edge flush with the face of the apron.

C. Cabinets shall be designed and fabricated to meet the following additional criteria (for laboratory countertops, see Section 11 53 00 herein, for laboratory cabinets see Section 12 35 53 herein):
1) Cabinet design shall be modular to the greatest extent possible to facilitate reuse in the event of future remodeling. Modules of 18", 24", 36" etc., are to be used.

2) Include allowances in the base cabinet to allow for minor vertical adjustments.

3) Material selection shall be based on the intended use. Sinks shall be in accordance with Section 12 35 53 herein.

4) Individual components shall be as follows:
   a) Hinges shall be 5 knuckle types.
   b) Slides shall be full length with nylon or stainless steel bearings
   c) Wood cabinets are acceptable for bio-safety less than level 3. Melamine or plastic laminate is acceptable.
   d) Door fronts shall be edge banded on all four sides and sealed with a durable finish for easy clean-ability.
   e) Consider “Sustainable Building Products” in the design and fabrication of cabinets. The A/E is expected to evaluate the possibility of such products and submit recommendations to the University Project Manager.

06 41 13 Wood-Veneer-Faced Architectural Cabinets
   A. Refer to Section 06 41 16 above for typical requirements.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
   07 10 00 Dampproofing and Waterproofing
   07 14 00/07 14 16 Fluid-Applied Waterproofing
   A. For all foundation /retaining walls (including walls which do not carry a building load and for slab-on-grade foundation walls) and for all underground horizontal structures (new and remodeled), provide the following:

   1) Specify a complete hot or cold applied waterproofing assembly, a fluid applied product over membrane system obtained from a single source manufacturer, and which will meet or exceed a 20 year guarantee/warranty and to comply with ASTM D412-06a, ASTM C836 / C836M-12.
a) The assembly shall have a proven record of superior performance commensurate with the 20 year guarantee/warranty and shall include surface conditioner (primer); adhesives and sealants; a monolithic (no seams) fluid applied waterproof membrane, drainage and protection board; Flashings, reinforcing fabric; drainage course, filter fabric, flexible waterproof boots; and perforated pipe adjacent to the base of the footing.

b) A fully compatible electronic field vector mapping testing system shall be specified on any plaza type project requirement waterproofing on horizontal applications.

c) All products used in the waterproofing system intended for a project are required to be the products of one manufacturer or part of the warranted system of the manufacturer (with one exception, the vector mapping system; however, the vector mapping system must be certified to work with the intended system.

d) Before the Contractor orders waterproofing materials, require submittals describing the system and installer. Submittals are to be submitted through the A/E and University Project Manager to Facilities Management for approval. Include the following as a minimum:

(i) A complete description of the fluid applied system assembly.

(ii) Verification that all products are from one manufacturer except the vector mapping system.

(iii) Verification that each product in the manufacturer’s wall protection assembly must be manufactured for the intended use; and must be fully compatible with all other materials which will be used in the manufacturer’s waterproofing assembly.

(iv) Certification that the vector mapping system is compatible and fully functional with the intended fluid applied waterproofing system.

(v) Manufacturer’s certification that the installer is fully qualified to apply the manufacturer’s products to meet a 20 year warranty.
2) Damp-proofing will generally not be allowed, but where seemingly appropriate, will be considered only through a Variance Request (see Design Process / 1.4 / C.) routed through the University Project Manager to the Design Standards Committee accompanied by sound justification.

3) Specify the following minimum installation requirements:

   a) Top of the waterproofing assembly will be 6” below finish grade.

   b) The drainage and protection board is to be applied over the fluid applied waterproofing membrane.

   c) Gravel fill shall be a minimum of 12” thick and protected with a filter fabric between the gravel and surrounding soil.

   d) The filter fabric must completely envelop the gravel and perforated pipe from the wall surface near the top, along the outer gravel boundary, around the gravel base containing the perforated pipe, and terminating over the flashing at the footing base.

   e) The upper fabric connection at the top of the gravel fill must be affixed to the drainage/protection board.

   f) The lower fabric connection near the bottom of the gravel fill must be affixed to the drainage/protection board above the footing.

   g) Specify either a 4” or 6” diameter perforated pipe at the base of the footing in the gravel. Engineer the pipe to meet the anticipated soil moisture conditions.

   h) Direct the contractor to set the top of the perf-pipe below the top of the footing.
i) Fluid applied waterproofing is to be applied in two directions. The horizontal application shall be installed with reinforcing fabric to a thickness of 215 mils. The vertical application shall be installed to a thickness of 180 mils applied in two 90 mil applications.

4) Require the Contractor to adhere to specific restrictions imposed or recommended by the manufacturer for environmental conditions, product delivery, inspection, storage handling, product protection, surface inspection, surface preparation, product application, etc.

5) Guarantee/Warranty

a) At the conclusion of the installation, require the manufacturer’s rep to certify verification that the installed system is leak free; that the membrane application is tight without voids; and that the system assembly including the applied mil thickness meets the manufacturer’s requirements for the 20 year guarantee/warranty period.

b) Before accepting the installation for plaza (horizontal) applications, require the installer or manufacturer’s representative to demonstrate to the A/E and University complete functionality and continuity of the vector mapping system within the completed waterproofing system.

   (i) The guarantee shall include the cost of materials and labor (no dollar limit and not pro-rated), and include the removal and reinstallation of landscaping, soil, paving, etc., to access the area to be repaired/replaced.

   (ii) If during the 20 year period, either the manufacturer or contractor goes out of business, the other is required to assume full responsibility for the guarantee/warranty.

07 90 00 Joint Protection

07 92 00 Joint Sealants

A. Precast Concrete, metal window walls (curtain wall), and metal windows: Silicone Rubber equal to Dow Corning #780, or a Polysulfide equal to Thiokol Base, Federal Specification TT-S-00227, or "Hornflex."
DIVISION 08 - OPENINGS

08 11 00 Metal Doors and Frames

A. General

1) Frames, anchored every 16” or less vertically in masonry and grout solid.
2) All door installations must meet manufacturer’s specifications.

B. Interior Metal Doors

1) Interior - 18 gauge minimum, SDI A250.8, Level 2.
2) Physical Performance: Level A according to SDI A250.4.

C. Interior Metal Frames

1) Interior - 16 gauge minimum, SDI A250.8, Level 3.
2) Physical Performance: Level A according to SDI A250.4.

D. Exterior Metal Doors

1) Exterior - 16 gauge minimum, SDI A250.8, Level 3.
2) Physical Performance: Level A according to SDI A250.4.

E. Exterior Metal Frames

1) Interior - 16 gauge minimum, SDI A250.8, Level 3.
2) Physical Performance: Level A according to SDI A250.4.

08 14 00 Wood Doors

A. Wood Doors: Solid core doors faced with minimum of 1/16 inch veneer finish are recommended. No wood doors to be used as exterior doors.

B. Sliding doors are not recommended.

C. Kick plates for doors in heavy traffic areas. This is to include classroom doors.

D. Mineral filled doors are not recommended.


08 15 00 Plastic Doors

A. Sliding doors are not recommended.
B. Kick plates for doors in heavy traffic areas. This is to include classroom doors.

C. Mineral filled doors are not recommended.

**08 33 00 Coiling Doors and Grilles**

A. All roll-up fire doors shall be motorized and have automatic self-closing closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without re-tensioning the counterbalancing mechanism. Release mechanism for motor-operated doors shall allow testing without mechanical release of the door. Automatic-closing device shall be designed for activation by the following:

1) Building fire-detection, smoke-detection, and alarm systems.

B. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

C. Obstruction Device

External entrapment device consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

D. All motorized roll up doors must have safety bar or motion sensor device to prevent door from closing on vehicles, equipment or persons.

**08 51 00 Metal Windows**

A. No ventilated windows to be operated with crank mechanisms unless windows are in tandem and heavy industrial crank mechanisms are used.

B. Provisions made to facilitate easy washing of windows from inside building.

**08 60 00 Roof Windows and Skylights**

**08 62 00 Unit Skylights**

A. Must be a manufactured product complying with State adopted codes.

B. No custom made skylight will be accepted.
08 70 00  Hardware

08 71 00  Door Hardware

A. General:

1) Fire-Rated Door Assemblies

Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

2) Smoke- and Draft-Control Door Assemblies

Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

B. Provide lock sets as follows:

1) Bored Locks: BHMA A156.2; Grade 1.
2) Mortise Locks: BHMA A156.13; Security Grade 1.
3) Classroom function for all classroom doors.
4) Turn button function for all offices.
5) Rigid function for custodial closets and mechanical rooms with 2-3/4 backset.
6) DO NOT key restrooms.
7) Securing the building and rooms within the building during construction is the Contractor's responsibility.

C. Electronic Locks

1) The University has adopted a campus wide security system. All new buildings will be designed with the CCure system, in accordance with instructions by the University Project Manager.

2) All exterior doors on new or existing buildings shall have the CCure system. See 3.6 Electrical Detail Drawings for alarm wiring, conduit and other rough-in requirements to be installed during construction.
3) For interior doors in buildings that already have a CCure system installed, a compatible lock will be installed and tied to main system in the building.

4) If any door will have electronic security devices, those devices should be supplied and installed by the security contractor to insure coordination of devices.

5) For interior doors in existing buildings without the CCure system, and where central monitoring by the University Public safety department is not needed, an Kaba Ilco with key bypass entry system will be installed. The system is to be operated, managed and maintained solely by the requesting department.

6) Where power at interior door is prohibitive in existing buildings without the CCure system, and where central monitoring by the University’s Public Safety Department is not needed, Locknetics keyless entry system will be installed; and, operated, managed, and maintained solely by the requesting department.

7) All electronic locking systems shall comply with current specifications provided by the University’s Alarm Committee. Upon request, the University will loan the A/E a confidential copy of the U of U Alarm Committee Approved Alarm Equipment document for use in the room security design.

8) On security drawings, require the coordination between the electronic hardware installer and the electrical contractor for power wiring to the devices. The A/E is responsible to coordinate drawings and verify that power to the devices is provided for on the appropriate electrical drawings.

D. Cylinder Locks

1) High-Security Lock Cylinders: BHMA A156.30; Grade 1. Doors with cylindrical locks are to be specified with heavy duty Schlage or prior approved equal. As a minimum standard, specified locks are to conform to Schlage “standard 6 pin cylinders”. Smaller formats are not acceptable. Interchangeable cores are not acceptable. Any variance from this standard must be approved by the University Project Manager in coordination with the University Facilities Key Shop and the Design Standards Committee prior to specifying.

   a) Doors fitted for cylinder locks are to be specified with a 2-3/4" backset.

b) Panic bars shall be specified Von Duprin 99 Series, or 33 Series on exterior doors where a narrow type device is necessary. All panic bars shall be rim type with removable mullions on double doors.
c) It is recommended that exterior doors have panic hardware installed, unless approved otherwise.

2) On all new buildings, or on large remodel projects that require a large number of new locksets, the locksets are to be provided without cylinders or blanks. The University will furnish and install the cylinders in the locksets and provide the keys. Facilities Management will schedule and fund the installation of the keys and cylinders through the University Project Manager.

3) On all new buildings and remodeling projects, specify a lever handle equal to Schlage L Series with return leg meeting ADA requirements.

   a) The minimum standard shall be Schlage "ND" series to fit Schlage 6 pin cylinders.

E. Hinges

BHMA A156.1 Use 4-1/2" x 4-1/2" ball bearing butts on all doors with jamb hinges.

F. Latch Rods

All top and bottom latch rods, where required on doors, are to be attached and secured at the top and bottom of the door.

G. Door Sweeps

All door sweeps on doors without a raised threshold must use Mechanical or automatic type door sweeps.

H. Finish. Match existing finish on remodeling projects.

I. Door Closers

   A. Closers

   BHMA A156.4 All doors leading to halls must open at least 140 degrees. Provide rated hardware as required by the code. Provide appropriate door stops in floor or wall as approved by Facilities Management through the University Project Manager.

   B. All exterior and interior doors shall have LCN closers with durability matching or exceeding that of closer type LCN 4041 “Series” (domestic manufactured).
C. Floor type closers are acceptable with the following stipulations:

1) Alignment of the pivot points shall be such that the original installation in line and that building movements, due to expansion and contraction, shall not cause excessive wear on the door closer.

2) Door closers shall not be located so that they are exposed to the weather. This is intended to reduce or eliminate the effect of water, snow, ice, salt and freeze upheaval on the door.

D. All surface mounted closers installed on mineral fill or particle board, chip board must be mounted with ¼”-20 thru bolts.

E. All steel doors 18 gauge or less must have backing plates to support mounting of door closer or door closer must be installed with thru bolts.

F. All doors that have a wall at a 90 degree to that door, the door closer must have a back check feature and must be adjusted properly.

08 71 13 Automatic Door Openers

A. Automatic door openers shall be required on at least one door in all accessible entries.

1) Automatic door opener push pads and any other opening device shall be hard wired. Wireless devices shall not be specified unless approved by the University Facility Operations through the University Project Manager during design and prior to bid.

B. Automatic door opener manufacturer shall have a minimum 10 year history as a company and a 5 year history manufacturing similar door opener products.

C. Require the automatic door opener to have a two year installer service warranty on parts and labor.

D. Specify that the automatic door opener replacement parts are to be available within the United States.

E. A service manual including installer and manufacturer information shall be given to the Carpenter Shop prior to Substantial Completion.

F. Approved automatic door opener manufacturers are:

1) LCN #4611 or #4622.
2) Pre-approved manufacturer.

G. All control devices on automatic doors, such as pneumatic operators must be accessible with not more than an 8’ ladder.

08 80 00 Glazing

08 81 00 Glass Glazing

A. Glass to be cleaned by Contractor at job completion.

B. Tinted Glass. Guarantees shall provide for perpetual inventory stock of matching glass for replacements.

C. Considerable difficulty has been experienced with water leaking through the caulking or gaskets around window glass. Specifications should provide for either a water leak test at a pressure equal to 50 M.P.H. winds or provide a 10 year guarantee against leakage through the caulking or gaskets.

D. For non-stock glass items which must be fabricated to size and generally not readily available in Salt Lake City (such as tempered or spandrel glass), specify two extra pieces or 2% over the total quantity installed, whichever is greater, of each non-stock glass size which shall be provided to the University in storage crates. Coordinate with the University Project Manager for delivery instructions.

E. For University projects where tempered or spandrel glass will be specified, obtain a list of common glass unit sizes currently installed and stocked on campus from Facilities Management through the University Project Manager, and determine if common sizes are applicable to the project. The University desires to limit special glass sizes to those currently installed and stored in order to reduce the number of sizes which must be managed in maintenance stock.

08 44 00 Curtain Walls and Glazed Assemblies

A. The architectural design team shall exercise caution in specifying metal curtain wall systems to minimize any visible "oil canning" on exposed finished metal surfaces.

DIVISION 09 - FINISHES

A. General Design Recommendations: Selection of wall and floor finishes and types must carefully consider maintenance issues. Generally exposed concrete floors in public areas are not recommended. Wood paneling in areas where hard surfaced floors are located must consider the effect of floor maintenance on wall surfaces.

09 22 16 Non-Structural Metal Framing
A. All interior wall studs shall be minimum 20-gauge galvanized steel. Rough buck openings for door frames shall be constructed with double 18-gauge stud columns extended to structure, or an engineered equivalent.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly by an independent testing agency.

C. Framing Members, General: Comply with ASTM C 754-00 for conditions indicated. Steel Sheet Components: Comply with ASTM C 645 - 13 requirements for metal unless otherwise indicated.


E. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 - 09 and classified according to ASTM E 413 - 04 by an independent testing agency.

F. Where doors that swing into an adjacent wall there must be a backing plate or fire treated wood blocking installed between studs to support sheet rock at the location where the door handles meet the wall to prevent damage and allow better mounting for wall mounted door stops.

G. All interior partitions shall receive a fire treated wood sill except where the finish flooring on both sides of the partition is carpet. In lieu of a fire treated wood sill, sheet metal backing behind the sill may be specified. The sheet metal backer shall be the same gauge thickness used in metal studs and shall extend from the floor to 6” above the floor.

09 29 00 Gypsum Board


B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly by an independent testing agency.

1) Fire rated walls to be full height from finish floor elevation to bottom of structure above with 5/8” Type – X Gypsum Board full height both sides.

2) Provide U.L. Design fire rated penetrations.

3) Provide U.L. Design fire rated wall details.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to
ASTM E 90 - 09 and classified according to ASTM E 413 - 04 by an independent testing agency.

09 66 00  **Terrazzo Flooring**

A. Colors of stairs and floors should be of intermediate to lighter shades in color so as not to show foot scuffs.

B. Protective nosings for stairs.

C. Design treads to facilitate sweeping.

D. Corrugated treads not recommended in any public space.

E. Aggregate to be clean and free from shavings, etc.

09 51 00  **Acoustical Ceilings**

A. Suspension systems should prevent the possibility of physical or sound transfer from room to room.

09 80 00  **Acoustical Treatment**

A. Design noise separations between rooms, and floor to floor to desired level 45 decibels or less.

B. Use materials with high absorption values for halls and lobbies.

C. Acoustical engineering consultant for special use halls, classrooms, and lecture spaces is recommended. Obtain services before shape of space is fixed.

09 65 00  **Resilient Flooring**

A. Use lighter shades where traffic is heavy. Color tones such as tan or beige preferred. 12" x 12" vinyl composition tile, 1/8 inch thick is preferred.

B. Clean and wax floors before turning building over to the University for occupancy. Cleaning and waxing to be done according to manufacturer's recommendations. Floor finish should match that which is currently being used by the University. Concrete floors to be sealed with concrete sealer.

C. Recommended minimum height of base is 4 inches.

D. Rubber tile has maintenance problems, especially with the lighter colors and deep ribbed or embossed patterns.

09 68 00  **Carpeting**

A. General
1) The type of carpeting (category types I, II, or III, IV & V) will be determined by specific project requirements.

2) Carpeting of stairs is not recommended.

3) Carpet color and type needs to consider maintenance issues such as staining and cycles of cleaning.

B. Samples

Upon request, samples shall be submitted to the University Project Manager for approval prior to ordering. Samples complete with specifications shall be submitted in a manner timely to avoid any delays in installation.

1) 13-1/2" x 18" sample of each broadloom carpet or 18" x 18" sample of any carpet tile proposed for use shall be submitted in the quality, pattern and color specified.

2) A 12" x 12" sample of cushion (pad) in exact product, weight and manufacturer shall be submitted (where applicable).

3) Metal or vinyl edge molding together with fasteners proposed for securing the molding to the substrate shall be submitted. Sample shall be approximately 9" long (where applicable).

4) A 9" section of the specified base material shall be submitted prior to ordering (where applicable).

C. Preparatory Work

It shall be the responsibility of the general contractor or installation contractor to present the floors in a condition to receive the carpet. The substrate shall be thoroughly clean, free of any foreign matter, dry and dust-free. All cracks wider than 1/16", depressions, etc. must be fixed with a Portland cement based patching compound. Where carpet is to be glued directly to the floor, or double-stick cushion is specified, all waxes, old adhesives, etc. must be removed prior to installation. The installation contractor shall notify the University in writing of any conditions which will be detrimental to the carpet installation. The start of carpet installation shall be an indication of acceptance of the floor by the installation contractor.

D. Guarantee

The Contractor shall guarantee in writing to reinstall (if necessary) or re-stretch any carpet that is wrinkled and to correct any other condition due to faulty installation, such as "peaks" or "valley" in seaming or seam failure.

1) The guarantee shall be effective for a period of one year where broadloom products are used and two years where tile is used following final acceptance of the installation.
2) Any repairs or replacements made under the guarantee shall be provided by the Contractor at no additional charge.

3) The carpet product used shall be guaranteed in accordance with manufacturer’s standard guarantee for category type from substantial completion date.

E. Donated Carpet

All carpeting donated to the University shall comply with the current State Carpet Contract specifications.

F. Materials for New Carpet

Meet or exceed current State Carpet Contract specifications for each category type. The University Project Manager will review and approve the carpet specification.

G. Carpet Cushion

Carpet cushion shall be specified as one of the following, depending upon the needs of the requesting agency. Cushion shall meet following requirements for normal cushion application as indicated:

1) Attached cushion is the preferred specification.

2) Where approved by the University Project Manager: Cushion shall be 3/8" thickness, no less than 4 pound density in moderate traffic areas; 1/4 thickness and no less than 7 pound density in heavy traffic areas. Cushion can be rebound rubber, having no clay products in its composition.

H. Rubber Base

1) Wall base shall be RUBBER BASE such as Johnsonite, Burke, Roppe or VPL. It shall be constructed of first quality materials properly vulcanized and shall be smooth and free from imperfections which detract from its appearance. The base shall conform fully to the requirements of ASTM F-1861, Type TS, Group I (solid) standard specification for resilient wall base.

2) All Cove Base shall have a standard toe of 5/8", a height of 4", and shall be available on roll basis.

3) Cove base shall be used with all hard surface floors.

4) Prefabricated corners are to be avoided unless specifically approved by the University Project Manager. All other outside corners are to be installed without product deformation or discoloration.
09 90 00   Painting and Coating

A. No varnish to be used on surface of interior brick. If sealant is desired, the A/E shall submit a recommendation with manufacturer's data to Facilities Management through the University Project Manager for approval.

B. Remove hardware before painting doors, windows, frames, etc.

C. Acceptable Paints:
   1) Provide best quality grade of various types of coatings regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer’s identification as a standard, best-grade product will not be accepted. Paints should carry at a minimum a 5 year warranty.

   1) Provide primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

   2) Provide paints with low to zero VOC content. All paints specified for interior use should be able to meet LEED requirements of VOC.

   3) Toilet Rooms and other wet areas where paint is specified shall have semi-gloss or higher sheen.

   4) Marker board paints shall be applied with a single roller coat or spray application. The paint specified shall be odorless and of low VOC. It shall be a solvent based dry erase coating that works with standard dry erase markers and accessories. Paint shall be supplied with a 10 year warranty.

D. Color samples are to be approved by Facilities Management through the University Project Manager before instructions are given to the Contractor for all color selections.

E. Piping, walls, ceilings and floors in mechanical rooms are to be painted in light and durable paint.

F. In remodel or paint patching work, any paint patching must be done between closest break points. For example, from corner to corner or from corner to a door.

09 72 00   Wall Coverings

A. General

2) Must be produced by quality manufacturer such as "Vicretex" or "Essex."

B. Description

1) Shall be Type II, Medium Duty, Class A Vinyl Coated Fabric Wallcovering for Institutional or Commercial use, conforming in all respects to CFFA Quality Standard for Vinyl Coated Fabric Wallcovering CFFA-W-101-A, developed and published in May 1984.

2) Shall meet the following average weight and thickness requirements:

   a) Total Weight (oz/lin. yd) 54" width average 20.0
   b) Total Weight (oz/sq. yd) 13.3
   c) Vinyl Weight (oz/sq. yd) 10.8
   d) Fabric Weight (oz/sq. yd) 2.5
   e) Fabric Type Osnaburg or Osnaburg Blend
   f) Total Average Thickness 0.024

C. Fire Hazard Classification

Products must bear the UL label or Manufacturer's Letter of Certification indicating fire hazard classification with flame spread in compliance with adopted codes and amendments in the State of Utah.

DIVISION 10 - SPECIALTIES

10 10 00 Information Specialties

A. Room numbering signs, exterior building sign, and building plaque shall be specified as part of the project to be installed by the Contractor. Approval of the numbering system must be obtained from Facilities Management through the University Project Manager.
10 11 00  Visual Display Surfaces

A. Acceptable Boards: ADP Lemco or other boards with ten year warranties.

B. In any one room, the combination of chalkboards and marker boards will not be allowed. Chalkboards will only be allowed if the requesting entity agrees to the known increased maintenance requirements of chalk dust.

1) All chalkboards/marker boards must be mechanically fastened (no exceptions).

10 21 13  Toilet Compartments

A. Urinal Screens

Urinal screen wall mount brackets shall be anchored to a minimum 16 gauge full height steel backer plate bolted to the wall studs with minimum ¼” anchor bolts at maximum 4” o.c., both sides.

10 26 00  Wall and Door Protection

A. Remodeling projects and new construction shall have wall guards at chair rail height in areas within which there is movable furniture. Vinyl or composite rails are preferred in all areas except in Class “A” office space where hardwood stained or painted rails should be considered. This should be reviewed with the University Project Manager on each project.

10 28 00  Toilet, Bath and Laundry Accessories

A. General

1) The following items will be supplied & installed by the University. The General Contractor shall install all blocking, rough framing, nailers, etc., necessary to support these items. See “Quality Assurance” item “3)” below.

   a) Towel Dispenser

      Steiner SST Single Service Cloth Towel Cabinet.

   b) Soap Dispenser

      Ultimatic Soap Dispenser System, Model No. L-3.

   c) Toilet Paper Dispenser

      Ultimatic 2-roll Tissue System Dispenser, Model No. S-44C.
2) The following items will be supplied and installed as part of the construction contract. All bathroom fixtures, including but not limited to, partitions, mirrors, feminine napkin disposers, sanitary seat cover holders, vanities etc., must be mounted using expandable hollow wall anchors such as zip togs or butterfly bolts. Conical plastic friction anchors or double stick tape will not be allowed. Specification for products to be as follows:

   a) Mirror Units

   This is up to the A/E's discretion with the University's approval. Typically single unit mirrors are installed above each lavatory to allow soap dispensers to be mounted alternating between them. A shelf is provided on mirrors installed over wall hung or free standing lavatories. No shelf is required when a counter is installed.

   b) Grab Bars

   c) Mop and Broom Holder

   d) Shower Curtain Rod

   e) Shower Curtain and Hooks

   f) Infant Changing Stations

   A fold down diaper changing station shall be installed at either a unisex toilet room or in one each of the main floor men’s and women’s toilet rooms.

3) Quality Assurance

   a) Inserts and Anchorages

   Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate design of wall construction with Facilities Management through the University Project Manager for University supplied items.

   b) Accessory Locations

   Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

   c) Stud Walls
Stud walls must have a 20 gauge minimum strap on solid blocking at all accessory locations for mounting.

B. Products for Accessories specified above:

1) Acceptable Manufacturers

a) Subject to compliance with requirements, provide toilet accessories by one of the following:

(ii) American Specialties, Inc.
(ii) Bobrick Washroom Equipment, Inc.
(iii) Bradley Corporation.
(iv) Proprietary items required by University for control of inventory for University maintenance.

10 44 00 Fire Protection Specialties

A. Portable fire extinguishers shall be installed with an electronically monitored technology system. This system will transmit information from the fire extinguisher to the fire control panel as designated by the University Fire Marshal. The transmitting electronics of the system may be hard-wired or wireless to the control panel with power supplied by an internal replaceable battery. The system will signal an alert when the portable fire extinguisher falls below a preset, specified pressure level, removed from its designated location, when access to the extinguisher is obstructed or when the battery voltage drops to a preset rating. The system shall meet all code requirements and listed by Underwriters Laboratories, Inc.

1) The manufacturer of this system shall be Mija, Inc. or a pre-bidding approved equal.

10 71 13 Exterior Sun Control Devices

A. Louvers are acceptable with approval of Facilities Management only.

B. Blinds: See section 12 24 00.

DIVISION 11 - EQUIPMENT

11 13 00 Loading Dock Equipment

A. General: Loading docks shall be subject to the following requirements:

1) Dock Width: 10'-0" from face of wall to edge of dock.
2) Roof Overhang: Roof overhang shall be flush with dock edge.

3) Vertical Clearance: 12'-0" from dock surface to underside of overhang.

4) Dock Height: 4'-0" from paving to dock surface.

5) Deck Plate: Size to be 6'-0" wide x 6'-8" deep electrically operated to raise and lower plate to match truck bed heights.

6) Dock Doors: Size shall be 10'-0" wide x 9'-0" high roll-up type doors, electrically operated with manual override option.

7) Dock Bumpers: Substantial dock bumpers shall be installed at appropriate spacing along dock edge.

11 21 23 Vending Machines

A. Provide adequate drains to sewer.

B. Provide adequate electrical outlets.

C. Space for refuse and empty bottle containers should be provided.

D. Floor and walls must be constructed of washable materials. Ceramic tile preferred.

11 53 00 Laboratory Equipment

A. The University prefers wood laboratory casework unless metal is specifically requested for a limited use. Prior to design, the A/E is to meet with the University Project Manager to determine whether modular or custom casework should be specified, and identify the corrosive chemicals to be used in the lab sinks. The Plumbing Shop Supervisor will assist in the selection of lab sinks.

1) Acceptable manufacturers of lab casework are Sheldon, Hamilton and Kewaunee or prior approved equal. The Graniteline plastic clad equipment as manufactured by the Granite Mill is also considered satisfactory as laboratory furniture.

B. Laboratory tops shall be Molded Epoxy Resin tops as manufactured by either Prime Industries; Laboratory Tops, Inc.; Durcon; or, Epoxyn Products; and shall be cast from thermal setting modified epoxy resins and inert fillers. Tops, splashes and curbs shall be a uniform mixture throughout their full thickness. Tabletops shall be 1 inch thick with drip grooves provided on the underside at all exposed edges. Further, all exposed edges, except as indicated below, shall be rounded to a 1/4 inch radius at front top edge and at vertical corners. Curbs and splashes shall be 3/4 inch thick, bonded to the surface of the laboratory top to form a square joint. Backsplash curb height is to be 4 inch minimum (or greater
as required by the end use). Sink cutouts shall be smooth and uniform without saw marks and the top edge shall have a uniform radius conforming to the sinks radius and shape. Where indented benches and table tops are required, specify 1 inch thick at the outer edge, indented 1/4 inch to provide a raised rim 1 inch wide all around all exposed edges. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded to a 1/8” inch radius. Fume hood work surfaces shall be 1” thick at outer edges, indented 1/4 inch to provide a raised rim around all edges. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded to a 1/8 inch radius. The juncture between the raised rim and the top surface shall be coved to a 1/4 inch radius.

1) Acceptable Manufacturers

Laboratory tops shall be Molded Epoxy Resin tops as manufactured by either Prime Industries; Laboratory Tops, Inc.; Durcon; or, Epoxyn Products.

C. Laboratory sinks should generally be:

1) Molded Epoxy Resin to match Laboratory Tops described in 2 above, and

2) Stainless Steel where radioactive isotopes are to be used in any quantity.

3) Fiberglass sinks will not be approved by the University.

D. For laboratory waste and drain lines, the A/E is requested to design and specify the under-sink fittings in Pyrex glass. However, "Durcon" and "Duriron" will be acceptable substitutes.

E. Laboratory benches shall be designed and installed to facilitate maintenance on all utilities serving the bench. This will require the provision of removable panels so that all fittings can be reached without disassembling the bench.

F. Paper towel dispensers shall be provided in laboratory areas over each sink. Scott Model #995 (white enamel) or equal.

G. Reference should be made to 3.8 HVAC of this supplement. Finishes, manufacturer, hardware, etc., should be coordinated with Facilities Management and the user group through the University Project Manager. The hood should be specified in this section and the mechanical design coordinated with the A/E’s mechanical engineer.

H. The usage of chemical resistant plastic laminate tops must be approved by University Project Manager.
DIVISION 12 - FURNISHINGS

12 35 53 Laboratory Casework

All cabinetry shall be designed and constructed to meet or exceed, the latest AWI Quality Standards, Premium grade. Refer to Section 06 41 16 above for typical requirements.

A. Laboratory cabinets shall be designed and fabricated to meet the following additional criteria (for laboratory tops, see Section 11 53 00 herein):

1) Material selection shall be based on the intended use. Sinks shall be in accordance with Section 12 35 53 herein.

B. Individual components shall be as follows:

a) Wood cabinets are acceptable for bio-safety less than level 3. Melamine interiors or plastic laminate is acceptable.

12 20 00 Window Treatments

12 21 00 Window Blinds

A. Manufacturer

Adjustable blinds shall be manufactured by Bali - Classic Blind Series 3000, or an approved equal. They must have one-inch wide virgin aluminum alloyed slats. The wand shall be a clear plastic rod.

12 48 00 Rugs and Mats

12 48 43 Floor Mats

A. Entry mats shall be a roll-up, polypropylene type floor mat, non-recessed, 3/8" thick, permanently crimped denier polypropylene pile fused to solid vinyl. University Project Manager to approve installation and coordination with Custodial Services.

12 59 00 Systems Furniture

A. Landscape partition systems shall accommodate power, telephone, computer hook ups and transportation.

B. Specify compliance to current Utah State adopted codes, in particular, but not limited to, the flame spread and smoke contribution, and seismic restraint requirements.
12 61 00  **Fixed Audience Seating**

A. All fixed seating regardless of intended use or location must have a ten year manufacturing and installation warranty on parts and labor from the manufacturer.

12 70 00  **Interior Recycling Bins**

A. General

Below is a list of areas and the materials that are required for new state funded facilities. To be ordered thru the Waste Management Department.

1) Office areas: One 13 qt. Office pack bin for each desk and one 23 gal. mixed pack bin for each room/cubicle area.

2) Classrooms: One 28 qt Mixed pack bin.

3) Conference/Break Rooms: One 28 qt Mixed pack bin

4) Copy Rooms: One 23 gal. Office pack bin and one 28 qt. Mixed pack bin.

5) Labs: The type of lab determines the bin type, size and quantity. For example, a chemistry lab would only require a 23 gal. Mixed paper bin while a computer lab would require two 23 gal. office pack bins and one 23 gal. mixed paper bin. This decision is made by the Waste Management and Custodial Departments.

6) Building Entrances: One for bin recycling center at all major entryways.

7) Hallways: One four bin recycling center on each floor, this does not include the recycling centers provided at major entryways. Vending machine areas required 30 gal. recycling bins for plastics and/or aluminum depending on the type of beverage container dispensed by the machine. Mixed paper recycling bins are also required in hallways and common areas. The size, type and quantity of the paper recycling bins are decided by the Waste management and Custodial Departments.

8) Restrooms: Recycling bins are not required in restrooms.

9) Café Areas: Recycling in café areas is the responsibility of the vendor.

10) Dock Area: A cardboard recycling trailer is to be provided. The trailer can be purchased thru the Waste Management Department. If the trailer is purchased independently it must follow the specifications provided by the Waste Management Department.
DIVISION 13 – SPECIAL CONSTRUCTION

13 05 00 Common Work Results for Special Construction – Animal Rooms

A. Epoxy treatment of walls and floors has proven advantageous in some areas on previous projects.

B. A monolithic type flooring, similar to "Dex-O-Tex" produced by Crossfield Products, with its own elastic membrane and the necessary coves at walls and corners appears advisable in areas where a waterproof, washable floor is mandatory.

C. Plain, sealed concrete has proven unsatisfactory. Floor cracking creates serious problems.

D. Vivarium design shall be in accordance with the guidelines outlined in the latest edition of the “Guide for the Care and Use of Laboratory Animals” and Section 2-4 of NIH Policies and Guidelines. Specifically referencing the guidelines for physical plant design.

E. Planning and design of Vivariums should be in close coordination with the University Director of Comparative Medicine. The A/E shall coordinate a vivarium planning meeting with the University project manager and the University director of comparative medicine during the planning stage of the project.

1) The meeting shall specifically cover and plan for the required surface finishes, space requirements, need for special behavior rooms, sound proofing, mechanical systems, security requirements, and Facilities for cleaning.

2) Notes from this meeting shall be distributed to the planning team and kept as part of the project record.

DIVISION 14 – CONVEYING EQUIPMENT

14 20 00 Elevators

A. Codes

1) Comply with State approved codes in the design of elevator system (see Design Requirements 2.0 Codes/Laws/Rules and Regulatory Requirements / 2.6 Labor-Industrial Commission).

B. Elevator Design Requirements
1) The interior dimensions and features of the specified elevators shall accommodate cleaning equipment and furniture and shall be designed for ease of cleaning and maintenance.

2) Specify removable full-height bumper blankets for wall protection in elevators primarily intended for freight, supplies, equipment, etc.

3) LED lighting or fluorescent tubes in specified elevators shall be a standard size, easily obtainable from local distributors.

4) See 3.5 electrical Communications and Security Wiring Systems / P. for special requirements regarding elevator phones and phone panels, elevator communications connections (traveling cable), access panels, conduit, emergency service lines, etc.

5) The elevator system shall be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment manufacturer.

6) The elevator design shall include on-site diagnostic functionality capable of identifying faults and malfunctioning components.

   a) If “fault diagnosis” requires a separate, detachable device, elevator specifications shall require that the device is to be furnished to the University as part of the Contractor’s bid with complete supporting documentations and appropriate training as part of the elevator start-up/commissioning. If such a device is required for elevator maintenance, it must be an “industry standard” device applicable to other elevator control designs (non-proprietary).

DIVISION 21 – FIRE SUPPRESSION

DIVISION 22 – PLUMBING

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING

A. Refer to 3.8

1) Miscellaneous Design Recommendations:

   a) Locate exterior hose bibs adjacent to exterior doors.

   b) Coordinate landscape sprinkler types and locations such that spray is kept away from building and glass walls.
c) Coordinate condensation drains to be directed to floor drains in a direct and appropriate manner so as to not be a hazard or unsightly.

DIVISION 25 – INTEGRATED AUTOMATION

DIVISION 26 - ELECTRICAL

A. Refer to 3.6

B. Miscellaneous Design Recommendations:

1) Locate light fixtures so the re-lamping and servicing can be safely and easily performed.

2) Light fixture types must be approved by Facilities Management through the University Project Manager. Lamps must be those types easily obtained and stocked by the University.

3) Provide waterproof covered receptacles adjacent to building entrances.

DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 13 13 Concrete Paving

A. Concrete Stairs

1) Install exterior concrete stairs with tooled nosings only.

2) If rebar is to be used in stair nosing, it is to be epoxy coated.

B. All concrete sidewalk slabs shall be doweled to adjacent slabs with epoxy rebar dowels at expansion joints or any break in the pour. Dowels are to be evenly spaced with maximum distance between dowels not to exceed 24 inches. Rebar dowels must be #4 or larger and at least 24 inches long. Dowels must be embedded at least 3 inches deep and no closer than 6 inches from the edges of the slab.

C) Exposed concrete to receive a smooth rubbed finish within one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. No cement grout other than that created by the rubbing process will be allowed.
**32 31 13 Chain Link Fences and Gates**

A. Indicate acceptable materials and products which may be used in construction of this project. Determine manufacturers and consult with Facilities Management through the University Project Manager.

B. Provide sufficient detail for construction procedures, fence layout and installation.

C. No fencing shall be attached to any building or gate anchor to any building without approval of Facilities Management.

D. Fencing Product/Materials:

1) Fabric:

   a) PVC coated steel chain link fabric with zinc coating applied to core wire. Material to be helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling at both ends of the wires to form the selvage of the fabric.

   b) Fabric mesh size shall be 2” x 2” except in areas where children climbing on fences is to be discouraged. In such areas, the mesh size shall be 1” x 1”.

   c) Fabric breaking strength shall be 800 LBS per square foot.

   d) Fabric height to be as noted on drawings.

   e) Weight of zinc coating on fabric shall be 0.30 oz. per square foot.

   f) Fabric selvage to be knuckled at both ends.

   g) Thickness of PVC coating on fabric shall be 0.015 inches min.

   h) Fabric color to be black.

2) Pipe shall be zinc coated with a chromate conversion applied. Polyester resin color coating thermally fused to the zinc coated pipe.

   a) End structural post shall be 2-1/2" O.D. diameter pipe with a wall thickness of 0.130 inches.

   b) Line posts shall be 2” O.D. diameter pipe with a wall thickness of 0.120 inches.

   c) Zinc coating shall be a min. of 0.06 OZ. per square foot.
d) Color coating shall be 0.004 inches thick and over cured.

e) Color to be coordinated with Facilities Management through the University Project Manager.

3) Fittings. All fittings (bands, caps, eye tops, rail ends, sleeves, truss rods, bars, hinges, ells, clamps, scrolls, and clips) shall have an electrostatically applied polyester color resin that has been oven cured and thickness of 0.004 inches.

4) Ties and Tension Wires. These items shall be of extruded PVC over zinc coated steel wire. Color to be coordinated with Facilities Management through the University Project Manager.

5) Concrete footings and concrete mow strip shall be as per drawings and specifications for cast-in-place concrete.

E. All gate material shall be consistent with the fencing material.

F. Provide sufficient information to ensure quality workmanship. Indicate that experience is required and specify the qualifications of workmen and tolerances expected.

G. Provide procedures for protection of existing landscaping. Indicate that there will be no pruning without authorization from Facilities Management (especially the Landscape Maintenance Department) through the University Project Manager.

DIVISION 33 – UTILITIES

See 3.2 Civil.

End of 3.3 Architectural.
3.0 DFCM REQUIREMENTS

3.4 STRUCTURAL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
**GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:**

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

**ADDED:**

This supplement provides structural design standards for construction of new and remodeled facilities at the University of Utah.

**ADDED:**

**REVISIONS SUMMARY**

for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 January 2016</td>
<td>3.4 B. 1)</td>
<td>Removed areas that repeat code.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.4 / B. / (2) / (f. / 1)</td>
<td>High Temp Water Equipment Rooms, Updated HTW Equipment room requirements.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.4 / B. / (2) / (f. / 1)</td>
<td>High Temp Water Equipment Rooms, Added HTW Equipment room requirements.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.4 / B. / (3) / (a. / 1) / (h)</td>
<td>Sidewalk Requirements, Added reference to campus sidewalk requirements in 3.2 Civil</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>General, Entire Chapter Updated</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td>General, All references to UBC changed to “State adopted codes”</td>
</tr>
</tbody>
</table>
3.4 Structural

**ADDED:**

B. University of Utah Requirements

1. Design Loads
   a. Design load requirements shall be as required by State adopted codes and shall include the following minimum requirements:
      1) Roof Loads
         a) Rain on Snow
         An additional 5 psf rain on snow surcharge; this surcharge may be disregarded where roof slopes exceed 1/2 inch in 12 inches. Rain on snow does not need to be included in seismic calculations.
         b) Office Areas
         Due to the nature of offices where there is a need for many filing cabinets, open office landscaping, etc., all office floors shall be designed for 80 psf minimum uniform load plus 15 psf for removable partitions. This requirement is in lieu of the 50 psf currently required in State adopted codes. Alternative floor load requirements may be approved by the University when deemed appropriate for the expected use of the building over its lifetime.

2. Design Criteria
   a. Special Inspection
      The structural engineer shall include in the drawings the structural items which require special inspection according to State adopted codes.
   b. Geotechnical Information
      A soil investigation report is required for all new buildings unless specifically waived in writing by Facilities Management through the University Project Manager. No part of the soils investigation report or borings should be included in the plans or specification. The specifications should be modified to include the geotechnical
engineer's recommendations as specific instructions to the Contractor.

c. Excavation and Compacted Fill

1) This is an area of great concern to the University and should be given special attention in the preparation of bidding documents. The University is interested in using on-site materials to the greatest degree possible, but at the same time, change orders for imported fill must be held at a minimum.

2) The A/E shall thoroughly investigate existing conditions and prepare bidding documents to achieve these goals. Each site needs to be considered on its own merits on a case by case basis. This precludes any kind of standard strategy, as each case will have differing conditions. Strategies should be considered that will minimize total project costs while protecting the University against excessive change orders. Strategies are to be coordinated with Facilities Management through the University Project Manager.

d. Footings and Foundations

1) Design of footings and foundations shall be based on the recommendations of the soils investigation report and the specifications shall be modified to reflect said recommendations. The following requirements shall also be used in design:

   a) Footing shall be designed to resist frost heave, water infiltration, settlement and overturning.
   
   b) Footings shall bear atop undisturbed earth or compacted backfill.
   
   c) Elevation of top of footing and finished grade lines shall be noted on building elevation views.

e. Parking Structures

1) Minimum Concrete Strength

   5,000 psi for post-tensioned members

2) Air Entrainment

   6-1/2% ± 1-1/2%

3) Rebar

   Adequate life cycle / corrosion resistant design is required to protect rebar.

4) Cover on Reinforcing

   1" min, 1-1/2" at top of slab
5) Top Deck (if no roof)

Combine snow load with vehicles. Review with Facilities Management through the University Project Manager those areas of higher loading due to snow removal.

f. High Temperature Water Equipment Rooms

1) Design high temperature water equipment rooms accommodate the forces associated with a possible rupture of a HTW pipe operating at 400 + psi and 400 degrees F. Wall and floor construction shall be designed, and doors and hardware shall be selected and specified with sufficient resistive strength to withstand the pressures of a maximum HTW release event.

   a) High Temperature Water Equipment Rooms shall be entirely designed by an engineer. Calculations shall be provided to support the design solution and justify all materials being specified in the construction of the room.

   b) Exhaust vents shall be sufficiently sized to dissipate the pressures that might occur in a maximum HTW event in a given HTW room.

   c) Doors and hardware shall be selected specifically to withstand maximum explosive HTW release pressures. Latching of these doors should be designed using flush bolts or other suitable means by which to safely maintain enclosure integrity and security during a HTW breach. The design should allow for normal operation of the doors after an explosive breach.

   d) Note that the HTW equipment room will require an exhaust system and conduit for an emergency HTW shut-off switch outside the room near the door.

2) Note that the HTW equipment room will require an exhaust system and conduit for an emergency HTW shut-off switch outside the room near the door.

(3) Material Strengths and Construction Requirements

a. Concrete

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>INTERIOR (not exposed to freeze-thaw)</th>
<th>EXTERIOR (exposed to freeze-thaw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings</td>
<td>3,000 psi</td>
<td>4,500 psi</td>
</tr>
<tr>
<td>Slabs on Grade</td>
<td>4,000 psi</td>
<td>4,500 psi</td>
</tr>
<tr>
<td>Walls</td>
<td>4,000 psi</td>
<td>4,500 psi</td>
</tr>
</tbody>
</table>
1) **Materials** shall comply with the standards specified in the latest addition of ACI 318. Minimum compressive strengths of concrete (28 day strengths) shall be:

   a) Normal weight concrete mixes shall comply with the concrete durability requirements of Chapter 4 of ACI 318 for all concretes exposed to freezing and thawing, sulfates soils or water, or for corrosion protection of reinforcement. Air entrainment shall be as recommended by ACI 318, Chapter 4.

   b) The concrete design should have a water to cement ratio such that the mix not exceed a 4” slump. The water cement ratio shall be as recommended by ACI 318, Chapter 4. For interior concrete not requiring special exposure conditions, the water-cement ratio may be increased; however, the slump shall not be more than 4” before a water reducer or HRWR (super plasticizer) admixture is used to increase the slump.

   c) Reinforcing steel shall be grade 60; fy=60 ksi.

   d) Lightweight concrete shall not exceed recommended unit weight for applicable UL-listed assemblies and shall be made of lightweight course aggregates and lightweight and/or normal weight fines.

   e) Provide a surface intentionally roughened to ¼” amplitude in all wall footings, and all horizontal and vertical construction joints. A continuous 2 x 4 keyway may be used in walls and elements other than shear walls.

   f) Provide reinforcing dowels to match the member reinforcing at the joint.

   g) Construction joints shall be made at the center of spans.

   h) Slabs-on-grade shall have construction or control joints placed in lengths not to exceed 30 times the slab thickness in any direction. Construction joints will not exceed a distance of 12'-0” o.c. in any direction. For walking surfaces along the accessible paths of travel, expansion/construction/control joints shall be no wider than 3/8” with tooled edges of not more than a 1/4” radius. The intent is to provide a joint which does not exceed 1/2” in width for ADA requirements. Other areas not requiring ADA compliance could use the 1/2” wide expansion joint material. Special requirements for campus sidewalks are found at: 3.2 CIVIL / A. PAVING / (3) / a.

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Compressive Strength (28 Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columns</td>
<td>4,000 psi</td>
</tr>
<tr>
<td>Beams and Suspended Slabs</td>
<td>4,000 psi</td>
</tr>
<tr>
<td>Post-tensioned Concrete</td>
<td>5,000 psi</td>
</tr>
<tr>
<td>All Other Site Cast Concrete</td>
<td>4,000 psi</td>
</tr>
</tbody>
</table>
b. Masonry

1) Concrete masonry unit assemblies shall be lightweight grade N1 or better (minimum unit strength 1,900 psi average for \( f' m = 1,500 \) psi).

2) Hollow clay unit assemblies shall be hollow brick, grade 1 or better (minimum unit strength 6,600 psi average for \( f' m = 2,500 \) psi).

3) Solid clay unit assemblies shall be SW or better (minimum unit strength 3,350 psi average for \( f' m = 1,500 \) psi).

4) Grout shall be proportioned, tested, mechanically consolidated, and reconsolidated in accordance with State adopted codes. Grout shall attain a minimum compressive strength of 2,000 psi.

5) Mortar shall be type "S", and tested in accordance with State adopted codes. Mortar shall attain a minimum strength of 1,800 psi.

6) Reinforcing steel shall be grade 60; \( f_y = 60 \) ksi.

7) Joint reinforcement may be included in the wall design, but this reinforcement shall not replace the requirement for reinforced bond beams.

8) Reinforcement that requires welding shall be of the deformed bar anchor type and conform to ASTM A496 or ASTM A706.

9) Footing stem walls to finish grade or floor shall not be constructed of masonry.

10) Dowels from the foundation into the supported masonry wall above shall be spaced an increment of the vertical masonry reinforcement.

11) Veneer shall have attached seismic anchorage in accordance with State adopted codes.

12) All anchors and lintels supporting veneer shall be galvanized.

c. Steel

1) W-Shapes

ASTM A992, \( (F_y = 50 \) ksi).

All Other Shapes and Plates: ASTM A36 \( (F_y = 36 \) ksi).

2) Tubes

ASTM A500, Grade B \( (F_y = 46 \) ksi)
3) Pipe and Columns
ASTM A53, Types E or S, Grade B (Fy=35 ksi).
Round ASS: ASTM A500, Grade B (Fy=42 ksi).

4) Deformed Bar Anchors
ASTM A496

5) Headed Stud Anchors
ASTM A108, with dimensions complying with AISC specifications.

6) Bolts
ASTM A325 or A490

7) Anchor Rods
ASTM F1554, Grade 36, minimum, with ASTM A563 heavy hex nuts and
ASTM F436 hardened washers.

(4) Design Submissions

a. Schematic Design

1) Code and Loadings
State the governing code used for design. State the criteria for live, wind, snow
and seismic loads, together with data to justify any difference from established
criteria. Seismic design shall be in accordance with State adopted codes.

2) Structural System
Provide a comparative description of at least three structural systems for the
building, i.e., consider wood, steel, concrete, masonry. Give a description of
the type of construction proposed and reasons therefor, including the structural
framing system. The structural design should be carried only to the point
where the total framing systems are determined and a realistic cost estimate can
be made.

3) Foundation Design
Describe the type of foundation proposed and define the basis for selection.
Include bearing capacity, anticipated settlement, alternatives considered, and
other pertinent design factors. Also include the depth of excavation,
disposition of excavated material, whether in-place foundation material will be
compacted, whether imported fill is required, whether compacted backfill will be utilized as foundation, and the frost penetration. State ground water level and method of waterproofing. State needs for drainage or vapor barrier. Describe pertinent corrosion control methods. Refer to the Soils Report included in the supplements.

4) Structural drawings should include:

   a) Foundation plan
   b) Floor and roof framing plan
   c) Details are not required

b. Design Development

1) The following plans shall be submitted:

   a) Foundation plan
   b) Floor(s) and roof framing plans
   c) Some typical foundation details
   d) Some typical roof framing details

2) Foundation plan shall show type of foundation proposed, depths, sizes and reinforcing of footings, relationship of walls and floor slab to foundation system, overall dimensions, column spacing, joint pattern in slab-on-grade, tie beams, grade beams, etc.

3) Floor(s) and roof framing plans shall show framing members including columns. The majority of the framing members shall have sizes indicated.

c. Contract Documents

1) Computations

   a) Present complete structural calculations covering all parts of the structure and miscellaneous facilities. Calculations shall be bound and indexed. When a computer is utilized to perform design calculations, the analysis will include, but not be limited to, the following information.

      (i) Design methods will be described, including assumptions, theories, and technical formulas employed in design solutions.

      (ii) Present copies of computer input data and output summaries in user friendly language, accompanied by diagrams which identify joints, members, areas, etc., according to the notations used in the data listings, will form integral parts of the design analysis in lieu of manual computations otherwise required. Complete listing of all computer output will be provided in a separate binding when it is too voluminous for including in the design analysis. These listings will be augmented with intermediate results where
applicable, so that sufficient information is available to permit manual checks of final results.

b) Live loads shall be placed to produce maximum stresses and minimum stresses where there is a possibility of stress reversal.

c) If special methods of solution, tables, etc., are employed, references shall be made in the calculations to the sources of such material.

d) Adequacy of existing structure, where applicable, to account for new functional loads or new criteria.

2) Drawings

All drawings shall be complete and represent coordination by the A/E with all disciplines. Evidence of this coordination shall be provided by the A/E at the final design review.

End of 3.4 Structural
3.0 DFCM REQUIREMENTS

3.5 ELECTRICAL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

1. This electrical engineering supplement is intended to provide A/E’s with specific requirements and minimum standards acceptable to the University for use in the construction or remodeling of buildings or facilities on campus. The A/E is expected to incorporate these requirements and standards into the project documents to ensure that the finished product meets the specific needs of the University. Any deviation will require a Project Variance Request or Change Request and subsequent approval by the Design Standards Committee in accordance with Design Process section 1.4.

2. The Facility Operations Electric Shop maintains electrical systems and equipment on campus, and together with staff electrical engineers, provides significant input and oversight to this supplement. The Electric Shop is responsible for the operation and maintenance of several critical electrical systems which serve research, life safety, health care, environmental, and other functions on campus.

3. The number of approved manufacturers for equipment and supplies described throughout this supplement is necessarily limited due to immediate critical response requirements, product performance parameters, site tests for quality and endurance, parts storage limitations, product training and familiarity, and other specific system needs. The products of other manufacturers and improved technologies are welcome for review and site testing at the University prior to being listed in this supplement with subsequent approval for use in construction specifications.
**ADDED:**

**REVISIONS SUMMARY**
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 January 2016</td>
<td>3.5 C. (2), (4), G. (7)</td>
<td>Update to language MC Cable and Aluminum bus barn</td>
</tr>
<tr>
<td>1 May 2015</td>
<td></td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.5 part 1 / B / 12 / b / i / vii</td>
<td>PanelBoard Labeling updated the standards</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.5 Part 1/C / 6 / d</td>
<td>Dimming Added requirement</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.5 Part 1/C / (7)</td>
<td>Exterior Lighting Several changes made to provide a standard for Walkway, Parking Lot, and Parking Terrace Lights that will fixture across campus.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.5/ part 2 / P. / (8)</td>
<td>Security Complete rewrite of the CCURE standards</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.5 / I. / (11)</td>
<td>Engine Generator sets for U of U projects Added to standard the requirement for generators to be designed with a secure enclosure around them.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.5 / part 2 / N / 6</td>
<td>Conduit Capacity Updated standard to allow for 1” conduits in place of the previous standard of ¾”</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.5 / P. / f.</td>
<td>Total Raceways Added Requirement</td>
</tr>
<tr>
<td>7 October 2013</td>
<td>3.5 / B. / (7) / a. / 1 b./ c.</td>
<td>University of Utah Electrical Requirements Added new requirements</td>
</tr>
<tr>
<td>7 October 2013</td>
<td>3.5 / I. / (3) / b. / 4 / e)</td>
<td>Electrical Added Manufacturer</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.5 / P. / (4) / e.</td>
<td>Manhole Ladders Added ladder attachment requirements</td>
</tr>
<tr>
<td>15 June 2012</td>
<td>Preface #2</td>
<td>Addition to General Introduction Removed the reference to the emergency phone detail drawing.</td>
</tr>
<tr>
<td>15 June 2012</td>
<td></td>
<td>General The entire electrical engineering section (Part 1) was updated and re-written. The guide spec format previously provided in Part 1 was abandoned, and guide spec requirements considered germane and essential to University operations were either relocated into, or revised as part of the re-written section.</td>
</tr>
<tr>
<td>15 June 2012</td>
<td>Detail Drawings</td>
<td>Part 1 Electrical Engineering Detail Drawings All Part 1 detail drawings have been removed or relocated. Pole Light and Electrical Manhole Drawings (Removed):</td>
</tr>
</tbody>
</table>
The re-write of the electrical engineering section changed certain requirements formerly found in the pole light and electrical manhole drawings, rendering them obsolete. These have been removed. Current University lighting and manhole requirements are now adequately described in the re-written electrical engineering section.

**EA Security Door Drawings** (Removed): All EA security door drawings have been removed from, and are not currently part of the University Supplement to the DFCM Design Manual.

**Manhole Ring/Cover and Communications Duct Bank** (Revised and Relocated): Drawings ELEC-6 Manhole Ring and Cover Detail and ELEC-9 Communications Duct Bank apply only to communications. These were revised; changed to COM-3 and COM-4, and moved to Part 2 Communications and Security Wiring Systems.

<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January</td>
<td>University Design Standards, The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Chapter 9 Electrical was reformatted to become supplement Part 1 of DFCM's 3.5 Electrical.</td>
</tr>
<tr>
<td>06 January</td>
<td>Campus Design &amp; Construction, CD&amp;C was changed to Construction Project Delivery and is shown as Construction Project Delivery or Facilities Management in this document.</td>
</tr>
<tr>
<td>06 January</td>
<td>Plant Operations, Plant Operations was changed to Facility Operations</td>
</tr>
<tr>
<td>06 January</td>
<td>Engine Generator Sets, Added a second transfer switch for critical research buildings</td>
</tr>
</tbody>
</table>
## Revisions Summary

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 June 2012</td>
<td>3.5 / P./(4)/e. / 2)/ a)</td>
<td>Manhole Cover. Added a reference to new Detail Drawing COM-4.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.5 / O./16612/c./2)</td>
<td>Engine Generator Sets. Added requirements for full load tests</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Campus Design &amp; Construction. CD&amp;C has changed to Construction Project Delivery (in this document CD&amp;C was replaced by Facilities Management)</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>3.5 / H. / (2) / z.</td>
<td>Variable Frequency Drives. Added GE to list of approved variable frequency drive manufacturers</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>3.5 / O./16730</td>
<td>Clock Systems. The section regarding building clock system requirements was re-written</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / B./ (1)/h.</td>
<td>Contractor to Repair Damage. Added requirement for repair inspection by Electric Shop</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / B./ (1)/l.</td>
<td>Clean-Up. Electrical rooms and equipment must be cleaned during and at end of project</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O./16110/b.</td>
<td>Parallel to Walls. Removed requirement to be parallel to walls</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O./16110/g.</td>
<td>Condulets. Restrictions on condulets changed</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O./16120/b.</td>
<td>Power Conductor Color Coding. Added green power conductor ground</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O./16140/a.</td>
<td>Label Outlet Box &amp; Cover. Label outlet box and cover with circuit and panel</td>
</tr>
<tr>
<td>REVISION DATE</td>
<td>LOCATION</td>
<td>SUMMARY OF CHANGE</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / H. / (1) / a.</td>
<td>MCC. Removed fusible MCC</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16167</td>
<td>Labels. Permanent plastic engraved labels are required</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16302 / b. / 2</td>
<td>Manhole Cable Supports. Added “or equal”</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16302 / b. / 6</td>
<td>Manhole Cable Racks. Removed “porcelain” sleeves</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16302 / b. / 8</td>
<td>Manhole Entrance Hatch. Added required location of the entrance hatch</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16302 / b. / 13</td>
<td>Manhole Bell End Entrances. Added “or equal”</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16304 / c.</td>
<td>Cables. Added high voltage splices and terminations</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. / 16304 / c.</td>
<td>Cables. Removed fiberglass fire resistant tape over 3M</td>
</tr>
<tr>
<td>REVISION DATE</td>
<td>LOCATION</td>
<td>SUMMARY OF CHANGE</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Cables. Replaced “neutral” with “ground” in three places</td>
</tr>
<tr>
<td></td>
<td>16304 / e.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Cables. Added requirement for cable tags</td>
</tr>
<tr>
<td></td>
<td>16304 / g.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Cables. Deleted special order uncoated #19 awg wire / trunk lines</td>
</tr>
<tr>
<td></td>
<td>16304</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Cables. Deleted cable factory tests</td>
</tr>
<tr>
<td></td>
<td>16304</td>
<td></td>
</tr>
</tbody>
</table>

Revisions Summary (concluded)

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Cables. Deleted DC Hi-Pot Testing</td>
</tr>
<tr>
<td></td>
<td>16304</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16360</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>HV Solid Dielectric Switches. Added solid dielectric switches, revised requirements</td>
</tr>
<tr>
<td></td>
<td>16360</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / F. /</td>
<td>Grounding. Added termination to ground buss</td>
</tr>
<tr>
<td></td>
<td>(4) / c.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / I. /</td>
<td>Transformer Overcurrent Protection. Replaced vacuum interrupter SF-6 w/ solid dielectric</td>
</tr>
<tr>
<td></td>
<td>(3) / c.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / C. /</td>
<td>Exterior Lighting. Revised requirements for outdoor lighting</td>
</tr>
<tr>
<td></td>
<td>(7) / c., g. &amp;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10) / a.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Generator Sets. Removed indoor generator sets</td>
</tr>
<tr>
<td></td>
<td>16612 / a.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Generator Sets. Added opacity test</td>
</tr>
<tr>
<td></td>
<td>16612 / e.</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.5 / O. /</td>
<td>Fire Protection Fan Shutdown. Added separate enclosure for relays</td>
</tr>
<tr>
<td></td>
<td>16721 / 1. /</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16721 / 1. / 2)</td>
<td></td>
</tr>
<tr>
<td>10 December 2009</td>
<td>ELEC-1</td>
<td>Walkway Light Assembly. Revised</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>ELEC-2</td>
<td>Drawing Detail. Removed</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>ELEC-3</td>
<td>Parking Lot Light Assembly. Revised</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>ELEC-5</td>
<td>Manhole Section. Added note regarding manhole opening</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>ELEC-8</td>
<td>Manhole Exploded View. Revised</td>
</tr>
<tr>
<td>Date</td>
<td>EA</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>------</td>
<td>----------------------</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>EA-1</td>
<td>CCure Door Detail</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>EA-2</td>
<td>CCure Door Detail</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>EA-3</td>
<td>CCure Door Detail</td>
</tr>
</tbody>
</table>
3.0 DFCM REQUIREMENTS

3.5 Electrical

**REVISED:**

The latest adopted edition of the following Codes and Standards are to be considered a minimum requirement for Section 3.5. Where items contained in this section are in conflict with any of the following codes or standards, the more stringent requirement shall apply: National Electrical Code – NEC; International Building Code – IBC; International Energy Conservation Code; Illuminating Engineering Society of North America – IESNA Handbook; UL 96A; NFPA 780; Utah State Fire Marshal’s Rules R710; National Fire Alarm Code – NFPA 72; and Agency/Institution Design Standards (comply with the latest edition of the design standards of the project agency or institution). If conflicts exist between DFCM and these design standards, obtain written clarification from representatives of DFCM and the agency/institution). Deviations from Codes, Standards, or standard industry installation practices (i.e., NEC Code Exceptions, etc.) shall be identified and submitted to Facilities Management through the University Project Manager for review during design and before bidding. Final Construction Documents shall not be submitted for bidding until all such deviations have been approved in writing by the Facility Operations Electric Shop, staff electrical engineer(s), and University Project Manager.

**ADDED:**


7. EPA Non-road Diesel Emission Standards

8. Electronic Industries Alliance/Telecommunication Industries Association 568/569 (EIA/TIA)

A. Lighting

**REVISED:**
(1) All lighting shall meet or exceed the current energy code for lighting power density, control requirements, and other requirements. All lighting shall utilize the most efficient fixtures available to meet the project requirements and budget. Incandescent lighting shall generally not be used, but may be used with the approval of the DFCM representative in the following applications: theaters/stages, television studios, and art galleries. However, in these applications, LED lighting shall be strongly considered. Exterior Lighting shall be LED unless approved by the DFCM Director for DFCM managed projects, or by the University Project Manager for University managed projects. Refer to Section 5.0 for additional requirements on lighting energy requirements.

(4) Interior Lighting:

**ADDED:**

a. Maintainability

1) Lighting equipment selected and positioned in the project as part of the A/E’s design shall be maintainable. The layout and location of light fixtures shall include consideration for lamp replacement. Placement of lighting fixtures in locations which cannot be reasonably serviced and re-lamped shall not be allowed.

2) Where lamp replacement will reasonably require the use of special equipment such as telescoping poles, man lifts, or fixture lowering devices, these shall be specified to be supplied as part of the contract.

3) Placement of lighting above stairways and atriums shall be avoided unless convenient re-lamping provisions are included as part of the design.

b. Spare Fixture Lenses

Require the Contractor to provide 10% of each type and size specified with a minimum 2 of each. Coordinate storing and delivery of spare lenses with the University Project Manager.

c. Lighting Control

A lighting control system should be provided for the interior lighting of all new buildings.

d. Dimming

1) When dimming is required, LED lighting shall be specified.

e. Fluorescent

1) Fluorescent ballasts shall be programmed start.
2) Premium lamps and ballasts shall be specified.

3) Do not specify, nor allow compact fluorescent downlight fixtures.

f. Metal Halide

1) Metal halide shall be specified with:

   a) High power factor, normal ambient, 180 degrees C insulation class

   b) Auto transformer with capacitor and igniter for lamps 150 watts or less

   c) Constant wattage autotransformer with capacitor for lamps above 150 watts


g. LED

1) LED lighting shall be used for following applications:

   a) Under-cabinet lighting applications

   b) Task lighting

   c) Cove lighting

   d) Downlights

   e) Emergency lighting and exit signs

   f) Dimming applications

h. Emergency Lighting

1) Design an LED emergency lighting system for the path of egress (required in all University buildings). Any deviation will require a Project Variance Request and subsequent approval by the Design Standards Committee in accordance with Design Process section 1.4.

2) In addition to the path of egress, emergency lighting shall be provided in the following locations:

   a) Where critical experiments or other activities warrant continued occupancy of the space during a power outage.

   b) Transformer Vaults / Pads
c) Main Electrical Rooms

d) Emergency Generator Areas

e) Telecommunication Rooms

f) Mechanical Spaces

g) Any other specific locations where emergency lighting is deemed necessary.

3) Emergency lighting and illuminated exit signs shall be powered from an alternate power source.

a) Whenever possible, the alternate power source shall be an engine generator set.

b) Emergency lighting in all new buildings shall be connected to a new emergency generator or to an existing generator at a nearby building.

c) When the project’s emergency power needs will draw from a nearby generator at another building, confirming capacity calculations (starting and load calculations) for the existing off-site generator shall be submitted to Facilities Management through the University Project Manager for review and approval prior to completing the design.

d) Remodeling projects at buildings with no access to an emergency generator may warrant the use of rechargeable batteries as the source of alternate power. If battery power is considered, the A/E must submit a request for its use to Facilities Management through the University Project Manager, and obtain written approval. When used, battery powered systems shall include automatic chargers and exercisers.

4) Emergency Exit Signs.

a) Emergency exit signs shall be typically specified as long life LEDs.

b) Photo luminescent exit signs may be approved in areas where they can be installed in accordance with all applicable UL and/or FM ratings and applications. Photo luminescent products specified for the project must be able to demonstrate minimum illumination to charge the sign.
c) Exit signs containing tritium shall not be allowed. Exceptional circumstances warranting their use will require approval from the University Department of Radiological Health through the University Project Manager, and a Project Variance Request and subsequent approval by the Design Standards Committee in accordance with Design Process section 1.4.

i. Lighting Fixture Product Data Sheets

The A/E shall submit color catalog descriptions / product data sheets (including fixture materials, dimensions, and maintainability information) both at the Design Development phase submittal and at the Construction Document phase submittal for all interior lighting fixtures intended for the project. Submit these in electronic format (PDF) to the University Project Manager who will distribute them to the appropriate Facility Operations staff electrical engineer and Electric Shop. University approval is required at each of the two phase reviews.

**REVISED:**

The technical standard for exterior lighting applies to all University properties. The aesthetic standard for exterior lighting applies to Lower Campus, Health Sciences Campus and Ft. Douglas. Aesthetics for all other areas should be consistent with the architectural context of the area.

(5) Exterior Lighting: Exterior Lighting shall be LED unless approved by the DFCM Director on state projects managed by DFCM. Provide break-way fuses for all phase conductors for all outside pole-mounted lighting fixtures. Provide a shorting fuse insert for neutral fuse holder. Do not use common neutral multi-wire circuits for this type of lighting. (these requirements regarding shorting fuse inserts and common neutral generally do not apply to University projects). Where outdoor lighting is specified on University projects, close coordination with Facilities Management (including the University Project Manager, Facility Operation staff electrical engineers, and the Facility Operations Electric Shop) will be required during design.

**ADDED:**

a. Exterior Lighting Controls

1) A lighting control system for building facade lighting and landscape lighting shall be included in the design of all new University buildings.

2) Each outdoor lighting circuit shall be controlled by a magnetically held 50A, 3P, 480V lighting contactor with a hand-off-auto selector switch and a photocell (120 v) in its own enclosure.

b. In-Concrete, In-Ground, and Bollard Lights Not Allowed
'In-concrete’ light fixtures (especially in exterior stairs and walls), ‘in-ground’ light fixtures, and bollard lighting systems are not allowed. Any deviation will require a Project Variance Request submitted through the University Project Manager, who will distribute for review and approval to Facility Operations staff engineers, the Electric Shop, and the Design Standards Committee in accordance with Design Process section 1.4.

c. Pole Lights

1) General

a) Exterior pole lights throughout campus are to be standardized for uniformity in appearance, light pattern, and light distribution; quality of unit fabrication, engineering, and assembly; and, reliability for long term University maintenance. Poles shall be standardized as either 10’ for walkways & landscape on Main Campus and the Health Sciences Campus, 16’ for walkway & landscape at Ft. Douglas or 20’ for Parking lots and Roadways. Light pattern and distribution requirements shall be coordinated with the University Lighting Specialist.

b) Colors of the poles lights shall be determined by the area in which they are located. Health Sciences shall have silver colored fixtures and poles, Main Campus shall have black fixtures and poles, and Fort Douglas shall have bronze fixtures and poles.

c) Poles shall have a powder coated finish.

d) Poles on the Main Campus and Health Sciences Campus shall be aluminum, 10’ tall x 4-1/2” straight round with the fixture end fabricated to match the appropriate fixture fitting, and all poles shall have a surface mounted round hinged base. Poles at Ft. Douglas shall be aluminum, 16’ tall x 4-1/2” straight fluted with fixture end fabricated to match appropriate fixture fittings, with decorative base cover shroud.

e) Exterior light fixtures and poles specified for campus construction projects shall be restricted
to the fixtures, equipment, and installation methods described herein.

2) Circuit Conductors / Conduit
   a) Circuit conductors shall be 3P, 5W (phases A, B, C, neutral and ground) and extend from the beginning of the circuit through each fixture to the end of the circuit. Minimum conductor size shall be #6 copper with a full-sized neutral and #8 ground.
   b) The incoming electrical conduit at each pole shall be buried at a minimum of 2’ below grade.
   c) Electrical conduit shall run from pole to pole without in-ground J-boxes.
   d) Require the Contractor to assemble all buried PVC conduit using both primer and glue at every joint. Glue-only joints shall not be approved (glue without primer tends to crack allowing water to flood the conduit).
   e) Minimum conduit size for outdoor lighting shall be 1-1/4” schedule 40 PVC.

3) Fusing
   a) Each fixture shall be specified with fusing inside of the hinged pole base.
   b) Fusing shall be provided for each ungrounded conductor.
   c) Fusing shall be Cooper Bussman type KTK-6, 6 amp 600 volt, with a Cooper Bussmann HEB-JJ in-line fuse holder with rubber insulating boots. Crimp style fuses shall not be allowed.

4) Concrete Bases
   a) All outdoor lighting concrete pole bases shall be sized to accommodate the weight being supported. The designer shall be responsible for determining proper sizing and reinforcing based on the soil conditions as well as other site specific considerations. As a minimum, the following guidelines shall be followed:
<table>
<thead>
<tr>
<th>Pole Height (feet)</th>
<th>Base Diameter (feet)</th>
<th>Base Height (overall in feet)</th>
<th>Below Grade Minimum Depth (feet)</th>
<th>#5 Rebar Vertical Reinforcing Bars (quantity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2.0</td>
<td>3.0</td>
<td>2.0</td>
<td>8 equally spaced</td>
</tr>
<tr>
<td>20</td>
<td>2.0</td>
<td>6.0</td>
<td>5.0</td>
<td>8 equally spaced</td>
</tr>
</tbody>
</table>

The concrete base shall have #3 rebar horizontal ties at 12” on center. All exposed edges shall have a 3/4” chamfer. Bases shall be formed using Sonoco Sonotube or equal concrete forms.

b) Refer to the table below for concrete base height above grade and requirements for a mow strip.

<table>
<thead>
<tr>
<th>Pole Location</th>
<th>Mow Strip Required (6” W x 3” D)</th>
<th>Base Height Above Grade (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting Area</td>
<td>Yes</td>
<td>12.0</td>
</tr>
<tr>
<td>Near Sidewalk or Curb (Planting Area)</td>
<td>Yes</td>
<td>12.0</td>
</tr>
<tr>
<td>Near Sidewalk or Curb</td>
<td>No</td>
<td>12.0</td>
</tr>
<tr>
<td>Parking Lot</td>
<td>No</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Require the Contractor to install light poles a minimum of 36” from center of base to edge of from sidewalks to avoid damage by snowplows.

c) Bases in or adjacent to parking areas shall be painted yellow.

6) Hinged Bases

a) A hinged base is required for each pole light.

b) The folding direction of each hinged base shall allow for a full 90 degree tilt.

c) Hinge direction shall not be directed onto a slope or into traffic. Coordinate hinge direction to allow for future maintainability with minimum interference to landscape, obstacles, pedestrians or vehicular traffic.

d) Pole and hinged base shall be either Sterner Lighting by Hubble Lighting, Inc. or LSI Industries, Inc.

7) Walkway Lighting Fixtures

a) All walkway lighting fixtures on the Main Campus and the Health Sciences Campus shall be LED Fixtures.
b) Fixtures shall be Dark-Sky compliant.

c) Approved LED walkway fixtures for the Main Campus and Health Sciences Campus are as follows:

   Cree – Beta Edge (60 LED, 350mA, 4300k) ARE-EDR-3M-R5-06-D-XX-BK-350-43k

   Hubbell – AAL Largent (60 LED, 350mA, 4200k) SLVT-T3-60LED-NW-BLK

   Cooper – Mesa LED (63 LED, 350mA, 4000k) MSA-B03-LED-E1-XX-T3-BK

d) Walkway fixtures on the Ft. Douglas campus shall be a 175 watt, metal halide, acorn type fixture.

e) An approved walkway fixture for the Ft. Douglas campus is the Hadco R52 GANN2XNNG175MH.

f) Approved Equals of other manufacturer will be considered.

g) LED fixtures shall have individually focused LEDs without prisms and without flat lenses.

h) Fixture optics shall typically be IESNA Type II, but shall be designed for the proper application.

i) Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.

j) All fixtures shall be required to have 60 LEDs, 4000-4500K color temperature, and a driver producing

8) Roadway / Parking Lot Lighting Fixtures

   a) All Parking Lot lighting fixtures shall be LED Fixtures

   b) Approved LED Parking Lot fixtures are as follows:

       Cree – Beta Edge (120 LED, 350mA, 6000k) ARE-EDR-5M-R3-12-D-XX-BK-350
Hubbell – AAL Largent (56 LED, 350mA, 5000k) SLVT-T5-56LED-5K-700

Cooper – Mesa LED (126 LED, 350mA, 6000k) MSA-B06-LED-5xx-T3-BK-7060

c) Fixture optics shall typically be Type V (symmetric), but shall be designed for the proper site application.
d) Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.
e) All fixtures shall be required to have, 5000-5500K color temperature, and a driver producing 350mA.

8) Parking Terrace Lighting Fixtures

a) All Parking Lot lighting fixtures shall be LED Fixtures

b) Approved LED Roadway / Parking Lot fixtures are as follows:

Cree – 304 Series
PKG-304-5M-XX-04-X-UL-SV-350-ML

Lithonia – D Series

Cooper – VPL VALET
VPL-B02-E1-SQ-WH-XX-OSX
c) Fixture optics shall typically be Type V (symmetric), but shall be designed for the proper site application.
d) Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.
e) Occupancy sensors shall be required as part of the lighting system in all parking terraces.

10) Lighting Fixture Product Data Sheets
The A/E shall submit color catalog descriptions / product data sheets (including fixture materials, dimensions, and maintainability information) both at the Design Development phase submittal and at the Construction Document phase submittal for all exterior lighting fixtures intended for the project.

B. Raceways to 600 V

**ADDED:**

(7) Conduits and Raceways

a. General

All conductors shall be run in approved conduits or other approved raceways.

b. Conduit Requirements

1) Minimum conduit size shall be 3/4" except for fire alarm systems and CCure security door control wiring where the minimum conduit size shall be 1/2".

2) Where conduits are exposed to weather, wet environments, or to potential mechanical injury, specify steel galvanized rigid conduit (GRC) or intermediate metal conduit (IMC).

3) Minimum conduit size for outdoor lighting shall be 1-1/4" schedule 40 PVC.

4) Flexible conduit in lengths greater than six feet shall not be allowed.

5) Recessed lighting systems shall not be wired with permanent flex conduit running from fixture to fixture. This provision shall not be interpreted to exclude properly installed and supported UL listed plug-in wriing systems.

6) Conduits will not be allowed for splices or junction boxes.

7) All EMT conduit fittings shall be fabricated from steel.

8) Fittings made from pot metal shall not be allowed.

9) Conduit installed with wrinkles, kinks, or not in accordance with recognized industry standards shall be replaced by the Contractor at no additional cost to the project.

10) Conduit installed in concrete suspended slabs or in concrete walls shall be PVC. If needed for the design of the project, obtain written approval from the structural engineer prior to any
design submission.

11) Conduit installed inside masonry walls shall be PVC or EMT.

c. Fire Alarm Circuits

For raceways containing fire alarm circuits, all conduit connectors and junction box covers shall be painted red.

d. Signal Conductors (Low Voltage)

Low voltage signal conductors (30 V / 1,000 V.A., or less) and conductors used for mechanical equipment controls shall be run in raceways.

e. Security Conductors (Low Voltage)

1) Low voltage security conductors shall be specified in conduit. *Exception:* When approved by UCard, security conductors may be routed in a cable tray installed above a UCard approved secured ceiling.

2) Loose routing of security cables shall not be allowed.

C. Conductors

*REVISED:*

(2) Aluminum conductors may be considered for feeders and services in sizes #1/0 and larger where approved by the DFCM Director and the user/agency of the project. Aluminum conductors are allowed on University of Utah campus between the building transformer and the building main distribution panel.

(4) Metal Clad Cable.

Type MC Cable is allowed only when concealed in ceilings or walls. MC Cable must be protected from physical damage and supported directly from the building or structure by use of a listed support. MC Cable home runs are not allowed. Home runs must be in conduit from the electrical panel or cabinet to the first junction or pull box. MC Cable used for Fire Alarm System Signaling or Initiation Circuits must have an overall outer coating of red. **MC Cable is allowed on University of Utah facilities except in the following locations:** Laboratories, Research facilities or work areas, and Mechanical, and Electrical Rooms. Where allowed, the MC Cable shall be labeled at each junction box, fixture, and receptacle. MC Cable shall not be used to penetrate floors or be encased in concrete.
(8) **Size / Stranded Requirements**

a. Minimum size conductors for power and light circuits shall be #12.

b. Conductors for control and fire alarm circuits may be smaller, but shall meet the requirements of the circuits they serve.

c. All conductors #12 and larger shall be stranded.

(9) **Neutrals**

a. All neutrals on distribution systems shall be sized to handle nonlinear loads.

b. **Branch Circuit Neutral Conductors**

1) **Lighting Circuits**

   A common neutral shall be allowed to serve not more than three circuits each connected to a separate phase and installed in a single raceway.

2) **Outlet Circuits**

   a) A separate neutral shall be installed for each phase conductor.

   b) Not more than three circuits, including separate neutral conductors, may be installed in a single raceway.

   c) Conductor ampacity should be corrected based on applicable de-rating factors.

(10) **Splices**

Splices for wire sizes #10 and smaller shall be screw on type. Crimp on splices designed to be used without wire stripping shall not be allowed.

(11) **Color Coding**

Color coding for conductors on University projects shall follow the following table:

<table>
<thead>
<tr>
<th>CONDUCTOR</th>
<th>208Y / 120V System</th>
<th>480Y / 277V System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>Phase B</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>Phase C</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
</tbody>
</table>
D. Grounding: Provide a separate green grounding conductor enclosed with phase conductors in all raceways on the load side of the service entrance.

**ADDED:**

(2) NEC and NESC Compliance

Design each grounding system in accordance with NEC and NESC.

(3) Insulated Conductors

Specify all ground conductors shall be insulated cables.

(4) Feeders

a. 480v Feeders

Raceways used for 480 volt feeders shall include a code sized green insulated ground conductor.

b. 208v Feeders

1) Raceways

a) Raceways used for 208 volt feeders shall include two code sized insulated ground conductors. These ground conductors include:

   (i) Common or Equipment Ground

   One ground conductor shall be used for the common (or equipment) ground, and shall be connected to an electrical panel's bonded ground bus at each end.

   (ii) Isolated Ground

   One ground conductor shall be used as an isolated ground system for sensitive equipment. This conductor shall be connected to an
Electrical panel's insulated ground bus at each end.

(5) Panels and Distribution Boards
a. 480v Panels

480 volt panels and distribution boards shall include a bonded ground bus.

b. 208v Panels

208 volt panels and distribution boards shall include both a bonded ground bus and an insulated ground bus. The insulated ground bus is intended to provide an isolated ground system for sensitive equipment.

(6) Branch Circuits
a. Raceways used for single or multiple branch circuits shall include a code sized green insulated ground conductor.

b. Circuits used for isolated ground outlets shall be run in separate raceways; or, shall have a separate green insulated ground conductor installed and tagged with identification at all outlet and junction boxes.

(7) Conduits
a. All metallic conduits shall be properly grounded and bonded.

b. Specify a separate code sized insulated ground conductor, terminated to an insulated/isolated ground buss for each of the following applications:

1) Conduits serving as panel or other feeders.
2) Conduits serving branch circuits
3) Conduits serving outlets anticipated to power computers or word processors.
4) Conduits serving isolated ground receptacles.
5) Full length of all plug strips and other surface wire ways.
6) All flex conduits.

E. Medium Voltage

(1) Medium Voltage Conductors:

**ADDED:**
a. Cables and Terminations
1) Medium voltage cables shall be single conductor cable rated to 15.5kV. Conductor shall be stranded, class B annealed copper, covered with an extruded semi-conducting ethylene propylene rubber (EPR) strand screen, 220 mil EPR insulation extruded EPR semi-conducting insulation screen 5 mil bare copper shielding tape with 12-1/2% minimum overlap, 80 mil flame retardant PVC jacket overall, 15kV type ungrounded neutral with 133% insulation level.

2) Each cable shall be individually wrapped using fire retardant electric arc proofing tape for its entire length where it is not located inside of a duct bank (i.e., inside each manhole, vault, transformer, switchgear section, etc.).

3) Each cable shall be individually mounted to the manhole with Unistrut supports (or equal) using porcelain or ZSI, Inc. Cush-A-Grip cable clamps (or prior approved equal).

4) All feeders entering a manhole shall ring the manhole a minimum of 360 degrees prior to terminating onto a switch or exiting the manhole.

5) Each medium voltage feeder which is part of the main distribution line shall consist of (3) #500MCM 15kV cables with (1) #4/0 THWN Cu ground.

6) Each medium voltage feeder branching from the main line to a transformer shall consist of (3) 4/0 15kV cables with (1) #4/0 THWN Cu ground.

7) Each ground conductor shall be grounded at each manhole or transformer/switch vault.

8) Conductors shall be color coded by phase with colored tape.
   a) The University phasing scheme is: Phase A – Red, Phase B – Yellow, and Phase C – Blue.
   b) Phase designation shall be provided near each entrance or exit point inside a manhole, vault or pad location, at 10’ on center inside a manhole, at any switch section the feeder connects to, and inside the primary compartment of each transformer.

9) Feeder Identification Tags
   a) Feeder identification tags shall be provided for each cable, attached to phase B using a black weather resistant zip tie, in each manhole or transformer vault.
b) See B. / (11) Labeling & ID Tags / b. / 3) / c. MV Cable for tag requirements.

10) Cable terminations shall be molded product, 600A dead break and 200A load break. Splices shall be either heat shrink or cold shrink style.

11) Acceptable Manufacturers

a) Cable
   Okonite, Kerite Company, General Cable Corporation and Superior Essex

b) Splices
   3M, Raychem TE

c) Terminations
   Thomas & Betts Elastimold, Cooper Power Systems, 3M and Richards Manufacturing

d.) Switches

1) General

a) The University’s underground medium voltage electrical distribution system is sectionalized by load break switches. Extensions to the underground distribution system shall be designed with load break switches described herein, mounted on concrete pads, and enclosed by a block wall with a lockable metal gate.

   (i) Switches shall not be allowed in manholes, unless approved in writing by Facilities Management through the University Project Manager.

2) Enclosure / Screen Wall

a) Design an enclosure or screen wall for exterior transformer(s) and/or switch(es). Enclosure / screening requirements described herein apply to both switches and transformers (transformer equipment requirements are provided below under I. Electrical Distribution).

b) Switch(es) may be combined with transformer(s) within the same enclosure or screened setting.

c) The design of the enclosure / screen wall shall be consistent with the architectural design of the adjacent
building and/or surrounding environment. Locate the equipment and appropriately screened setting in such a way that it is complimentary to and compatible with its surroundings.

d) Each switch or transformer shall be mounted on a concrete pad.

e) Design the enclosure / screen wall with accessibility for maintenance and future removal / replacement of the switch and/or transformer.

f) Location and screening details shall be submitted for approval during project design to Facilities Management through the University Project Manager.

g) Switches and transformers are to be specified with cabinet locks which will suffice for basic equipment security [see 4) Cabinet Door Standardized Locks below]. If the equipment must also be placed within a gated secure enclosure, add the following features:

(i) Generally, each unit located within the secure enclosure shall have its own metal access gate facing the unit’s primary maintenance access panels.

(ii) The gate width for each opening shall be sized sufficiently wider than the unit it faces to allow direct removal and replacement of the entire unit.

(iii) The enclosure and metal gate(s) shall be rugged, maintenance free, designed to discourage entry by the public, and include an appropriate no-maintenance drainage system.

(iv) Design each gate in the enclosure to be locked with an ASSA catalog #65190B padlock. Due to security keying constraints, no other lock will be approved. See 4) Cabinet Door Standardized Locks below for cabinet lock requirements. Require the Contractor to coordinate with Facilities Management Key Shop through the University Project Manager for standardized keying instructions.

3) Solid Dielectric Switch Requirements

a) SF6 and oil switches shall not be allowed.
b) New switches shall be 15kV, 600A, pad style with switching contacts contained within a solid dielectric medium.

c) Specify combination of 600A dead break and 200A load break “vacuum fault interrupting” (VFI).

d) Require switch sections with single blade per phase, externally operable, with “quick-make”, “quick-break” mechanism.

e) Specify bushings located on the front of each switch section, disconnecting handle mounted on the side.

f) Include overcurrent protected ways with a VFI and electronic controller contained in a submersible enclosure.

g) Require parking stands adjacent to each entry bushing.

h) Specify a window in each section with visible trip flags.

i) Require a disconnect handle in each section with provisions for being locked in the “on” or “off” position using the University of Utah standardized cabinet door lock described below.

j) Include contacts for future SCADA switch position monitoring.

k) Specify entry termination(s) suitable for standard 600A dead break molded elbows for incoming and outgoing lines.

l) Require VFI ways with entry terminations suitable for standard 200A load break molded elbows.

m) Specify that the switch shall be mounted on a stainless steel support structure with adequate seismic bracing.

n) Require a painted NEMA 3R enclosure.

o) Include additional spare ways for future needs of the campus electrical system.

p) Acceptable Manufacturers

(i) Thomas & Betts Elastimold

(ii) G & W Electric Company
4) Cabinet Door Standardized Locks
   a) Specify specific padlocks for each lockable cabinet door. Exterior rated weatherproof industrial grade padlocks shall be ASSA catalog #65190B, #2 padlocks, with rekeyable cores and non-retaining key.
   b) All padlocks shall be keyed alike with the University’s master electrical key.
   c) Require the Contractor to coordinate with Facilities Management Key Shop through the University Project Manager.

5) Labels and Identification Tags
   a) A switch identification tag shall be provided to identify the switch and its service information.
   b) See B. / (11) Labeling & ID Tags / b. / 3) / d) and e) for tag and attachment requirements.

(2) Medium Voltage Duct Banks.

*ADDED:*

a. Communication Duct Banks

Communication duct bank requirements are not provided in this section. See 3.5 Electrical Communications and Security Wiring Systems for communication duct bank requirements.

b. Spare Ducts in Medium Voltage Duct Banks

The A/E’s design shall include spare ducts within the duct bank in consideration of future needs of the campus electrical system.

c. Assembly Requirements for Medium Voltage Duct Bank

1) A duct bank shall be an assembly of conduits with, supports, rebar, etc., encased in concrete and buried as described below.

2) Primary ducts in a straight-line, or near straight-line duct bank (not at building or manhole entries) shall be 5” schedule 40 PVC conduits, spaced a minimum of three inches between ducts.

3) Duct bank turns greater than 30 degrees shall require 5” diameter elbows of either galvanized rigid conduit wrapped with PVC tape, or fiberglass sweep elbows, connected to straight length conduit with smooth transitions.

4) Each conduit in the duct bank at building entry, vault, or
manhole entry shall be a 10 ft. length of rigid conduit, wrapped in PVC, connected to up-line conduit with smooth bore couplings, and threaded at the open end. Terminate each conduit opening in the building, vault or manhole with a flush mounted “bell-end” threaded into each conduit opening. Metal bell-ends shall be galvanized, rigid metal, and installed flush in the wall.

5) Each duct bank shall have a minimum of two (2) 1” schedule 40 PVC conduits located at the top of the duct bank (for future SCADA and 120V power connections in the manhole). Require these conduits to be terminated with a small extension into the manhole to allow for future connection to or extension of the conduit.

6) Rebar in the duct bank shall consist of U-shaped #3 cross rebar installed at 36” on center along the entire length of the duct bank. The cross rebar shall be pounded a minimum of 12” into the ground below the bottom of the duct bank.

7) The duct bank shall contain two (2) 4/0 bare copper grounds running throughout its entire length. The ground cables shall be terminated at grounds within each manhole or vault.

d. Concrete Encasement

1) Concrete encasement shall be a minimum of three inches between conduits, and four inches between conduits and earth.

2) Require the Contractor to either mix red dye in the concrete, or sprinkle red dye on top of freshly poured concrete while still wet.

e. Soil Cover Requirements

1) Coordinate site grading and landscaping to provide a minimum of 36” cover between finished grade and the top of the duct bank.

2) Require the Contractor to install a yellow metallic locator ribbon during backfill. The locator ribbon shall be placed directly above the centerline of the duct bank and 12” below finished grade.

f. After Installation

1) After installation, direct the Contractor to pull a mandrel through each duct to insure that no debris has collected in the duct. The mandrel shall be not less than 12 inches long, and the mandrel diameter shall not be less than 1-1/2 inches diameter smaller than the duct diameter.
2) Direct the Contractor to insert a full length polypropylene pull rope in each unused conduit, connect a plastic conduit plug to each end of the rope, and seal the plugs to each end of all unused conduits with silicone sealant.

g. Labeling Requirements

1) Require the Contractor to install a permanent engraved label on each end of the duct bank near the duct bank’s placement within the building/manhole/vault.

2) Additionally, the Contractor shall be required to install a permanent engraved label for each conduit leaving the manhole. Specific instructions are provided in B. / (11) / b. / 3) / b) herein.

**ADDED:**

(4) University Manholes

a. General

Manholes will be included in the design of the University’s underground medium voltage electrical distribution system in accordance with the requirements below. *Note:* Communications manholes have separate requirements. See 3.5 Electrical Communications and Security Wiring Systems for communications manhole requirements.

b. Site Location

1) The placement of manholes on campus shall be carefully considered with Facilities Management through the University Project Manager.

2) The A/E shall develop the proposed distribution design layout and manhole locations using information found in the University Campus Master Plan. The distribution design shall address the electrical power needs for the project and include the needs of existing buildings and future facilities identified in the Campus Master Plan.

3) Manhole placement shall include consideration for reasonable pulling tension.

4) Access hatches for manholes shall be located in landscaped areas and not in parking lots and roadways.

c. Manhole Size

University manholes shall be 10’ wide x 16’ long x 9’ high (inside
d. Manhole Fabrication and Accessory Requirements

1) Manhole Fabrication Requirements

a) The manhole shell shall be fabricated with 8” reinforced concrete walls, roof and floor, either cast in place or pre-cast. Knock out panels shall be provided as needed for the project.

b) Manhole construction shall be suitable for an H20 highway loading.

c) Require a full width lift off panel on the roof for equipment access.

d) The access opening shall be located in the corner of the manhole opposite the location of the medium voltage switch.

e) Grade rings are preferred to be poured in place to match existing grade or slope.

f) Specify waterproofing for manhole openings, including the manhole entrance, air vents, etc. Require the Contractor to seal openings, grade rings, etc., with Sika “Sikadur Combiflex” sealing system or prior approved equal.

g) Each manhole shall have openings for two 12” schedule 80 PVC air vents. The vent openings shall be located on opposite walls, one located near the bottom of one short wall, and the other near the top of the opposite short wall. See “Manhole Accessory Requirements” below.

h) Specify flush mounted cast-in horizontal cable supports, equal to galvanized Unistrut, for the manhole walls.

(i) Specify a minimum of (3) evenly spaced rows of Unistrut supports with the lowest support at 12” above the finished floor of the manhole, and the remaining two installed at 3’-8” and 6’-4” above the manhole floor.

(ii) These Unistrut cable supports shall circle the full interior, on all four walls of the manhole.

i) Each manhole shall have four (4) iron ring pulling eyes cast into the manhole walls, one near the floor of each wall, centered on the wall.
j) Each manhole floor shall be sloped to a grate drain and matching frame in the center which will drain to a rock sump provided under the manhole floor.

2) Manhole Accessory Requirements
a) Entry Hatch

(i) Specify a 4’ x 4’ galvanized steel “floor/vault/sidewalk” style hatch with two (2) 2’ x 4’ doors.

(ii) Cover and frame shall be 1/4" galvanized steel.

(iii) Cover shall be diamond-patterned with a hot-dipped galvanized finish.

(iv) Specify a formed channel frame with full anchor angle welded around the perimeter, designed for the collection and draining of water. The hatch frame shall have a 1-1/2” drain coupling welded under the frame assembly, suitable for connection to an auxiliary drain pipe. The collection system shall be adequately sized to divert storm water or landscape irrigation from entering the manhole.

(v) Hatch operators shall be compression springs enclosed in telescopic tubes to provide lift assistance for each cover door. An automatic hold-open arm with grip release handle shall be specified for each door.

(vi) Specify 3/8" forged brass heavy duty hinges with stainless steel hinge pins. Hinges shall be recessed into the doors to provide a flush surface.

(vii) Specify a stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle. The access cover for the exterior handle shall be a screw plug insert which is gasketed and flush with the cover.

(viii) Require the Contractor to connect a full size drain from the frame drain coupling to a gravel sump (separate from the manhole air vent drywells).
The access hatch covers and entire assembly shall be designed to withstand an H-20 wheel loading.

b) The manhole ladder shall extend from floor to hatch entry point. The ladder shall be all stainless steel, 14” wide, with 1-1/2” x ½” runners and 3/4” knurled risers at 12” on center. The ladder shall be securely bolted to the structure at the top and bottom of the manhole with stainless steel bolts.

c) Design a full width lift off panel in the manhole roof for equipment access.

d) University manholes shall have two (2) 12” schedule 80 PVC air vents attached to opposite short walls.

(i) Air vent entries shall be located near the bottom of one short wall, and near the top of the opposite short wall.

(ii) Each air vent riser shall extend below the manhole wall entry into a gravel drywell (1 cubic yard of gravel). This extension will allow rain and irrigation water flowing down from the topside air vent termination box to bypass the manhole wall entry and continue down into the gravel drywell.

(iii) The A/E’s design shall show the location of the joint air vent termination box. Both air vents shall be routed into a 24” x 24” concrete box with a powder coated expanded metal top (color to match or blend with the landscape surroundings). The vents shall extend up into the concrete box 12” above finished grade, flush with the expanded metal top. The vent outlets and concrete box shall be located in landscaped areas (sidewalks and parking areas must be avoided).

e) Include specifications for an appropriate rock sump under the manhole grate drain.
f) In addition to the flush mounted “cast-in” horizontal Unistrut supports, require the Contractor to install vertical, surface mounted, cable supports over the cast-in horizontal supports, equal to galvanized Unistrut. Vertical cable supports shall be installed in a minimum of four (4) columns along each long wall, and two (2) columns along each short wall.

g) Require the Contractor to install a grounding ring, consisting of a 4/0 bare copper conductor, circling the entire manhole. Require the following connections to this ground ring:

(i) Two (2) 3/4” x 10’ copper clad ground rods located in opposite corners.

(ii) All Unistrut support racks.

(iii) Each bell end at each duct bank.

(iv) Each ground conductor running through the duct bank.

h) Each manhole shall have two (2) evenly spaced, ceiling mounted, vapor tight, wet location, 120V, compact fluorescent, cast aluminum “jelly jar” light fixtures with cast guard. A light switch, enclosed in a cast iron box with weatherproof flip cover, shall be located near the manhole entrance.

i) Each manhole shall have one (1) 20A, 120V duplex receptacle in a cast iron box with weatherproof flip cover, located on a wall near the top.

j) Require the Contractor to install a University furnished manhole identification tag at each manhole. Specific instructions are provided in B. / (11) / b. / 3) / h) herein.

k) Cable entering / leaving the manhole shall enter / exit through 10”-0” rigid conduit with bell ends at the manhole interior wall.

l) Require the Contractor to ring the manhole with each cable before terminating.

m) Support each cable in the manhole at Unistrut cable supports with rubber cush-grips.
n) Specify and/or detail all required safety connections (i.e., deadbreak connectors with cable clamps, drain wire, neutral grounds, etc.).

(5) Transformer Vaults on Campus

a. Transformer vaults shall be designed at locations where vault doors open directly to the outside.

b. Vault doors shall be sufficiently sized to allow full access for removal and replacement of the transformer(s) and switch(es).

c. Design adequate outside ventilation for transformer cooling per manufacturer’s requirements. Transformer fan cooling shall not be allowed.

d. Transformers with external wiring to open insulators shall be oriented in the vault with the high voltage side against a wall.

e. Transformers and associated switch gear shall be set on individual concrete housekeeping pads 6” above floor level.

f. Generators shall not be allowed to be located in transformer vaults.

F. Motor Controllers

(1) Motor controllers:

ADDED:

a. Combination Starters

1) Combination starters shall be specified as full voltage, non-reversing magnetic type. Disconnect shall be quick make, quick break. Starters shall have electronic resettable thermal overload elements for all three phases. Minimum starter size shall be NEMA 1. Starters shall be specified with hand-off-auto selector switch.

2) Acceptable Manufacturers

a) Eaton Corporation Cutler-Hammer

b) GE Energy

c) Siemens AG
b. Electronic Solid State Starters (where applicable)

1) An electronic soft start system shall typically be specified for each motor 10HP and above. Soft start systems shall incorporate the features of the combination starter in addition to the following:
   a) 18 Pulse converter design to maintain minimal AC line distortion.
   b) Adjustable ramp start of 0.5-180 seconds.
   c) Adjustable current limit of 0-85% of locked rotor current.
   d) Adjustable soft stop from 0-60 seconds.
   e) Electronic timing relay adjustable from 0.1-60 seconds.
   f) Automatic fault isolation.
   g) Elapsed time meter located on the front door of the starter.

2) Acceptable Manufacturers
   a) Eaton Corporation Cutler-Hammer
   b) GE Energy
   c) Schneider Electric Square D
   d) Siemens AG

c. Motor Control Centers (MCC)

1) All motor control centers shall be specified with:
   a) Copper busing.
   b) CU/AL rated lugs.
   c) Circuit breaker type.
   d) Two normally open and two normally closed spare contacts for all controllers.
   e) No external control wiring. Auxiliary contacts shall be used.
2) Specify wiring standard to be Class-B.

3) Require the Contractor to install a permanent engraved label(s) to clearly identify each controller and any spares/spaces. Specific instructions are provided in B. / (11) / b. / 3) / j) above.

4) Acceptable Manufacturers
   a) Eaton Corporation Cutler-Hammer
   b) GE Energy
   c) Schneider Electric Square D
   d) Siemens AG

(2) Variable Frequency Drives:

ADDED:

a. General Requirements

VFD specifications shall require complete schematic drawings, catalog sheets and wiring diagrams showing actual components, including part numbers, and how they are all interconnected. All of these items shall be included in the Operation and Maintenance Manuals with test certificates, warranties and a listing of qualified service personnel responsible for all warranty work.

b. Specific VFD Requirements

1) Each drive shall be specified as a complete system and shall be assembled in a single NEMA rated enclosure suitable for the conditions in which it is to be located.

2) Where multi motor units are used, each motor shall have separate overload protection.

3) Variable frequency drives shall be rated for continuous operation at 10 percent (minimum) over the full load current rating of the motor served.

4) Inverter shall be altitude compensated, and sized for the elevation at which it is installed. Inverter shall be mounted on a removable panel to facilitate maintenance. Inverter shall be VT rated.

5) Specify remote signal connection terminals (0-10 VDC = 0-100% speed, or, 4-20 mA = 20-100% speed). Label the VFD cabinet specifying which control signal is used.
6) AC line reactors shall be specified.

7) Specify surge suppressors for the line side conductors feeding each variable frequency drive.

8) Specify reactive filters for the load side conductors feeding each variable frequency drive.

9) Cooling fans and filters are required in all variable frequency drive enclosures. Filters are to be replaced with new at Substantial Completion.

10) Short circuit protection shall be provided through an externally operated, door interlocked fused disconnect, circuit breaker, or motor circuit protector (MCP). MCP shall allow for trip adjustment sufficient to start the motor across the line in the bypass mode and normally will be set at a minimum setting for maximum protection in the VFD mode. The door interlocked handle must be capable of being locked in the off position and be pad lockable.

11) Overcurrent protection shall be provided in the VFD system through electronic motor overload (MOL) circuits with instantaneous trip, inverse time trip, and current limit functions which shall be adjustable and optimized for the application.

12) Over- and under-voltage protection, over-temperature protection, ground fault protection, and control/microprocessor fault protection shall be provided. These protective circuits shall cause an orderly shutdown of the VFD, provide indication of the fault condition, and require a manual restart, except for an under-voltage condition. Under-voltage from a power loss shall be set to automatically restart after a time delay and return to normal power.

13) Control power for operator devices shall be 120 volts with primary and secondary fuses.

14) Specify integral harmonic mitigation to ensure maximum total harmonic distortion is 3% for voltage and 12% for current.

a) See J. Power Quality / (6) below for additional requirements.

15) Require the capability to connect each VFD to the University’s building management system (see 3.5 Mechanical Part 1).
16) The VFD shall have a three contactor bypass arrangement.

17) All wiring for the VFD will be hot emboss marked for ease of troubleshooting.

18) Each complete variable frequency drive package shall be listed and carry the label of at least one of the following:
   a) UL - Underwriters Laboratory
   b) ETL - ETL Testing Laboratories, Inc.

19) Specifications shall require a five year warrantee for parts and labor.

20) Vendor start up shall be specified for each variable frequency drive system.

c. Inverter Protective Features / Required Alarms
   1) Overcurrent Shut-Off
   2) Regenerative Overvoltage
   3) Electronic Thermal Protector
   4) Heatsink Overheat
   5) Instantaneous Power Failure
   6) Ground Fault

d. Door Mounted Operator Devices
   Door mounted operator devices shall be industrial oil tight similar to those found on motor control centers.

e. Required Door Mounted Operator Controls
   1) Hand/Off/Auto switch
   2) Local/Remote switch
   3) Frequency Setting Speed Pot
   4) Power On light
   5) VFD Enable light
   6) VFD Fault light
7) External Fault light (safeties interlock)
8) Bypass switch (for motors over 5 HP)

f. Required Termination Points on Field Connection Terminal Strip

1) Safeties Interlock (N.C. contacts located remote)
2) Remote Start/Stop Contact (N.O. contacts located remote)
3) Remote VFD Fault Contacts (N.C.)
4) Remote VFD/Bypass Enable Contacts (N.O.)
5) Remote Electronic Signal Input

g. Environmentally Controlled Room

Each motor controller shall be installed inside the building in an environmentally controlled room. Written approval must be obtained from the University Project Manager, Facility Operations staff electrical engineer, and Electric Shop for any exterior installation, including controllers serving rooftop equipment.

h. VFD Local Vendor Requirements

1) The vendor must be actively engaged in supplying pulse width modulated adjustable speed (variable frequency) drives and custom built up systems as a certified manufacturer’s representative, and must have a minimum of two years of experience in supply and manufacturer authorized installations.

2) The vendor must maintain full time service personal on call 24 hours/day as well as authorized parts and service facilities within 250 miles of the University with a demonstrated record of satisfactory service for at least the last two years.

3) When a project requires "built-up" assemblies which are not "factory-standard" products, require the installing vendor to have UL 508C or ETL certification. Certification is to be submitted with the shop drawings.

i. Label Requirements

Require the Contractor to install a permanent engraved label mounted to the exterior face of the controller. Specific instructions are provided in B. / (11) / b. / 3) / k) above.
j. Acceptable VFD Manufacturers – No Others Approved

1) Danfoss
2) GE Energy
3) Mitsubishi Electric Automation
4) Rockwell Automation Allen Bradley
5) Yaskawa Electric America

(3) VFD Manual Bypass
Provide a manual bypass of the VFD as part of controller.

ADDED:

a. A manual isolation bypass switch shall be specified for VFD’s rated over 5 HP. The manual isolation bypass switch shall be on the line side of the inverter allowing maintenance operations to be safely performed while the system is operating in bypass mode. The bypass shall include minimum of two (2) mechanically interlocked contactors.

b. Do not design a VFD system for motors 5 hp or less.

G. Electrical Distribution

(1) Overcurrent and Ground Fault Protection:

ADDED:

a. For all electrical distribution systems at the University of Utah, selective coordination and short circuit studies shall be completed by the A/E and submitted as part of the Construction Documents phase submittal. The A/E shall assume an infinite bus on the primary side of all building transformers. Settings for all adjustable trip breakers shall be provided to the Contractor prior to electrical system startup.

b. Electrical service to all University buildings shall be 120/208V, 3P, 4W or 277/480V, 3P, 4W, or both.

(3) Transformers:

ADDED:

a. Distribution Transformers for University Buildings

1) Transformers shall be pad mounted on the exterior of the building or in a vault with adequate access to the exterior allowing replacement of the transformer. Transformers shall meet the following requirements as a minimum:

a) Pad mounted.
b) All copper windings with a delta primary and wye secondary.

c) FR3 insulation fluid (vegetable oil based) with nitrogen blanket.

d) Four (4) 2-1/2% full capacity primary winding taps, with two above and two below the rated primary voltage with an externally operated de-energized tap changer.

e) Transformer primary shall have two (2) sets of three (3) 200A bushing wells (loop feed style) that will accept load break elbows or lightning arrestors. Lightning arrestors shall be provided and installed on second set of bushings.

f) Each transformer shall be capable of being readily and easily locked. Provide exterior weatherproof, industrial grade rated padlocks for each transformer lockable cabinet door. Specify the padlock to be an ASSA catalog #65190B, #2 padlock, rekeyable core, non-retaining key. Due to security keying constraints, no other lock will be approved. Require the Contractor to coordinate with Facilities Management Key Shop through the University Project Manager for standardized keying instructions.

g) Transformer sound levels shall comply with NEMA Standard TR.

h) For transformers larger than 750 KVA / 208-240V secondary, and 1500 KVA / 480V secondary, the low voltage bushings shall be wall mounted with additional insulated support for the bushings.

2) Transformers shall have a 12470V primary rating. If fed from an existing feeder that is not on the new campus standard 12470V system, the transformer shall be specified to be dual rated to allow for future transition to 12470V.

3) Each transformer is to be protected on the primary side by a separate solid dielectric vacuum fault interrupting switch. The specified VFI shall coordinate with the existing University electrical distribution, and settings shall be provided to the Contractor.

4) Require the Contractor to install a permanent engraved label mounted to the exterior of the transformer. Specific instructions are provided in B. / (11) / b. / 3) / f) herein.
5) Acceptable Manufacturers
   a) Cooper Power Systems
   b) GE Energy
   c) Eaton Corporation Cutler-Hammer
   d) Schneider Electric Square D
   e) MGM Transformer Company

b. Step Down Transformers for University Buildings
   1) When electrical power is needed at a voltage other than that provided by the building’s electrical service, the needed voltage may be provided by including a step down transformer in the system design.
   2) Step down transformers shall be specified with the following requirements:
      a) Dry-type, K rated.
      b) Pad mounted.
      c) Copper windings.
      d) Specify a K-20 rating with 200% neutral for transformers smaller than 300kVA intended to handle non linear loads.
      e) Specify a K-13 rating with 200% neutral for transformers 300kVA and above intended to handle non linear loads.
      f) Temperature rise rating shall be 115 degrees through 15kVA and 150 degrees for 30kVA and larger.
      g) Fan-assisted transformers shall not be allowed.
      h) See J. / (5) Step Down Transformers below for more requirements.

3) Require the Contractor to install a permanent engraved label mounted to the exterior of the transformer. Specific instructions are provided in B. / (11) / b. / 3) / g) herein.

4) Acceptable Manufacturers
   a) Eaton Corporation Cutler-Hammer
b) GE Energy

c) Schneider Electric Square D

d) Siemens AG

e) Synergy Energy, Inc.

c. Enclosure / Screen Wall for Exterior Transformers

See G. Medium Voltage / (1) Medium Voltage Conductors / b. Switches
/ 2) Enclosure / Screen Wall for specific requirements regarding
screening / enclosing exterior transformers.

(5) Utility Metering:

**ADDED:**

a. Specify a complete metering system with the capability to connect by
   Ethernet to the main campus utility management system.

b. Provide an empty raceway from each service meter to the closest telecom
   room.

c. For buildings over 2,000 square feet, specify a digital power meter with
   the following:

   1) True RMS metering.

   2) Standard CT and PT inputs.

   3) 0.2% Accuracy for current and voltage.

   4) Min/Max displays for metered data.

   5) On-board clock and calendar.

   6) Standard RS-485 communications.

   7) Set-point controlled alarm/relay functions.

   8) On-board event and data logging.

   9) Waveform capture.

   10) High speed triggered 12 cycle event capture.

   11) Date/time for each min/max.
12) Optional voltage/power module for direct connection to 480Y/277V systems.

13) Non volatile memory.

14) Front panel features:

a) LCD digital electronic display with ability to show:

<table>
<thead>
<tr>
<th>Real Time / Instantaneous Readings</th>
<th>Demand Readings</th>
<th>Energy Readings</th>
<th>Power Analysis Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current (per phase, N, G, 3phase)</td>
<td>Current (per phase present, peak)</td>
<td>Accumulated energy – real</td>
<td>Crest factor (per phase)</td>
</tr>
<tr>
<td>Voltage (L-L, L-N)</td>
<td>Average power factor (3phase total)</td>
<td>Accumulated energy – reactive</td>
<td>K-factor demand (per phase)</td>
</tr>
<tr>
<td>Real power (per phase, 3phase)</td>
<td>Demand real power (3phase total)</td>
<td></td>
<td>Displacement power factor (per phase, 3phase)</td>
</tr>
<tr>
<td>Reactive Power (per phase, 3phase)</td>
<td>Demand apparent power (3phase total)</td>
<td></td>
<td>Fundamental Voltages (per phase)</td>
</tr>
<tr>
<td>Apparent Power (per phase, 3phase)</td>
<td></td>
<td></td>
<td>Fundamental Currents (per phase)</td>
</tr>
<tr>
<td>Power Factor (per phase, 3phase)</td>
<td></td>
<td></td>
<td>Fundamental Real Power (per phase)</td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td>Harmonic Power</td>
</tr>
<tr>
<td>THD (current and voltage)</td>
<td></td>
<td></td>
<td>Unbalance (current and voltage)</td>
</tr>
<tr>
<td>K-factor (per phase)</td>
<td></td>
<td></td>
<td>Phase Rotation</td>
</tr>
</tbody>
</table>

b) Kilo/Mega units LEDs.

c) Meter indication LEDs.

d) Setup/rest parameter.

e) Phase select button with phase indication LEDs.

f) Model select button with mode indication LEDs.

g) Select meter buttons.

h) Communication port.

d. Acceptable Digital Power Meter Manufacturers

1) Electro Industries/Gauge Tech (EIG) “Shark”

2) GE Energy

3) Schneider Electric Square D “Power Logic”
(6) Switchboards and Panel boards:

**ADDED:**

a. Switchboards / distribution boards for University of Utah projects shall be specified with:
   1) Copper busing.
   2) CU/AL rated lugs.
   3) Circuit breaker type.
   4) Fully rated.
   5) Minimum of 50% spare and space capacity.

b. For remodeling projects, match new switchboards and distribution boards to the manufacturer/style of existing units in the building.

c. Include with the panel schedule, where applicable, information identifying the conductor insulation color for (a) all ungrounded conductors, (b) grounded conductors, and (c) equipment and isolated grounding conductors.

d. Labeling Requirements
   1) Specify a permanent engraved label for all switchboards mounted on the outside face of switchboard.
   2) Specify a permanent engraved label to clearly identify each switchboard breaker and spare/space.
   3) Specific instructions are provided in B. / (11) / b. / 3) / i) herein.

e. Acceptable Manufacturers for Switchboards / Distribution Boards
   1) Eaton Corporation Cutler-Hammer
   2) GE Energy
   3) Schneider Electric Square D
   4) Siemens AG

(7) Panel boards:

**ADDED:**

a. University panel boards shall be specified with:
   1) Copper busing. Aluminum alloy bus bar is allowed in Building Main Distribution Panels rated 800 amps and above.
   2) CU/AL rated lugs.
3) Circuit breaker type with bolt-on style breakers.

4) Fully rated.

5) Minimum of 50% space capacity.

6) Equipment and isolated ground bus.

b. For remodeling projects, match new panel boards to the manufacturer/style of existing units in the building.

c. Panel board covers shall be hinged door-in-door style. Each door shall have a flush, stainless steel cylinder lock with catch and coil spring loaded door pull. All panels shall be keyed alike, but inner and outer doors shall not be keyed alike.

d. Panel boards shall have a sufficient number of spare conduits stubbed into ceiling spaces (or alternate locations approved by the University Project Manager and Electric Shop) to allow for full future utilization of the spare capacity available in the panel board.

e. Panel boards shall have sufficient space inside the cabinet for future cable pulls.

f. Provide a permanent engraved label for all panel boards mounted inside the door for flush panels and on the outside face of the door for surface panels. Specific instructions are provided in B. / (11) / b. / 3) / i) above.

g. Acceptable Manufacturers for Panel boards

1) Eaton Corporation Cutler-Hammer

2) GE Energy

3) Schneider Electric Square D

4) Siemens AG

ADDED:

(9) Disconnecting Means for University of Utah Projects

a. Equipment disconnecting means (thermal switch, disconnects, fused disconnects, circuit breakers, etc.) are to be provided at the unit or immediately next to the unit served. Installation of the disconnecting means at a remote location from equipment, or using a circuit breaker at the power panel as disconnecting means for equipment are not acceptable installation methods.

b. Final location of the equipment disconnects and controllers (air handlers, condensing units, exhaust fans, roof top units, pumps, etc.) are to be
coordinated with the Facility Operations staff electrical engineer and Electric Shop through the University Project Manager prior to issuing construction documents.

c. The A/E’s design shall facilitate compliance to OSHA CFR 1910.147, Control of Hazardous Energy (Lock Out Tag Out).

(10) Outlets

a. Outlets shall utilize standard NEMA configurations. Minimum outlet rating shall be 20A.

b. A minimum of one electrical convenience outlet powered from the emergency electrical system shall be provided at each transformer vault/pad, main electrical room(s), and generator location.

c. Special purpose outlets (208V, 1p, 20A) shall be provided for University supplied pressure washers at each air handler, roof top unit, or any other mechanical equipment with heating/cooling coils.

d. Outlets shall be color coded based on the power source and size of the device as follows:

1) Normal power – White

2) Emergency power – Red

3) UPS Power – Blue

4) Isolated Ground (Clean Power) – Orange

5) All devices greater than 20A – Black

6) The entire body of the wiring device should be the same color (i.e., a wiring device with an orange triangle on a white body is not an acceptable wiring device for isolated ground receptacle).

(11) Engine Generator Sets for University of Utah Projects

a. Each new building on campus shall be designed with an emergency generator to provide power for life safety, legally required standby systems, and optional standby systems.

b. A secure enclosure or area shall be designed around the generator.

c. Each generator shall meet the following requirements as a minimum:

1) Diesel fuel operated.

2) Skid mounted fuel tank providing capacity for 8 hours of operation at full load.
3) Four pole automatic transfer switch (ATS) with manual bypass. A separate ATS shall be provided for each type of emergency load served.

   a) During design, consideration should be given to adding a secondary transfer switch for generator testing at buildings with critical research equipment. The monthly generator test normally interrupts building power for approximately 10 seconds. This could adversely affect research activities so a second transfer switch for non-life safety systems is required at buildings with critical research equipment.

4) Waterproof, level II sound attenuated enclosure.

5) Critical silencer including flexible exhaust fitting.

6) Meet the latest EPA Tier Standard.

7) See J. Power Quality / (8) below for additional requirements.

d. Generators shall not be installed in transformer vaults or switch rooms.

e. Each generator installation shall be tested at full load for a minimum of 2 hours using load banks.

   1) Fuel and suitable load bank equipment shall be specified as the responsibility of the Contractor for the test.

   2) Follow testing requirements found in NFPA 110 (tested under load, transfer switch operation verified).

   3) Require the Contractor to schedule inspection(s) by the code official(s) for code compliance, including verification of testing under load and transfer switch operation.

   4) For ‘research critical’ buildings, design the transfer system such that operation of the secondary transfer switch will easily protect non-life safety research processes / systems during the monthly generator test.

f. Require generator emission data to be submitted through the University Project Manager to the University Department of Environmental Health and Safety for review and generator approval.

   1) During design, coordinate early with the University Project Manager to establish a timeline and application / submittal requirements for generator approval by the jurisdiction having authority.
g. Acceptable Manufacturers for Engine Generator Sets

1) Caterpillar
2) Cummins Onan
3) Detroit Diesel
4) Generac Power Systems
5) Kohler Power Systems

(12) Uninterruptible Power Supplies for University of Utah Projects

a. Uninterruptible power systems shall not be designed for whole building or overall project applications. Any intent to design a building-wide or large UPS system must be approved in writing early in the design phases by Facility Operations staff electrical engineer and Electric Shop through the University Project Manager.

1) Local UPS units are generally the responsibility of the end user department which will occupy the completed project. Each user department will typically furnish and install its own electronic systems and include local UPS units with their in-house purchases.

b. If approved for large system applications:

1) UPS systems shall include all equipment to automatically provide the specified voltage, current and frequency at its output terminals when utility, generator or battery power is available at its input terminals.

2) The system shall be rated for continuous duty at full load.

3) The system shall include local and remote monitoring and alarm facilities to provide advance warning of UPS equipment failure or power system failure to allow computer shutdown.

4) The system shall be designed to be serviced where it is installed without removal of any part for return to manufacturer or service facility.

5) See J. Power Quality / (9) below for additional requirements.

6) UPS Vendor Requirements:

   a) The vendor supplying the UPS system shall be “local” with office and staff based along the Wasatch Front.
b) The vendor must be actively engaged in supplying UPS systems as a certified manufacturer’s representative, and must have a minimum of two years of experience in supply and manufacturer’s authorized installations.

c) The vendor must maintain full time service personal on call 24 hours/day as well as authorized parts and service facilities within 250 miles of the University with a demonstrated record of satisfactory service for at least the last two years.

7) Acceptable Manufacturers for Large UPS Systems

   a) Emerson Network Power Liebert
   b) MGE UPS Systems, Inc.
   c) Mitsubishi Electric Automation, Inc.
   d) Toshiba Corporation

H. Power Quality

    REVISED:

    (1) Performance Approach

        a. The A/E shall include as a basis of design an evaluation of potential Harmonic Risks to the Electrical Distribution System and provide a plan to mitigate these risks. The Power Quality Plan shall be approved by the DFCM representative for DFCM managed projects, or by the University Project Manager for University managed projects. Power Quality Testing may be performed by the DFCM or the University after the facility is occupied to determine the effectiveness of the Power Quality Mitigation approach.

    (2) Prescriptive Approach

        a. Electrical Services.

            REVISED:

            i. Services of 300 KVA or larger shall be 277/480 volt at the Service Main Disconnecting means except for those proven to be unnecessary and approved by the DFCM Director for DFCM managed projects, or by the University Project Manager, Facility Operations staff electrical engineer, and Electric Shop for University managed projects.

        c. Power Factor.

            REVISED:

            All new Construction or Upgrade of existing Electrical Services shall meet the minimum requirement of 95% and Maximum of 98% Power Factor. The DFCM Representative for State projects, or the Facility
Operations staff electrical engineer and Electric Shop through the University Project Manager for all University projects shall approve the method and layout of Power Factor Correction Capacitors prior to installation.

d. Step Down Transformers

**REVISED:**

a. All Step Down transformers shall be Energy Star Nema TPI K-rated or HMT with 200% Neutral capability, unless proven unnecessary and approved by the DFCM Representative for State projects, or the Facility Operations staff electrical engineer and Electric Shop through the University Project Manager for all University projects. The K-Rating shall be as determined by Manufacture recommendations for the equipment they serve. See I. Electrical Distribution / (3) / b. Step Down Transformers above for additional University of Utah requirements.

e. Variable Frequency Drives

**REVISED:**

For motors 15 HP and larger, provide a minimum power quality performance of 12% current THD and 3% voltage THD measured at the VFD input terminals. This shall be accomplished by using Harmonic filters or a minimum of 12 pulse drive that will comply with the power quality performance requirements. For motors less than 15 hp provide AC Line Reactors and/or DC link chokes with a minimum of 3% Impedance. Provide output filtering if the motor is located more than 50 feet from the drive. See H. Controller / above for additional University of Utah requirements.

g. Generators

**REVISED:**

For new construction a service that is to be backed up by a Generator shall be designed to have no more than 12% Current THD or 3% Voltage THD. For Existing Services to be backed up by a Generator Power Quality Testing shall be performed to determined that there is not more than 12% Current THD or 3% Voltage THD and that there is not a leading Power Factor. If there is it shall be corrected prior to bringing the Generator online. See I. Electrical Distribution / (11) Engine Generator Sets above for additional University of Utah requirements.

h. Uninterruptible Power Supplies

**REVISED:**

Provide a minimum Power Quality performance of 12% current THD and 3% voltage THD measured at the UPS input terminals. Provide filtering if necessary. See I. Electrical Distribution / (12) above for additional University of Utah requirements.
ADDED: Building Clock Systems for University of Utah Projects

e. A self-correcting clock system will be installed in University buildings either as called for in the project program, or to extend/replace existing building clock systems. The new clock system will consist of the following:

1) Clocks and Clock System Controls

a) Self-correcting clocks will operate on A/C power, shall correct via a wireless signal and be compatible with the current University system. Battery operated clocks will not be approved.

b) The clock system shall be limited to the products of SimplexGrinnell; Primex Wireless; or, Sapling, Inc. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

c) The clock system will be furnished and installed by the Contractor; however, the Contractor is required to coordinate with the University Electronics Shop prior to ordering/installing the equipment.

2) Front-End Controller

The clock system’s wireless front end controller shall be located in one of the building’s telecommunications rooms where an Ethernet connection is available. Coordinate with the Electronics Shop for an approved location to install the device. The front-end controller will monitor the precise time from an internet based master clock and relay time signals wirelessly to building clocks.

3) Installation and Set-Up

a) The University’s Plant Operations Electronics Shop must be contacted for coordination.

b) The Electronics Shop will:

   (i) Review the intended system for approval prior to the Contractors’ initial material order,

   (ii) Coordinate with the Contractor for equipment location prior to installation, and

   (iii) Work with the Contractor during system set-up.
f. Spare Fuse Cabinets

Provide spare fuse cabinet(s) in the design, located in the vicinity of the building main switchboard. Provide 10% spare fuses of each type and size specified with a minimum of three of each.

g. TVSS / SPD

Transient Voltage Surge Suppression Devices (TVSS) / Surge Protective Devices (SPD) shall be provided on building incoming electrical services, and on distribution and power panels serving sensitive electronic equipment.

h. Communication Protocols

Data communication protocol for integration of electrical systems with the building management system shall be compatible with BACnet data communication protocol. This requirement shall be applicable to all electrical systems, including, but not limited to, lighting control systems, non-local UPS systems, emergency generators, transfer switches, paralleling switchgear, power monitoring, power metering, VFDs, motorized shade controllers, etc.

(5) Fire Alarm

a. Provide addressable fire alarm systems…

ADDED:

(i) General

1) Fire alarm systems shall be fully addressable, analog and shall operate as non coded, continuous sounding systems with reverseolarity remote signal transmission.

2) All necessary provisions shall be made in the design of the fire alarm system to allow for automatic reporting of all alarms from the project fire alarm system to the remote station receiving console in Building #0301 via telephone lines.

(ii) Compatibility

All equipment, devices and installations shall be compatible with the existing system of operation.

(iii) Approved Manufacturer / Installer

1) Fire Alarm System

a) The only approved manufacturer shall be FCI (Honeywell Gamewell Fire Control Instruments) furnished and installed by Nelson Fire Systems. No
other manufacturers / suppliers / installers will be approved.

2) Fire Extinguisher Electronic Notifying Pressure Switch Monitoring System

a) Specify an electronic notifying pressure switch fire extinguisher monitoring system. The only approved manufacturer shall be MJJA, Inc., model en.Gauge. No other manufacturer will be approved.

(iv) Fire Extinguisher Monitoring System

1) During design, coordinate with the University Fire Marshall through the University Project Manager to determine the type of monitoring system (wireless or hard-wired), and type of fire extinguishers (A, B, C, D, CO₂, Halon, etc.) to be used in the project.

2) For new buildings, design a hard wired fire extinguisher monitoring system, supervised through the building’s fire alarm system.

3) For existing buildings provide fire extinguishers with wireless monitoring systems.

a) At or before the design development phase review, coordinate with the University Fire Marshall through the University Project Manager to determine the locations of wireless receivers and high power repeaters, and fix their locations on project drawings.

(v) Control Panel General Requirements

1) The fire alarm control panel shall detect the operation of any signal initiating device, display the description of the device and the area of the alarm, and print out the alarm type, location, time, and date.

2) The panel shall operate all alarm and auxiliary devices and close all fire and smoke doors.

(vi) Required System Features

1) Trouble lamp and buzzer.

2) Self-restoring silencing switch.

3) Automatic locking of all alarm signals until the device is returned to its normal condition and the panel manually reset.
4) Supervision of circuits such that a fault condition in any circuit, or group of circuits, will not affect the proper operation of any other circuit.

5) Circuit fuses for each signal initiating and alarm circuit which, if blown, shall cause the audible and visual trouble signals to operate.

6) Digital transmitter with terminals and other necessary hardware/software to permit the transmission of trouble and alarm circuits over telephone lines to a remote station receiving panel.

7) A key operated “Drill Switch” to simulate the operation of an initiating device. The switch shall not trip the device which transmits a signal to the fire department, operates elevator return systems or operates fire doors.

8) Fire alarm panels shall be red, baked enamel, lockable, 16 gauge steel, with hinged door cabinets.

9) Batteries shall be gel cell type. The system will be provided with an automatic tester and charger.

10) The battery system shall have an additional 25% spare ampere-hour capacity above that required.

11) The battery system shall be capable of operating the fire alarm system at full load for 24 hours and still provide five minutes of alarm sounding at the end of the 24 hour period.

12) Visually indicating call stations.

13) Horn/strobe indicating devices with a minimum rating of 97dB and a temporal pattern signal. Electron indication devices are not acceptable.

14) External indicating appliances allowing for notification in the direction of parking lot, playground, or other people space areas.

15) Uniquely addressable detectors, removable base, with indicating lamps.

16) Connection of all fire protection systems within the building, including special extinguishing systems and elevator lobby detectors.

17) A Fire Marshall approved key plan drawing of the entire building graphically displaying the location and address of all initiation and notification devices. The key plan drawing shall indicate area occupancies and smoke separation walls. Key
18) Pre-signal systems of any type will not be allowed.

19) Wiring Requirements

   a) Unless otherwise specified, minimum wire size shall be 16 gauge for audible alarm circuits, and 18 gauge for signal initiating circuits.

   b) Strobes shall be wired separately from audible devices, including combination horn/strobe units.

   c) Speaker and strobe wiring shall be installed in separate raceways.

(vii) Fire System Telephone Line

1) At the appropriate stage of construction, direct the Contractor to submit a formal written request to the University Project Manager who will arrange for the necessary fire system telephone line. This request must be made a minimum of two weeks prior to the final connection.

2) The Contractor shall provide two connections from the fire alarm control panel to the telephone panel, and finally to the appropriate telephone line(s) at the project end.

3) The University Department of Environmental Health and Safety (EH&S) shall make the final connection to the telephone line at the system head-end in Building #0301.

(viii) System Test

A complete system test, including all connections into the fire alarm panel, comprehensive operational review, and testing of all fire alarm devices and wiring shall be accomplished by a representative of the equipment supplier or manufacturer, qualified by the manufacturer to perform such work.

(ix) Labeling

1) Provide permanent engraved labels at each fire alarm control, notification appliance (NAC), power supply, transponder, and speaker system panel. Specific instructions are provided in B. / (11) / b. / 3) / 1) above.

2) Provide self-adhesive labels for all initiation and notification devices. Specific instructions are provided in B. / (11) / c. / 4) / g) above.
(x) Final Inspection

Upon completion of the work, require the Contractor to request a final inspection through the University Project Manager to the University Fire Marshall and University Building Official. During the final inspection, all fire alarm devices shall be tested by the Contractor and witnessed by these University officials.

(xi) Warrantee Period

Specify that the accepted fire alarm system shall carry a full three year parts and labor warrantee. Require the Contractor, the equipment supplier, and the installer to provide continued emergency response services (responding within four hours of any reported system failure) through the full term of the warrantee.

ADDED:

I. University of Utah Electrical Design Requirements

(1) Pre-Design Responsibilities

a. A pre-design meeting with Facilities Management is required for new facilities or extensive remodeling of existing facilities. This meeting will be arranged by the University Project Manager, and include a Facility Operations staff electrical engineer and representative of the Facility Operations Electric Shop. The purpose of this meeting will be to identify special electrical considerations and requirements for the project.

b. The A/E’s electrical engineer shall visit the project site and identify all conditions affecting the proposed electrical design.

c. Record as-built drawings, specs, utility maps, etc., applicable to the project may be requested through the University Project Manager.

d. Underground high temperature hot water piping at the site will require special precautions, especially if located in the vicinity of, or will require crossing by, buried conduit or a duct bank. See 3.8 Mechanical.

(2) Energy Management Buildings

a. Several buildings on campus were retrofitted with energy efficient equipment as part of an on-going energy management plan. Prior to design, the A/E must determine if the project will affect any of these buildings.

b. If the A/E’s design will update or remodel any portion of these buildings, the A/E shall match the existing lighting fixtures, electrical systems, and mechanical equipment previously installed by retrofit. The A/E shall request information regarding design limitations and operational requirements from Facilities Maintenance through the University Project
Manager.

c. Energy efficiency and operating characteristics of existing and new fixtures and equipment must not be diminished by the A/E’s design.

(3) Mutual Responsibility

Mutual responsibility requirements described in the General Conditions are often neglected, especially by subcontractors. The A/E shall add emphasis where appropriate by using drawing notes and/or references in project specifications which require the electrical contractor to communicate, coordinate, and cooperate with other intersecting trades working on the project.

(4) Maintainability

a. The University has selected materials and equipment which will satisfy specific maintenance and operational needs of the campus electrical system. Materials and equipment described herein have been tested, evaluated, and approved by the Facility Operations staff electrical engineers and Electric Shop.

b. For other materials and equipment needed for the project but not described herein, the A/E is directed to investigate and recommend products with regard to product quality and maintainability. The A/E shall select material and equipment for the project which are fabricated by reputable manufacturers, having readily available spare parts, and who are likely to remain viable with a quality product offering in the future.

(5) Material & Equipment Selected for the Project

a. List of Intended Equipment

The A/E’s or its electrical engineer shall prepare a comprehensive list of all electrical fixtures and equipment intended for insertion into the project design. The A/E shall submit this list to Facilities Management through the University Project Manager, who will distribute to the Facility Operations staff electrical engineer and the Electric Shop for review and comment. The A/E’s electrical engineer shall not proceed with design until receipt of equipment approval from Facilities Management.

b. Substitutions

Equipment or material substitution requests will only be approved by addendum prior to bid. A/E recommendations must be submitted for review by Facilities Management. See (10) c. below.

c. New Materials and Equipment
The project specifications shall require that the electrical contractor provide and install only new materials and equipment. Any exception must be submitted to Facilities Management through the University Project Manager who will distribute to the Facility Operations staff electrical engineer and Electric Shop. Written approval by Facilities Management is required for any exception.

d. UPS Systems [also see I. Electrical Distribution / (12) herein]

1) Local UPS units are generally the responsibility of the end user department which will occupy the completed project. Each user department will typically furnish and install its own electronic systems and include local UPS units with their in-house purchases.

2) Large UPS systems must be approved in writing early in the design phases by Facility Operations staff electrical engineer and Electric Shop through the University Project Manager.

(6) Protective Device Coordination

a. The electrical design shall include a protective relay coordination study for new buildings and for the main service upgrades at existing buildings.

b. The protective relay coordination study shall extend to distribution panels rated at 225 amps and above.

c. The proposed settings shall be submitted through the University Project Manager to the Facility Operations staff electrical engineer and Electric Shop and for review and approval.

(7) Arc Flash Study

a. The A/E shall perform or model an arc flash study as part of its design services to meet requirements of NFPA 70 and NFPA 70E.

1) Results of the study shall be submitted to the University, and appropriately applied to the review documents.

b. The arc flash analysis shall include the following at each distribution bus:

1) Bolted Fault Current
2) Arc Fault Current
3) Protective Device Settings
4) Protective Device Characteristic and Arc Fault Duration
5) System Voltages and Equipment Class
6) Working Distances
7) Calculated Incident Energy

c. Calculated Arc Flash Protective Boundary

The results of the study shall be used to specify appropriate labels specific to each panel, identifying the ARC flash hazard class based upon NFPA 70E.

(8) Short Circuit Selective Coordination

Short circuit selective coordination shall be required for emergency circuits.

(9) Commissioning

Commissioning of electrical systems shall be required on new projects with estimated electrical cost over $250,000.

(10) Seismic Support

Submit plans and calculations showing compliance to seismic requirements directed by NEC and IBC. The submittal form and additional information can be found at www.facilities.utah.edu “Building Official” section.

(11) Specification and Drawing Requirements

a. Scope Statement

Provide a summary description of the electrical scope of work in the project specifications. The purpose is to help orient the Contractor by outlining the major tasks required to complete the project.

b. Specifications

All parts of the electrical system shall be completely specified.

c. Substitution Requests

1) The University’s ‘boiler-plate,’ which is added to and precedes the A/E’s specifications, will provide directions to bidders and suppliers regarding substitution requests for material and equipment.

2) The University’s ‘boiler-plate’ will require bidders to send substitution requests directly to the A/E. Each request is to be evaluated within the limitations found in this supplement.

3) The A/E’s recommendations for approval or rejection must be
sent to Facilities Management through the University Project Manager, who will distribute to the Electric Shop and the Facility Operations staff electrical engineer for their review.

4) The A/E will adjust the list of approved materials and equipment in accordance with the University comments. The revised list of approved materials and equipment shall be inserted into an A/E authored addendum, which will be submitted to the University Project Manager and Facilities Business Services for distribution to contractors prior to the bid.

5) All addenda will be distributed only by Facilities Business Services. The A/E shall not issue addenda to contractors.

d. Special Tests & Inspections

The A/E will specify any special tests and inspections for electrical systems which are not governed by, or for which special needs exceed State adopted codes.

e. Drawing Requirements

1) Electrical drawings shall be prepared at a scale appropriate to the project size, but not less than 1/8\textsuperscript{th} scale for building floor plans. See Design Process for more information.

2) Drawings shall include a complete layout of all electrical systems, including device locations. All parts of the system shall be completely detailed on the drawings.

3) Each device shall have its circuit number shown on the drawings. All panel schedules shall be shown on the drawings.

4) After project completion, system maintenance, future alterations, and future additions to the project will rely on the A/E’s drawings as a basis for system maintenance and design modifications. Therefore, as project electrical drawings are prepared, the A/E will need to consider the future usefulness of the drawings as an aid to ongoing maintenance of the electrical system, and as an aid in the design of alterations or additions to the system.

(12) Labeling & ID Tags

a. General Requirements

1) The A/E shall include the information provided below in project electrical specifications and drawings, requiring the Contractor to provide and install appropriate labels and tags throughout the project’s electrical system.
2) The purpose of the labels and tags is to provide clear indications of the function of each item, the loads served, routing information, etc., for primary and secondary elements comprising the electrical system.

b. Permanently Engraved Lamicoid Nameplates

1) Specify permanently engraved nameplates, labels, or ID tags for a master nameplate, also for manholes, distribution equipment, devices, etc., identified in 3) below.

2) Lamicoid nameplates shall be three-ply plastic, 1/16 inch thick. Letters shall be formed by engraving into the outer colored ply, exposing the white or black center-ply. Lettering shall be a minimum of 5/8 inch high, except for MV cable (see below).

<table>
<thead>
<tr>
<th>LAMICOID NAMEPLATE COLORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMEPLATE</td>
</tr>
<tr>
<td>Master Nameplate Black</td>
</tr>
<tr>
<td>Normal Power Black</td>
</tr>
<tr>
<td>Emergency Power Red</td>
</tr>
<tr>
<td>UPS Power Blue</td>
</tr>
<tr>
<td>Medium Voltage Yellow</td>
</tr>
</tbody>
</table>

3) Provide permanently engraved nameplate labels / tags for the master nameplate, for each manhole, duct bank, all distribution equipment, devices, etc., listed below as well as all other similar equipment. Other electrical sections in this supplement may have additional labeling requirements.

Each label shall include the arc flash hazard class based upon NFPA 70 E, where applicable.

a) Master Nameplate

Provide a permanently engraved lamicoid master nameplate at the main distribution location affixed with double sided adhesive tape covering the back of the nameplate, to identify the project, the engineer and the installation date.

b) Duct Bank Identification Nameplates

(i) Permanently engraved lamicoid nameplate labels must be placed adjacent to each entering / leaving duct at the duct banks in the man hole.
(ii) Labels are to be 3” x 5” yellow with black engraved letters.

(iii) Labels are to include a ¼” hole in each corner. Each label shall be affixed to the wall using plastic anchors and screws.

(iv) Lettering shall indicate the conduit’s next destination point or last departure point (e.g., To MH #123, From Pad #123, To Vault #123).

(v) Example duct bank identification nameplate:

![Image of a label with four holes and "To MH-41A." ADDED]

c) MV Cable

(i) Feeder identification tags shall be attached to each feeder near entrance or exit points inside manholes, vaults or pad locations; at any switch section the feeder connects to; and, inside the primary compartment of each transformer.

(ii) Lamicoid tags shall be 2 ½” x 2 ½” x 1/16”, diamond orientation (not a square), and shall be yellow with black engraved letters.

(iii) Lettering shall be 3/8” high, centered, and shall indicate the substation and feeder number (i.e., F-71 [indicating substation 7, feeder #1]; or, RB F-10-2 [indicating the Red Butte Substation, Substation 10, feeder #2]).

(iv) Lamicoid tags shall be attached to phase B using a black weather resistant zip tie. Tags are to include a ¼” hole in the top corner to allow attachment by means of the zip tie.
(v) Tags shall be located where lettering will be readily visible. The zip tie attachment must not be pulled too tight, allowing for minor adjustment by maintenance personnel.

d) MV “Switch Cabinet” Identification Nameplates

(i) Permanently engraved laminoid nameplate labels shall identify each switch cabinet.

(ii) Labels are to be 3” x 5” yellow background with black engraved letters.

(iii) Each label shall be affixed to the cabinet with double sided adhesive tape covering the back of the nameplate.

(iv) Each nameplate shall include the pad number, switch number, the building name and number served by the switch, and voltage.

(v) Example MV switch cabinet identification nameplate follows on the next page:

---

Pad 350
MV Switch SW-A
Bldg. 350 USB
12,470 V

---

e) MV “Switch” Identification Nameplate

(i) A permanently engraved laminoid nameplate label shall:
   Identify the device the switch will operate; or,
   Identify the destination manhole, vault, or pad number; the switch number; and, section it serves; or,
   Identify the destination switch and the section the feeder serves.
(ii) Labels are to be 3” x 5” yellow background with black engraved letters.

(iii) Each label shall be affixed to the switch with double sided adhesive tape covering the back of the tag.

(iv) Example MV switch identification nameplate:

| To MH - 942 |
| Switch SW-A |
| Section #4 |

f) Distribution Transformer Identification Nameplates

(i) Permanently engraved laminoid nameplate labels shall identify each transformer and its location.

(ii) Labels are to be 3” x 5” yellow background with black engraved letters.

(iii) Each label shall be affixed to the cabinet exterior with double sided adhesive tape covering the back of the nameplate.

(iv) Each nameplate shall designate the pad number (same as the building number), transformer number, primary and secondary voltages, KVA rating, and the building name / number served by the transformer.

(v) Example transformer identification nameplate:
g) Step Down Transformer Identification Nameplate

(i) A permanently engraved lamicoid nameplate label shall identify each transformer.

(ii) The nameplate shall be 3” x 5” with yellow background and black engraved letters.

(iii) Each label shall be affixed to the cabinet with double sided adhesive tape covering the back of the nameplate.

(iv) The nameplate shall designate the transformer, electrical source feeding the transformer, load supplied, size (kVA), and the primary and secondary voltages (i.e., Transformer T-1, Source PH1-1, 3, 5; Load PL1, 150kVA, 480:208/120).

h) Manhole Identification Nameplates

(i) Manhole identification nameplates will be supplied to the Contractor by the Facility Operations Electric Shop through the University Project Manager.

(ii) A manhole identification nameplate is required for each manhole, installed at existing and new manholes associated with the project.

(iii) The nameplate shall be mounted on the north side of the concrete ring as you enter the manhole, and shall be easily visible both from ground level outside and from the floor level inside the manhole. This standard will be followed for all manholes on campus, and provides a means for convenient orientation by
observing the nameplate in a known location, either while entering or when established inside the manhole.

(iv) The nameplate shall be affixed to the concrete ring using plastic anchors and screws.

i) Switchboards, Distribution Boards, and Panel boards

(i) Permanently engraved laminoid labels are required for each switchboard, distribution board, and panel board, as described below.

(ii) For normal power, labels are to have a black background with white engraved letters.

For emergency power, labels are to have a red background with white letters.

(iii) Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

(iv) Conductors shall be color coded by phase with colored tape. See E. Conductors / (9), and G. Medium Voltage / (1) / a. / 8) for color coding requirements.

(v) Switchboard Label

The switchboard label shall include the switchboard name, electrical source feeding the switchboard, voltage, size (amps), number of phases, number of wires, and AIC rating (i.e., MDP1, Transformer-1, 480V, 3P, 4W, 65kAIC). If the switchboard contains a main building disconnect, this shall be included on the label, (i.e., Main Building Disconnect 1 of 2).

(vi) Switchboard Breaker and Spare Space Labels

Switchboard breaker and spare space labels shall be installed to clearly identify each switchboard breaker and spare/space. Each label shall include the breaker number and the load served (i.e., MDP1-1, Panel PH1). For spare/space, the label shall indicate “spare” as well as the size in amps and phase (i.e., Spare, 200A, 3P or Space, 400A max, 3P).

(vii) Panel board Labels
Panel board labels shall be mounted inside the door for flush panels, and on the outside face of the door for surface panels. The label shall include the panel name, source feeding panel, voltage, size (Amps), number of phases, number of wires, AIC rating, and the arc flash hazard class based upon NFPA 70E (i.e., PH1, MDP1-1, 277/480V, 225A, 3P, 5W, 42kAIC, Arc Flash Class __).

Use the labeling scheme for panel boards provided on the following page:

**PANELBOARD LABELING SCHEME**

<table>
<thead>
<tr>
<th>Level</th>
<th>UPS / Emergency Power</th>
<th>Voltage Level</th>
<th>Panel Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (Level 0 / Basement)</td>
<td>U (UPS)</td>
<td>H (277 / 480 V)</td>
<td>1</td>
</tr>
<tr>
<td>1 (Level 1)</td>
<td>E1 (Emergency Life Safety – Connected to ATS-1)</td>
<td>L (120 / 208 V)</td>
<td>2</td>
</tr>
<tr>
<td>2 (Level 2)</td>
<td>E2 (Critical Emergency – Connected to ATS-2)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3 (Level 3)</td>
<td>E3 (Optional Emergency – Connected to ATS-3)</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
</tr>
</tbody>
</table>

**Examples:**

(a) 2E1L1 – Level 2, Emergency Life Safety Power, 277/48120/208V0V, 1st panel on level 2

(b) 0UL6 – Level 0, UPS Power, 120/208V, 6th panel on level 0

(c) 1H2 – Level 1, 277/480V, 2nd panel on level 1

(d) 3L11 – Level 3, 120/280V, 11th panel on level 3

(j) Motor Control Centers (MCC), Motor Controllers

(i) Permanently engraved 3” x 5” lamicoid labels are required to identify the MCC and each controller.

(ii) For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.

(iii) Each label shall be affixed to the cabinet in a readily visible location with double sided...
adhesive tape covering the back of the nameplate.

(iv) MCC labels shall identify the MCC, source feeding the MCC, voltage, size (amps), number of phases, number of wires, and AIC rating (i.e., MCC#1, MDP1-2, 600A, 3P, 4W, 42kAIC).

Where applicable, the label shall also include the load served and the breaker size (i.e., EF-1, 125A).

For spare / space, the label shall indicate the size in amps and phase (i.e., EF, 125A).

k) Variable Frequency Drives (VFD)

(i) Permanently engraved 3” x 5” lamicoid labels are required to identify the equipment controlled, electrical source feeding the controller, voltage, number of phases, disconnect and fuse sizes in amps where applicable, and equipment horse power (i.e., AHU-1, PH1-1, 3, 5, 480V, 3P, 200A/150A fuse, 75HP).

(ii) Additionally, require a second label on the VFD cabinet specifying which control signal is used.

(iii) For normal power, labels are to have a black background with white engraved letters.

For emergency power, labels are to have a red background with white letters.

(iv) Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

l) Fire Alarm Control Panels (FACP), Fire Alarm Notification Appliance Circuit Panels (NAC), and Other Fire Alarm Panels / Cabinets

(i) Permanently engraved 3” x 5” lamicoid labels are required to identify each panel. Require labels for each fire alarm control, notification appliance (NAC), power supply, transponder, and speaker system panel.

(ii) For normal power, labels are to have a black background with white engraved letters.
For emergency power, labels are to have a red background with white letters.

(iii) Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

(iv) Each label is to include the panel name and the source feeding the panel (i.e., FACP, PL1-1 or NAC-1, PL1-3).

m) Additionally provide permanently engraved lamicoid nameplate labels / tags for the following, as well as all other similar electrical devices and equipment.

(i) UPS and Surge Protection Devices

(ii) Safety Disconnects

(iii) Generators

(iv) Automatic Transfer Switches

(v) Paralleling Switchgears

(vi) Electrical Contactors and Relays

(vii) Lighting Control Panels, Lighting Contactor Panels, Dimming Panels

(viii) Timeclocks

(ix) Security Panels

(x) Power Supplies

c. Self-Adhesive Labels

1) Specify self-adhesive labels for the devices and equipment identified in 4) below, as well as all other similar devices and equipment.

2) Self-adhesive labels shall have black lettering with a clear (see through) background, and a self-adhesive sticky back.

3) Each label shall identify the applicable circuit number feeding the device. The label shall also display “EMERGENCY” or “UPS” as applicable next to the circuit number for devices fed from Emergency or UPS power. For example, a receptacle fed from circuit 2 in panel 1P1 would read “1P1-2” on the label.
4) Require the Contractor to apply self-adhesive labels to the following devices and equipment, and all similar equipment.

a) Thermal Switches and Manual Starters

b) Power Outlet Receptacles

c) Light Switches

d) Wall Mounted Occupancy Sensors

e) Wall Mounted Time Switches

f) Dimming Switches and Wall Mount Dimming Controllers

g) Fire Alarm Initiation Devices (Smoke Detectors, Heat Detectors, Pull Stations, etc.) and Fire Alarm Notification Devices (Horns, Strobes, etc.).

(i) Require self-adhesive labels for all initiation and notification devices.

(ii) Each initiation device label shall indicate the addressable node, the addressable loop number, device type (S=sensor, M=monitor), and device number (i.e., N1-L1S001, N1-L2M001).

(iii) Each notification device label shall indicate the device type (S=speaker, L=strobe), the circuit number, and the device number (i.e., S1-1 or L1-2).

d. Handwritten Labeling

1) Specify legible handwritten labeling for all junction boxes containing power and fire alarm wiring.

2) Require the Contractor to use a permanent chisel tip black marker, and write the required information in a neat and clearly legible manner clearly visible from the floor.

3) Label each junction box with the applicable circuit number(s) for the cables contained within.

e. Word Processor Generated Branch Panel Schedules

1) Specify typewritten branch panel schedules incased in clear, transparent covers for each branch panel.
2) Require the Contractor to label every breaker or available space.

3) Actual room designations (room name and room number) assigned by the University must be used. Instruct the Contractor to verify room designations. Room identifiers on project drawings may be different than final room assignments.

4) When the project requires changes in, or additions to existing panels, distribution boards, etc., provide new schedules and labeling to accurately reflect the changes.

(12) Contractor Responsibilities

a. Foreman

The Contractor shall be required to provide competent supervision for all electrical work throughout the duration of the project. The same foreman shall remain on the project from the beginning to completion unless a change is authorized by both the A/E and University Project Manager.

b. Permits

1) The A/E shall coordinate with the University Project Manager for projects where special permits are required, and request additions to the University’s boiler-plate when these are to become the responsibility of the Contractor.

2) Shut-down and digging permits are the Contractor’s responsibility, and specific requirements are described in the Supplemental General Conditions for University of Utah Projects.

c. Shop Drawings

1) Require the Contractor to review shop drawings prior to delivery to the A/E. Shop drawing submittals are to be complete, approved, and signed by the Contractor before delivering to the A/E.

2) The A/E shall receive the Contractor’s shop drawings and review them for conformance, and determine their acceptability.

3) The A/E shall forward the shop drawings with its recommendations to Facilities Management through the University Project Manager, who will distribute them to the appropriate Facility Operations shops for University review and comment.

4) University approval of the shop drawings is required prior to the Contractor’s release of the order.

d. Workmanship
The A/E shall expect professional workmanship of the Contractor. Specify that all workmen shall be qualified and licensed for the work they perform. Substandard workmanship shall not be allowed. Any workmanship or installation deemed to be substandard by the A/E and University Project Manager will be required to be redone until acceptable.

e. Inspection of Repaired Damage, Replaced Work

In addition to the requirements of Article 9 of the General Conditions, repair or replacement of defective or nonconforming Work shall be inspected by the Facility Operations Electric Shop prior to being accepted.

f. Housekeeping and Cleanup

A reasonable level of housekeeping and cleanup shall be required throughout the duration of the project. At the conclusion of the project, require the Contractor to restore all areas and equipment to an “as-new” condition.

(13) Display As-Builts and One-Line Diagrams

a. The electrical engineer’s design of the electrical systems for new buildings, major additions or renovations shall include a requirement for a set of completed and University approved as-built electrical drawings (including a copy of the electrical one line diagrams), framed and permanently mounted in the electrical distribution room, vault or other suitable location selected by the A/E and Facilities Management.

b. The A/E and Contractor shall coordinate with the University Project Manager and Electric Shop to determine the mounting location and size of the sheets required to be clearly readable.

c. These drawings shall be framed between 2 sheets of 1/8” Plexiglas.

**ADDED:**

J. Communications and Security Wiring Systems Serving University of Utah Buildings

(1) Introduction

a. Designer Qualifications

The University expects a high quality, standards-based communications infrastructure on campus. The design of communications infrastructure for new or remodeled facilities shall be engineered by a qualified Registered Communications Distribution Designer (RCDD) actively affiliated with the Building Industry Consulting Services International (BICSI) organization. Further, engineering designs must meet all
applicable Federal, State, and local codes and standards, and must be
designed in accordance with this Design Manual and University of Utah
Supplement.

b. Communications Entrance

The design for new buildings will include a communications service
entrance and provisions for running communications conductors to
various parts of the building. The scope of these provisions will be
determined in consultation with Facilities Management through the
University Project Manager. The communications service entrance will
interconnect the building with the University underground
communications duct system. The communications service entrance will
include a minimum of six 4” ducts into the building. The service
entrance ducts shall be run without bends. Where this is not possible
specific approval of Facilities Management electrical engineer(s) through
the University Project Manager will be required.

c. CAD Layering

Telecommunications wiring, conduit, and raceways are to be layered
separately from electrical layers.

d. Installation by UIT

In an effort to maintain a consistent structured wiring system throughout
campus, University Information Technology department (UIT) is the
only entity on campus authorized to install new communication cabling,
both inside and between buildings. Therefore, the designer is to notify
contractors that the University of Utah installs their own
telecommunications wiring in new and remodeled spaces. Project
specifications are to require the Contractor to coordinate the work with
the University, thereby properly sequencing the installation of the wiring
with the rest of the construction work. Wiring must be completed prior
to the installation of drop ceiling grid.

e. Penetrations of Fire Rated Partitions

The University has experienced problems in many buildings where the
installation of communications wiring resulted in penetrations of fire
rated partitions, which were left untreated. The designer is to refer to 3.3
Architectural H (1) University of Utah Supplement.

f. Total Raceways

It shall not be acceptable to run low voltage wiring as a free air system.
All low voltage wiring systems shall be run in conduit in walls up to a
raceway system. The raceway system can be specified as J-hooks, cable
tray, conduit, or any other approved cable management system.
(2) **Cable Tray**

Where appropriate cable tray shall be provided to facilitate the installation of communication cable in University buildings. Where provided, cable tray shall be installed in such a manner that free and unobstructed access is provided at all times after completion of construction.

(3) **Communications Duct Banks**

a. **General**

Duct banks will be provided to house underground communication cables. See Detail Drawing COM-3. Duct banks will be concrete encased round bore plastic duct. Typically the duct size should be 4 inches. Spare ducts will be provided in duct bank installations in consideration of the future needs of the campus communications system. Duct banks will have a minimum slope of 4 inches per 100 ft. Seal around all cables entering manhole with Virginia KMP Presstite Permagum. Provide plastic plugs in both ends of all unused ducts and seal with silicon sealant. Concrete encasement will be a minimum of three inches between ducts and between ducts and earth. The top of the concrete encasement will be a minimum of 3 ft. below finished grade. Care shall be taken during installation to insure no debris gets into the line. After completion a mandrel not less than 12 inches long and approximately 1-1/2 inches diameter less than the duct diameter will be pulled through each duct to insure that no debris has collected in the duct. Mandrel pulls shall be witnessed by the A/E and University Project Manager. The A/E should inspect duct bank construction before concrete is poured. Provide polypropylene pull rope in each unused duct.

b. **Rigid Galvanized Steel**

Where duct banks enter manholes, buildings or vaults, a 10 ft. length of rigid galvanized steel conduit will be used for each duct. All elbows and offsets in duct runs will be made of rigid galvanized steel.

c. **Maximum Bend Radius**

All communications ducts must be installed in such a manner as to be free of bends, twists, turns etc.. Absolutely no 90, 45, 30 degree bends shall be allowed. A maximum bend radius of 5 degrees shall be allowed. Any other bend necessary shall require approval of Facilities Management electrical engineer(s) and the Campus Utility Services Electronics Shop (upon request to the University Project Manager). Any bends required greater than 5 degrees shall be rigid steel. The A/E shall provide elevation drawings that show elevation differences.

(4) **Telecommunications Service Entrance and Termination**

a. **General Information**
“Telecommunications service entrance” on campus is defined as the means by which connections for Local Exchange Carrier’s, Campus Distribution, Interexchange Common Carrier, etc. will enter and terminate in campus buildings. Entrance conduit begins at the communications manhole nearest the structure and ends when terminated in the equipment room for that structure [see (5) Equipment Rooms (ER) below].

b. Types of Entrances

1) The acceptable means of service entrance on campus is an underground conduit system. All entrance conduit must be four inch (4”) PVC conduit, encased in concrete, and buried at a minimum of twenty four (24) inches below grade. The actual number of conduits designed for any campus structure will be determined by the University Project Manager and University Information Technology (UIT) project coordinator during the design phase of the project.

2) On each new building, and where approved for each remodel, include a two inch (2”) roof mounted galvanized rigid conduit with weather-head in the system design. The new conduit is to extend two feet (2’) above the finished roof. The base is to be sufficiently secured to support future electronic equipment which may be attached to the conduit. The designer shall coordinate with the A/E for a location: a) which is reasonably close to (preferably directly over) a telecommunications room; b) which is near a roof access for maintenance and service; and, c) which would have walkway approach protection to limit the possibility of roof damage. If possible, this roof conduit should be located directly over the top floor telecommunications room. Extend conduit into the building either to the telecommunications room or to the nearest communications cable tray. Review the design with the University Project Manager and UIT project coordinator for approval at the design development submittal review or prior to completion of the bidding documents.

c. Bends

Bends in service entrance conduit are generally considered unacceptable. However, should bends be unavoidable, they shall be reviewed for approval by Facilities Management and UIT prior to installation; and, they will be long, sweeping bends with a radius not less than ten times the internal diameter of the conduit. There shall be no more than the equivalent of two quarter bends (180° total) between pull points. All bends and sweeps are to be in rigid conduit.

d. Preventing Shearing
In order to prevent shearing of conduits, each entrance conduit is required to have 10 feet of rigid steel conduit leaving and entering any structure including buildings, manholes, etc. Ends of metallic conduit must be reamed and bushed.

e. Manholes

1) Communication manholes will be provided for the underground communications distribution system.

2) Manholes used for communications will not be used for the distribution or termination of any electrical cables.

3) Communication Manhole Fabrication Requirements

a) Communications manholes will have a minimum of 96 square feet of floor area (unless pre-approved by UIT) with a minimum 8’ ceiling height; and, are to be reinforced concrete, either poured in place or pre-cast; and, must be suitable for H20 highway loading.

b) Covers will be clearly marked “COMMUNICATIONS”.

c) Manholes must be equipped with bonding inserts and struts for racking. Include cast-in provisions for cable supports (equal to Super Strut Series No. C300).

d) Include pulling eyes cast into each wall of the manhole. Pulling eyes shall be at least 2.2 centimeters in diameter.

e) Manholes must include a sump of at least one (1) cubic yard of crushed rock with a three (3’) foot diameter.

4) Required manhole accessories shall include, but not be limited to:

a) Manhole cover and seat shall be in accordance with Detail Drawing COM-4.

b) Require a minimum of two ground rods for each manhole, each shall be 3/4” x 10’, copper clad steel, and each ground shall extend below the manhole at opposite corners of the manhole floor.

c) Require complete water proofing of the manhole, entrance structure, and all openings.

d) Require bell end entrances for all conduits. Specify threaded metallic type Emerson O.Z. Gedney Bell End Entrances (or equal). Require the Contractor to seal all conduit entrances.
e) Require a demountable stainless steel ladder affixed at both top and bottom, but removable from below by the worker if desired.

(i) The ladder system, including all hardware, is to be submitted for review and approval before purchase and installation.

(ii) The ladder top shall be hooked to the side of the manhole.

(iii) Each bottom rail shall be drilled to receive a security pin which locks the ladder to angle flanges anchored to the concrete manhole floor. Specify both the pin and its associated pin lock to be attached to the ladder rail by stainless steel chain to prevent misplacing the pin locking devices (the required security chain is not shown in the picture below). This assembly will provide a safe entry descent, and enable workers to unpin the bottom rails and unhook the ladder top when additional workspace is desired while working in the manhole.

(iv) All hardware shall be specified stainless steel.

(v) The following pictures indicate the approved attachments, except for the required pin-to-pin lock-to-ladder rail stainless steel chains (one for each ladder rail) described above.

5) Spacing of manholes will be carefully considered to allow reasonable pulling tensions for cable pulls between manholes. Spacing between manholes shall not exceed 400 feet.
6) The University of Utah requires all communications manholes to be fitted with a secure access system. Coordinate with the University Project Manager and UIT for current approved details regarding manhole security and access systems. The only approved secure access system is manufactured by the University Metal Shop, with a lock provided by the University Key Shop. When manholes are included in the design, coordinate with the University Project Manager to either a) cover the cost by internal work order, or b) notify Facilities Management Business Services that an allowance of $1,000 is required on the Bid Response Form when bidding documents are being prepared. The work order amount or bid allowance shall be $1,000 for each manhole.

f. Terminating Conduit Inside a Building

Service entrance conduits should enter the communications room without bends. If the conduits enter the building below the finished floor, this is best accomplished by creating a trench for the conduits to enter. The trench must be a minimum of three (3) feet wide to allow the bending of cable inside the trench. The trench must be fitted with a steel grate to cover the entire span of the trench. Knockouts in the grate, for cable entrance and exit, must be provided. The grate must be capable of withstanding weight in excess of 1,000 pounds. If conduits enter from the ceiling, they should terminate four inches (4”) below the finished ceiling. It is imperative that slope and grade be considered in the design and installation of entrance conduits, ensuring that conduits inside the building are not lower than the conduits leaving the manhole, thus creating drainage problems.

g. Redundant Entrance Provision

All new buildings shall be equipped with dual entrance facilities, originating from separate manhole structures. All standards that apply to the primary entrance facility apply to the redundant facility. Any deviation from this standard must be approved by both the University Project Manager and University Information Technology (UIT) project coordinator.

h. Fill

All conduit must be concrete encased.

(5) Equipment Rooms (ER)

a. Definition

1) Equipment Rooms (or “ER”) provide secure space and maintain suitable operating environments for large communications and/or computer equipment. Equipment Rooms are generally considered to serve a building, where Telecommunications
Rooms [or “TR” – see (6) below] generally serve only one floor of a building. *Any or all functions of a Telecommunications Room may be provided by an Equipment Room.*

2) The Equipment Room is typically the point of demarcation (“dmarc”) for the following services:

a) Local Exchange Carrier (Qwest)
b) Fiber Optic Network
c) Building Maintenance Systems
d) Security Systems

b. Considerations for Design

1) When designing Equipment Rooms, consider incorporating building information systems other than traditional voice and data communications systems (*e.g.* CATV distribution systems, alarm / security systems, and audio/paging systems). In most instances, the Equipment Room may also serve as the entrance facility for the building communication.

2) The design of a new Equipment Room should begin with an assessment that considers each of the factors listed below. The information gathered from this assessment must be considered by the designer at all stages of the project design, along with guidelines and requirements of applicable local, state, federal standards, this Design Manual and the University of Utah Supplement.

   a) Customer Requirements
   b) Telecommunications Pathway Locations
   c) Service Provider (Local Exchange Carrier [LEC]) Requirements
   d) Environment/Facility Conditions and Resources

c. Locating the Equipment Room

1) The location of the main Equipment Room can have significant impact on all other aspects of communications systems distribution design. Location selection is to include consideration of spaces immediately adjacent to the Equipment Room (beside, below, and above). In general, the main Equipment Room should be located near the building center to minimize cable distance.

2) Design of Equipment Rooms must take in to consideration:

   a) Services to be terminated
   b) Access and proximity to distribution cable pathways
c) Building facilities and access to the Equipment Room

d) Local Exchange Carrier (LEC) requirements

e) Proximity to electrical service and EMI sources

f) Space required for equipment

g) Provisions for future expansion

3) Do not locate Equipment Rooms in places that are subject to the following conditions:

a) Water infiltration

b) Steam infiltration

c) Humidity from nearby water or steam

d) Heat (e.g., direct sunlight)

e) Any other corrosive atmospheric or environmental conditions

4) Shared use of Equipment Room space with other building facilities must be avoided. Locations which are unsatisfactory for Equipment Rooms include space in or adjacent to:

a) Electrical Closets

b) Boiler Rooms

c) Washrooms

d) Janitor Closets

e) Storage Rooms

f) and any space that contains:

(i) Sources of excessive EMI

(ii) Hydraulic equipment or other heavy machinery that may cause excessive vibration

(iii) Steam pipes

(iv) Drains

(v) Clean-outs

5) Avoid locations that are below the water level unless preventive measures against water infiltration are employed. The room must be free of plumbing and electrical utilities that are not directly required to support the Equipment Room function. A
floor drain is required if there is any risk of water entering the facility.

d. Working Clearances

NEC Section 110-16 requires three (3) feet of clear working space around equipment with exposed live parts. This applies to communication Equipment Rooms.

e. Conduit Accessibility

It is essential that clear, unobstructed access to cable trays and conduits be provided within the Equipment Room. Entrance conduit and distribution conduit/cable trays should enter and exit on the same wall. If this is not possible, a cable tray inside the room should be provided for distribution from wall to wall.

f. Electrical Systems

Power for telecommunications equipment in Equipment Rooms should be supplied by feeders dedicated only to supplying that equipment (NEC Article 215). Quadplex power receptacles with separate 20 amp feeders and isolated grounds, should be mounted on every wall in the Equipment Room, spacing should be on six foot (6’) centers, and located eighty four inches (84”) above the finished floor. Other power requirements (e.g. fluorescent lighting, motors, air conditioning equipment, etc.) should be supplied by a separate feeder, conduit, and branch panel.

g. Dimensions

Determination of “adequate size” for the Equipment Room depends upon what services are to be terminated there. Input from UIT personnel, LAN support groups, Electronics Shop, HVAC and UCard personnel should be considered. Minimum size for an Equipment Room is ten by 15 feet. (10’ x 15’) The actual size of the Equipment Room will be determined during the design phase of the project when more information, pertinent to the size and application of the building, is available.

h. Space Allocation & Layout

1) The layout of major communications equipment in the main Equipment Room must facilitate the effective routing of power and communications cabling. The main Equipment Room must provide adequate space for:

a) All planned equipment
b) Access to equipment for maintenance and administration
c) Future growth
2) In addition to space for communications and security system requirements, an Equipment Room may also include space requirements for environmental control equipment, power distribution/conditioners, and UPS systems.

i. Determining Size of Equipment Rooms (Based on Area Served)

1) When specific equipment that may be used in an Equipment Room is not yet known, the following criteria may be used to determine the minimum size of the Equipment Room.

a) Divide the amount of useable floor space (building area used by occupants during normal daily activity, including hallways, copier rooms, etc.) by 100 ft.² (or smaller if average work area size is less) to determine the number of individual work areas; or, count the number of individual work areas (offices, conference rooms, cubicles, etc.).

b) Multiply the number of work areas to be served by 0.75 ft.² to determine the minimum Equipment Room size.

2) If there are fewer than 200 work areas, the Equipment Room must be no less than 150 ft². In special use buildings (hospitals, hotels, etc.) Equipment Room sizes may vary. Refer to ANSI/EIA/TIA-569-B.

j. Fire Protection / Fire Rating / Fire Suppression

All ER spaces shall be designed with pre-action fire suppression systems (the space remains water free until both heat and smoke detectors are activated). Fire alarms should be installed in accordance with this Design Manual and University of Utah Supplement. Portable fire extinguishers should be located in the room as close to the entrance as possible. A minimum of a 2 hour fire rating should be provided with a fire sprinkling system exterior to the room.

k. Environmental Considerations

Environmental considerations should be determined prior to design; however, assume that air conditioning will be a year-round requirement and should be capable of maintaining a maximum temperature of 75 degrees F and a relative humidity of 30% to 50%.

l. Floor Requirements

Equipment Room spaces are generally considered to be computer rooms. Design these rooms with raised floors, 18 inches clearance (minimum), to ensure maximum flexibility of power and communication cabling.

m. Loading Requirements
1) The floor rating under distributed loading must be greater than 12 Kpa (250 lb/ft.²).

2) The floor loading under concentrated loading must be greater than 4.4 M (1,000 lbs) in areas that will support communications equipment, racks, and cabinets.

da. Ceiling Requirements

The recommended height of the finished ceiling to the finished floor in an Equipment Room is sufficient height to allow 8 ft. 6 in. clear space below light fixtures. Any ceiling protrusions (ventilation, sprinklers, etc.) must be located with a minimum clearance height of 8 ft. 6 in. The ceiling finish must minimize the introduction of dust, and be light colored to enhance room lighting.

db. Lighting Requirements

Equipment Rooms shall be designed with adequate and uniform lighting that provides a minimum equivalence of 540 lux (50 footcandles) when measured 3 ft. above the finished floor. Locate lighting fixtures a minimum of 8 ft. 6 in. above the finished floor. Locate light switches near the entrance(s) to the Equipment Room. Power for lighting should not come from the same circuits as power for the communications equipment. Provide emergency lighting as required by applicable building codes.

dc. Security Design Considerations

Provide adequate clear wall space to accommodate the required number of CCure iStar security control panels as determined by UCard. Provide an adequate quantity of power outlets to serve the iStar panels.

dd. Cable Management

Cable management, either overhead or under the floor, must be given careful consideration during design. As a minimum, all communication spaces shall be designed with cable trays installed at a height of one hundred eight inches (108") above the finished floor, with minimum dimensions of (4”d x 12”w) and which wraps the entire room. Considerations for additional cable trays and/or raised floor will require consultation with the University Project Manager, the UIT project coordinator, and the tenants of the proposed building or space.

dd. HVAC Requirements

Telecommunications equipment requires full time operation of heating, ventilating, and air conditioning in the room to meet the criteria shown below. If the building’s HVAC system cannot provide continuous
service to satisfy the ER room’s environmental requirements, consult with the University Project Manager and UIT project coordinator to consider an independent HVAC system. If approved, each ER space would be designed with an independent cooling system capable of operation when other chiller and ventilation systems may be interrupted (e.g. fire alarm tests, maintenance, season off-times for cooling or heating, etc.). The system should be designed with a high performance cooling system utilizing positive pressure techniques.

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>64 degrees to 75 degrees F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity Range</td>
<td>30 percent to 55 percent relative</td>
</tr>
<tr>
<td>Heat Dissipation</td>
<td>750 to 5,000 BTUs per hour per cabinet (number of cabinets to be determined through consultation with Facilities Management through the University Project Manager).</td>
</tr>
</tbody>
</table>

s. Electromagnetic Interference (EMI)

Because EMI causes severe problems with electronic equipment, telecommunications rooms must not be shared with electrical feeders, branch circuits of noisy equipment or transformers.

t. Un-Interruptible Power Systems (UPS)

A building UPS system shall be installed and connected to all communication spaces; and, should be equipped with access to building emergency generator power to protect critical voice and data systems. The sizing of the UPS will depend on the size and use of the building which is to be determined during the design phases with the assistance of UIT and the building occupants’ IT staff.

u. Telecommunications Grounding and Bonding

1) A proper grounding and bonding infrastructure is essential for the reliable operations of today’s sensitive telecommunications equipment and systems.

2) The building telecommunications grounding and bonding should follow ANSI-J-STD-607-A. This standard is intended to augment (not replace) the requirements specified in the NEC.

3) The grounding and bonding infrastructure originates at the electrical power service entrance and extends throughout the building. Predrilled copper grounding bus bars are to be installed in all TR’s and ER’s.
4) Whenever two or more telecommunications bonding backbones (TBB) are used within a multistory building, they are to be bonded together with a grounding equalizer (GE) at the top floor and every third floor in between.

5) The size of wire used in the telecommunications bonding backbone is distance driven. See Drawing Detail COM-2.

<table>
<thead>
<tr>
<th>Telecommunications Bonding Backbone length (ft)</th>
<th>Telecommunications Bonding Backbone (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 13 feet</td>
<td>6 AWG</td>
</tr>
<tr>
<td>14 – 20 feet</td>
<td>4 AWG</td>
</tr>
<tr>
<td>21 – 26 feet</td>
<td>3 AWG</td>
</tr>
<tr>
<td>27 – 33 feet</td>
<td>2 AWG</td>
</tr>
<tr>
<td>34 – 41 feet</td>
<td>1 AWG</td>
</tr>
<tr>
<td>42 – 52 feet</td>
<td>1/0 AWG</td>
</tr>
<tr>
<td>53 – 66 feet</td>
<td>2/0 AWG</td>
</tr>
</tbody>
</table>

(6) Telecommunication Rooms (“TR”)

a. Telecommunication Rooms

Telecommunications Rooms differ from Equipment Rooms and entrance facilities in that they are generally considered to be “floor-serving” (as opposed to “building-serving”) spaces that provide a connection point between backbone and horizontal distribution pathways. Requirements for the design of ERs found in this document, specifically power/UPS, HVAC, fire alarm / suppression, security, cable management, and electrical systems also apply to TR design.

b. General

1) Telecommunication Rooms are “floor-serving” spaces for:

   a) Voice equipment (e.g. KSU’s, etc.)
   b) Data equipment (routers, concentrators, etc.)
   c) Cable terminations (both horizontal and backbone)
   d) Fiber optic terminations (both horizontal and backbone)
   e) Cross-connect wiring

c. Size

TRs vary in size depending on their function and the size of the floor area they serve. Typically size requirements are based on distributing
telecommunications service to one individual work area per 100 feet $^2$ of occupied work space. While the actual size of Telecommunications Rooms will depend on the application of the building and therefore will require input from various entities during the design phase of the project, minimum Telecommunications Room sizes are shown in the table below:

<table>
<thead>
<tr>
<th>IF THE SERVING AREA IS....</th>
<th>THEN THE TR MUST BE AT LEAST....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 740 meters$^2$ (8,000 feet$^2$)</td>
<td>3.0 meters x 3.0 meters (10 feet x 10 feet)</td>
</tr>
<tr>
<td>Larger than 740 meters$^2$ (8,000 feet$^2$)</td>
<td>3.0 meters x 3.6 meters (10 feet x 12 feet)</td>
</tr>
</tbody>
</table>

d. Working Clearances

NEC Section 110-16 requires three (3) feet of clear working space around equipment with exposed live parts. This applies to Telecommunication Rooms.

e. Conduit Accessibility

It is essential that clear, unobstructed access to cable tray and conduits be provided within the Telecommunication Room. When possible entrance conduit and distribution conduit/cable tray should enter and exit on the same wall, if this is not possible cable tray inside the room should be provided for distribution from wall to wall.

f. Electrical Systems

Power for telecommunications equipment in Telecommunications Room should be supplied by feeders dedicated only to supplying that equipment (NEC Article 215). Quadplex power receptacles with separate 20 amp feeders and isolated grounds, should be mounted on every wall in the Telecommunications Room, spacing should be on six (6) foot centers, located eighty four inches (84”) above the finished floor. Other power requirements (e.g. fluorescent lighting, motors, air conditioning equipment) should be supplied by a separate feeder, conduit, and branch panel. Refer to (5) u. above for grounding requirements.

g. Lighting

Telecommunication Rooms should have adequate and uniform lighting. Design room lighting to maintain an intensity of 50 foot candles (LM/ft$^2$) at 3 feet above floor level. Coordinate light fixture positions with the equipment layout, especially overhead cable trays, to ensure the light is not obstructed.

h. HVAC Requirements

Telecommunications equipment requires full time operation of heating, ventilating, and air conditioning systems. If the building’s HVAC system cannot ensure continuous operation (including weekends, holidays, off-
season, maintenance, etc.), coordinate with the University’s Project Manager and UIT to consider stand alone systems with independent controls. Typical room requirements are as follows:

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>64 degrees to 75 degrees F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity Range</td>
<td>30 percent to 55 percent relative</td>
</tr>
<tr>
<td>Heat Dissipation</td>
<td>750 to 5,000 BTUs per hour per cabinet (number of cabinets to be determined through consultation with Facilities Management through the University Project Manager).</td>
</tr>
</tbody>
</table>

i. Structural Guidelines

1) Telecommunications Room walls should extend from the finished floor to the structural ceiling (e.g. the slab).

2) If ceilings must be installed they must be a minimum of 2.6 meters high to provide space over the equipment frames for cables and suspended racks.

j. Fire Alarm

A fire alarm should be installed in all Telecommunications Rooms. A portable fire extinguisher should be made available inside all Telecommunications Rooms.

k. Locating Telecommunication Room

1) It is imperative that TRs be located so as to minimize cable lengths for both horizontal and vertical cable runs.

2) Vertical Distribution

When designing TRs for vertical distribution it is preferable to "stack" TRs so that the Telecommunication Room on level one is located directly below the Telecommunications Room on level two, etc. TRs should be connected to one another via four (4), four (4”) inch conduits. Conduits should penetrate the floor in the TR on the far left corner of the TR, and extend no less than two inches (2”) above the finished floor.

3) Horizontal Distribution

Telecommunication Rooms must be located so as to maintain a distance no greater than ninety (90) meters (cable length) from the furthest termination point (communication outlet) being served by that TR. Ensure that conduits and cable trays feeding the Telecommunication Room terminate completely inside the TR.
Communications Distribution Systems (Pathways & Spaces)

a. Definition

Communications pathways and spaces are facilities used to distribute and support cable and connecting hardware between Equipment Rooms; and, between Equipment Rooms and the work area outlet. These spaces may include conduit, cable tray, open air plenums, cellular floor duct, etc.

b. Backbone Communication Pathways

Backbone communication pathways may consist of shafts, conduits, raceways, and floor penetrations (i.e. sleeves or slots) which provide routing space for communication cables.

c. Sleeves & Slots

1) Vertically aligned TRs with connecting sleeves or slots are the most common type of backbone pathway.

2) Position cable sleeves or slots adjacent to a wall, which can support backbone cables. Sleeves or slots must not obstruct wall terminating space. All sleeves and slots must be constructed in accordance with the National Electrical Code (NEC) and local fire codes, and must have curb, a minimum 2 inches high from the finished floor.

3) Design sleeves with a 4 in. diameter, unless a smaller size is required by the structural engineer.

4) The following table provides general guidelines for determining the number of 4 in. sleeves required, based on ANSI/EIA/TIA-569.

<table>
<thead>
<tr>
<th>TOTAL SQUARE FEET</th>
<th>QTY-OF SLEEVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50,000</td>
<td>3</td>
</tr>
<tr>
<td>50,000 to 100,000</td>
<td>4</td>
</tr>
<tr>
<td>100,000 to 300,000</td>
<td>5-8</td>
</tr>
<tr>
<td>300,000 to 500,000</td>
<td>9-12</td>
</tr>
</tbody>
</table>

5) The following table provides general guidelines for determining the sizes of slots required, based on ANSI/EIA/TIA-569.

<table>
<thead>
<tr>
<th>TOTAL SQUARE FEET</th>
<th>SIZE OF SLOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 250,000</td>
<td>6&quot; x 9&quot;</td>
</tr>
<tr>
<td>250,000 to 500,000</td>
<td>15&quot; x 46&quot;</td>
</tr>
<tr>
<td>500,000 to 1,000,000</td>
<td>23&quot; x 51&quot;</td>
</tr>
</tbody>
</table>
d. Open Shafts

Open shafts should only be used where large quantities of cables are required. Backbone cables should never be located in elevator shafts.

e. Conduit / Enclosed Metallic Raceways

1) Conduit or enclosed raceways may be used to run cables “point to point” where intermediate splicing is not required, or where physical protection or enhanced security is required.

2) The following table indicates the “conduit fill ratio” based on area and the minimum bend radius. Apply these fill percentages to straight runs with nominal offsets equivalent to no more than two 90° bends.

<table>
<thead>
<tr>
<th>Conduit</th>
<th>Area of Conduit</th>
<th>Minimum Bend Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade Size (in.)</td>
<td>Internal Diameter</td>
<td>Area=.79D^2</td>
</tr>
<tr>
<td>¼</td>
<td>0.82</td>
<td>0.53</td>
</tr>
<tr>
<td>1</td>
<td>1.05</td>
<td>0.87</td>
</tr>
<tr>
<td>1 ¼</td>
<td>1.30</td>
<td>1.51</td>
</tr>
<tr>
<td>1 ½</td>
<td>1.61</td>
<td>2.05</td>
</tr>
<tr>
<td>2</td>
<td>2.07</td>
<td>3.39</td>
</tr>
<tr>
<td>2 ½</td>
<td>2.47</td>
<td>4.82</td>
</tr>
<tr>
<td>3</td>
<td>3.07</td>
<td>7.45</td>
</tr>
<tr>
<td>3 ½</td>
<td>3.55</td>
<td>9.96</td>
</tr>
<tr>
<td>4</td>
<td>4.03</td>
<td>12.83</td>
</tr>
<tr>
<td>5</td>
<td>5.05</td>
<td>20.15</td>
</tr>
<tr>
<td>6</td>
<td>6.07</td>
<td>29.11</td>
</tr>
</tbody>
</table>

f. Horizontal Communication Pathways

1) Horizontal distribution systems (or horizontal pathways & spaces) consist of structures that conceal, protect, and support horizontal cables between the communications workstation
outlet and the horizontal cross-connect in the serving Telecommunications Room.

2) Horizontal communications pathways are used to distribute and support horizontal cable and connecting hardware between the workstation outlet and the Telecommunications Room. These pathways & spaces are the "container" for the horizontal cabling.

3) It is the responsibility of the designer to review all proposed horizontal distribution systems with the UIT project coordinator to ensure that the systems design:

   a) Makes optimum use of the ability of the horizontal cabling system to accommodate change,

   b) Is as unconstrained as possible by vendor-dependence,

   c) Complies with ANSI/NFPA 70 (ref. 7.1), this Design Manual and University of Utah Supplement, Local, State, and Federal Codes, and,

   d) Complies with ANSI/EIA-TIA-569 (Ref. 7.20).

g. Design Considerations

1) Horizontal distribution systems must be designed to accommodate diverse user applications including:

   a) Voice Communications

   b) Data Communications

   c) Local Area Networks (LANs)

   d) Wireless Applications

2) The designer shall also consider any other building information systems (e.g. CATV, building alarms / security, audio PA systems, etc.), which may require area/space in the horizontal distribution system, and shall allow for these systems accordingly.

3) An effective design of a building’s horizontal distribution system should meet the following criteria:

   a) All applicable local, state, and federal, codes.

c) Provide flexible cable distribution to workstation locations
d) Facilitate ongoing maintenance
e) Easily accommodate future changes in equipment and services
f) Minimize occupant disruption when horizontal pathways and spaces are accessed.
g) A minimum of three cable runs per individual workstation.

4) The horizontal distribution system must be designed to handle all types of communications cabling (i.e., UTP, STP, Coax, and Fiber Optic). When determining the type and size of the cable pathway, consider the quantity and size of the cables that the pathway is intended to house, and allow for growth of the area served over the planning cycle.

5) When designing the horizontal distribution system it is important to consider adds, moves, and changes, and minimal disruption to immediate occupants.

h. Number of Cable Runs per Work Area

The pathway design should allow for a minimum of three cable runs per individual work area.

i. Electromagnetic Interference (EMI)

1) Because EMI causes severe problems with electronic equipment, telecommunications, and data communications, avoidance of all potential sources or electromagnetic interference must be a primary consideration when designing a horizontal distribution system. To avoid electromagnetic interference, all distribution pathways should provide clearances of at least:

a) Four ft. (4’ or 1.2 m) from large motors and/or transformers

b) One ft. (1’ or 0.3 m) from conduit and cables used for electrical power distribution

c) Five in. (5” or 12 cm) from fluorescent lighting

2) Horizontal distribution pathways should cross perpendicular to fluorescent lighting and electrical power cables or conduits.
3) For additional clearance requirements, see ANSI/EIA-TIA-569 and ANSI/NFPA 70.

j. Grounding & Bonding

Horizontal pathways must be grounded and bonded in accordance with the requirements specified in ANSI J-STD-607-A, except where other codes or local authorities impose more stringent requirements.

k. Fire-Stopping

1) Install removable fire pillows.

2) All horizontal pathways that penetrate fire-rated barriers must be sealed in accordance with applicable codes. Provide smoke rated protection as required for smoke rated wall and floor penetrations.

l. Administration of Horizontal Distribution Systems

Utilize standard methods and procedures for labeling and managing horizontal pathways. Locate markings so that they are clearly visible after installation, and easily distinguishable from any markings that appear on individual components. For details on guidelines and requirements for the administration of horizontal pathways and spaces, see BICSI TDM Manual Chapter 4 and ANSI/TIA/EIA-606.

m. Types of Horizontal Distribution Systems

1) Many types of horizontal distribution systems are acceptable for installation at the University of Utah. Many buildings may require two or more of the following systems to meet all distribution needs. Acceptable types of horizontal pathways are:

   a) Unlimited access (raised floors).
   b) Ceiling zones and grids
   c) Cellular floors.
   d) Conduit
   e) Underfloor ducts (one-level or two-level)
   f) Cable tray

n. Sizing of Horizontal Pathways

1) The size requirements for horizontal distribution pathways depend on the following:
a) Usable floor space served by the pathway.

b) Maximum occupant density (i.e., floor space required per individual work area).

c) Cable type and diameter.

d) Pathway capacity (requires that the fill factor be taken into account).

<table>
<thead>
<tr>
<th>Trade Size</th>
<th>Cable Outside Diameter Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>½</td>
<td>1</td>
</tr>
<tr>
<td>⅝</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>1 ⅛</td>
<td>16</td>
</tr>
<tr>
<td>1 ⅝</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>2 ⅛</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
</tr>
<tr>
<td>3 ⅛</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
</tr>
</tbody>
</table>

2) The usable floor space (also referred to as "office space") is generally considered to be the building area used by the occupants for their normal daily work functions. For design purposes, this space should include hallways. All other common areas in the building should be disregarded.

3) The occupant density or floor space allocation per office or individual work area for the University of Utah is 100 ft² of usable floor space.

4) Cable Density

Design for pathway capacity to accommodate a minimum of three horizontal cable runs per workstation location.

5) Cable Diameter

For planning purposes use the following table to determine the minimum amount of Horizontal Pathway Distribution capacity.

<table>
<thead>
<tr>
<th>Horizontal Cable Type</th>
<th>Typical Outside Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four-Pair Category 5, 100-ohm UTP</td>
<td>0.25 to 0.28 inches</td>
</tr>
<tr>
<td>Two-Pair Shielded Twisted Pair, 150-ohm STP</td>
<td>0.31 to 0.43 inches</td>
</tr>
<tr>
<td>Duplex 62.5/125pm Optical Fiber Cable</td>
<td>0.11 to 0.18 inches</td>
</tr>
</tbody>
</table>
6) Conduit Capacity

Adequate planning should allow for a minimum of 1 inch conduits to each workstation location. Maximum conduit fill capacities shall not be exceeded in accordance with ANSI/NFPA 70, Chapter 9.

o. General Conduit Distribution

A horizontal conduit system consists of conduits radiating from the Telecommunications Room to the work station outlets in the floor, walls, ceilings, and columns of a building.

p. Suitable Conduit

1) The following types of conduit are deemed suitable for building installation at the University of Utah:

   a) Flexible Metal Tubing - (limitations apply, obtain specifications and direction from the UIT project coordinator)

   b) Rigid metal conduit (typical two (2), 3/4 inch conduits to each workstation location for horizontal distribution)

q. Conduit Runs

1) Conduit runs should be designed for the most direct route, parallel to building lines, with no more than two (2), 90 degrees bends between pull points or pull boxes. Design each run with a maximum horizontal cable run of ninety (90) meters (295 ft.). Continuous sections shall not be longer than thirty (30) meters without pull points or pull boxes installed.

2) It is recommended that conduit runs be kept to no more than 45 meters (150 ft.) in total length including sections through pull boxes.

r. Conduit Quantity and Size

1) A minimum of two (2), 3/4 inch metal conduits shall be installed from the Telecommunications Room and terminated to each four square workstation outlet.

2) Include in the design, the installation of one ¾” metal conduit from the Telecommunications Room to termination at each wireless access point.
s. Conduit Bend Radii

The radius of a conduit bend must be at least 6 to 10 times the diameter of the conduit. Conduits designated for Futureflex tubing must be installed with a minimum bend radius of 12 times the diameter of the conduit.

t. Conduit Entering Telecommunications Rooms

Horizontal distribution conduits entering a Telecommunications Room should terminate near the corners and allow for proper cable racking. If conduits are entering through the floor, they must terminate four inches (4”) above the finished floor. If conduits are entering through a wall, the conduits must be reamed and bushed, and terminated as close as possible to the terminating rack or wall.

u. Completing Conduit Installation

1) Upon completion of Horizontal Distribution Conduit, the conduits will be:

   a) Left clean, dry and unobstructed
   b) Capped for protection
   c) Labeled for easy identification

2) All conduits will be equipped with a contiguous length of plastic or nylon pull string with a minimum rating of 200 lbs. (90 Kg) or a 12 AWG wire.

v. General Cable Tray Systems

Cable tray systems are used primarily as main corridor distribution apparatus. Cable tray systems should be designed as equipped to support only telecommunications and data communications cable. Shared systems with power are not acceptable under the guidelines listed in avoiding EMI.

w. Suitable Cable Tray Systems

1) The following cable tray systems are acceptable for installation at the University:

   a) Channel
   b) Ladder
   c) Solid Bottom
   d) Trough
   e) Wire Mesh (basket), dual hung with no center support
x. **Cable Tray Runs**

Cable tray systems should be installed with a minimum number of bends installed, if more than three 15 degree turns are installed in a contiguous length, then de-rate the effective capacity of the cable tray by twenty five (25) percent. Delineations in a level cable tray installation are often unavoidable, however these delineations should be kept at a minimum with each delineation not exceeding 30 degrees and 24 inches offset. The total delineation for the tray span should not exceed 180 degrees.

y. **Cable Tray Size and Capacity**

Cable tray size and capacity will be determined by the amount and type of cable installed, the static load capacity of the tray, and the length of the support span. Cable tray systems should be designed to accommodate 100 percent future growth.

z. **Cable Tray Installation Clearance**

1) **Cable Tray Systems** are to be installed with as much clearance as possible from other building facilities, and installed in the lowest position below all other building facilities but above the ceiling grid, in accordance with ANSI/NFPA standards and meeting the following criteria:

   a) 8 in. clearance from obstructions on both sides.
   b) 8 in. clearance from obstructions to the top.

2) Installation of cable tray pulley systems installed in a solid ceiling environment should provide access points at 20 ft. on-center, and at any directional deviation greater than 15 degrees and/or 90 degree turns.

aa. **Cable Tray Entering Telecommunications Rooms**

Cable tray entering a Telecommunications Room should wrap around the room and allow for proper cable racking.

bb. **Completing Cable Tray Installation**

1) Upon completion of horizontal cable trays, the trays shall be inspected by the designer to verify that the trays are:

   a) Free and clear of all obstructions and debris
   b) Free of burrs, sharp edges, and projections
   c) Labeled for easy identification
   d) Identified as "Telecommunications Cable Tray Only"

cc. **Other Types Of Horizontal Distributions Systems**
1) The university has identified other types of acceptable horizontal distribution systems that may be installed. These include, but are not limited to:

   a) Unlimited access (raised floors).
   b) Ceiling Zones and Grids
   c) Cellular Floors.
   d) Conduit
   e) Underfloor ducts (one-level or two-level)

2) Due to the individuality, complexity, and the broad scope of requirements for these systems. The University Information Technology (UIT) will review each of these specified systems on a ‘case-by-case’ basis.

dd. Outlet Boxes, General

Telecommunications outlet boxes installed in dry-wall, plaster, or concrete block wall shall be single gang plaster (mud) rings. Wall phones and wireless connections shall use single gang plaster (mud) rings.

ee. Mounting Outlet Boxes, Office Environment

1) Outlet boxes installed in an office environment must be specified to meet the following criteria:

   a) At least 4 in\(^2\) by 2-1/8 in. deep
   b) Mounted at least 18 inches above the finished floor or even with adjacent electrical duplex services
   c) Outlet boxes shall not be placed back to back

ff. Mounting Outlet Boxes, Above Counters

1) Outlet boxes installed above a counter will meet the following criteria:

   a) Counter with Backsplash
      At least 6 inches above the top of the counter to the center of the outlet.
   b) Counter without a Backsplash
      At least 12 inches above the top of the counter to the center of the outlet.

gg. Mounting Outlet Boxes, Wireless
1) At least 4 in² by 2-1/8 in. deep

2) Mounted at 10 inches below the finished ceiling

3) Outlet boxes shall not be placed back to back

4) Distance between units determined by the project designer

hh. Elevator Phone

Elevator phones on campus are installed and maintained by UIT.

ii. Communication Connection

Include in specifications that the Contractor will be responsible for the installation of the traveling cable from the elevator panel to the Car Operating Panel ("COP"). A minimum of four (4) 18 gauge wires will be provided in the traveling cable for the purpose of communication services transport. The communication wires will extend from the COP to the access panel opening that is provided for the communication device.

jj. Conduit

1) Include in the Design

The Contractor must provide a home run 3/4 inch conduit extending from the top of the elevator panel and extending to the nearest Telecommunication Room (TR or ER). UIT will provide the necessary cable to connect the emergency line to the elevator panel.

kk. Communication Device

1) The elevator communication device (phone panel) will be a standard design and configuration per drawing Detail COM-1. The ‘back-box’ is required per the drawing. The University UIT Department will furnish and install the device. The approved device for elevator installation is Ramtel Corporation Model RR833. The unit is a stainless steel, brushed finish panel which meets ADA requirements. The minimum required opening that must be provided for the approved device is 9 1/4" H x 6-5/8” W with a minimum 4 inch clearance for the back of the device.

2) The elevator car is to be factory prepared for this device; or, the Contractor shall prepare the car to receive the device per Detail COM-1. Note that the device must be mounted at a height which positions the activation button no higher than 48-3/4” above the finished floor.
II. Emergency Service Line

1) The telephone line that is used in the elevators is a standard Centrex line that automatically rings to Public Safety.

2) It is the responsibility of the University Project Manager to order the line for the elevator and to notify Public Safety that a new elevator phone is being added to their system.

(8) Security Systems

a. Access Control and Intrusion Detection

   1) System

   a) The Access Control and Intrusion Detection system is the Software House C*Cure system which includes a microprocessor based and managed access control system, with options for intrusion detection, and personal protection (duress) security and specifies sensors, detection devices, signal equipment, system controls, and displays. Each system installed will utilize either the iSTAR Pro or iSTAR Edge Controllers, or designated dialer.

   b) The system shall tie into the existing C*Cure access control system currently installed on the University Campus.

   c) The system shall have access controlled doors as well as perimeter doors and hatches monitored with door position switches.

   d) The system shall interface with the fire alarm system and in the event of an alarm, shall unlock all controlled doors designated for emergency egress.

   e) Any card access component of this system shall be an extension of the existing campus-wide C*Cure access control system utilized by the University of Utah for all their facilities, with all existing functions available and be completely compatible with the then current version of the CCure system installed.

   f) Duress alarm: Performed by indicated hard wired stationary duress alarm button locations and remote wireless receivers that are triggered by portable transmitters.

   g) Alarm Annunciation: In addition to the audible signal sounds and visual text indication on the system keypad, video images from associated cameras in the area may,
at the election of Facilities Central Services, be called up immediately and automatically to an assigned workstation for viewing. No additional operations for video call up by the control officers shall be necessary. Provide all licensing as required for CCure system and video system to perform automatic video camera call up via event programming in CCure.

h) Battery backup for all components in security system shall be capable of operating for a minimum of 8 hours in the event of a power failure.

i) Security contractor shall interface ADA openers where security access control is installed to allow for proper ADA access/egress as per building code.

2) Testing

The campus Facilities Central Services Office will perform final system testing. Contractor must provide notification to Project Manager that system is complete and ready. Project Manager will schedule the final testing with the University Facilities Central Services.

3) Warranty

Specify two year warranty to repair or replace components of access control and intrusion detection devices and equipment that fails in materials or workmanship. Warranty should be started upon completion of final walk through and sign off with University Facilities Central Services.

4) Equipment

a) Equipment specified for the C*Cur system will be required to use the approved University Parts list. The Parts list can be found in the University Forms at (Insert Link Here)

Any deviation will require a Project Variance Request in accordance with Design Process section 1.4

b) Surge Protection

Comply with minimum requirements of UL Standard 1449, "Transient Voltage Surge Suppressors," for each component using solid-state devices and having a line voltage power source connection or an exterior underground signal connection.

c) Controllers
Provide at the locations identified, a complete and C*Cure System including but not limited to the following equipment:

i. iSTAR Pro or iSTAR Edge controller
   iSTAR Pro controllers can be purchased and installed as either an 8 door package or a 16 door package. The Altronix Power Supply AL300ULX can be used for powering 2 iSTAR Pro controllers when they are installed in the same room.

ii. For a list of approved parts for the 16 and 8 Reader Front End Package Equipment refer to the University Parts list. The Parts list can be found in the University Forms at (Insert Link Here)

iii. I-class Card Readers

iv. Relay Output Contact

v. Motion Detectors

vi. Request to Exit Devices

vii. Door Contacts

viii. Power Supplies and Transformers

d) Magnetic Door Locks

Magnetic door locks shall not be used within alarm and access systems at the University

e) Power Supplies

i. Provide power supplies as per manufacturers written recommendations with total number of powered devices for each power supply restricted to only consuming 75 percent of the power supplies rated amperage. Provide separate power supplies for system controllers (As per manufacturer), card readers (12VDC, 5 A), and locks (24 VDC, 7 A).

ii. 120 V 60 Hz from locked disconnect device. System components are supplied with power through separate power supplies. Provide all required power supplies and associated transformers as specified by the manufacturer and required for the installation.
iii. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data. Whenever possible, the system should be tied to the building’s emergency power.

iv. To ensure adequate power, installer must calculate the total power requirements of the iSTAR Pro controller and related hardware. If the maximum power consumption exceeds the output of the iSTAR Pro power supply, an additional power supply must be connected to the system.

c) Card Access System Hardware

i. The access control panel (iSTAR Pro and/or iSTAR Edge controller) shall be provided and wired with back-up battery power for a minimum of eight hours operation upon loss of AC power.

ii. The access control panel shall have provisions for relay suppressor kits for each relay used, to protect the access control panel from collapsing electrical fields.

iii. Card readers shall be HID Prox-Pro and HID Mini-Prox readers matching the readers currently installed on campus for door control. The access control panel shall support card readers using Wiegand, Proximity and Biometrics technologies.

g) Door and Window Switches

i. Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of [two] [three] encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields. Position switches on doors shall be magnetic reed switch type and shall be per manufacturers recommendations for the type of door installed on. Provide concealed door frame types.
ii. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

iii. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

iv. Remote Test: Simulate movement of actuating magnet from central station control unit.

h) Exit Request Devices

i. Passive Infrared (PIR) Devices: Detect request to exit by monitoring infrared energy emitted within the door exit zone. Units are sensitive to the infrared wavelengths emitted by the human body and are insensitive to general area thermal variations.

ii. On door types (see drawing schedules) that do not show motion detectors being used, the request to exit function will be handled by the switched exit hardware devices. It shall be the responsibility of the security contractor to coordinate with the hardware contractor in wiring of power transfer hinges and switched exit devices. The only doors that do not require any exit request are doors with a reader on both sides.

i) Acoustic Type, Glass-Break Sensors

i. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.

ii. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).

iii. Activation Indicator: LED that lights on sensor housing when responding to vibrations, remaining on until manually reset at sensor controller or at central-station control unit.

iv. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
v. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

j) Photoelectric Sensors

i. Sensitivity: Detect standard-intruder movement within sensor's detection patterns at any speed of less than 7.5 fps (2.3 m/s) though the beam. Allow installation of multiple sensors within same protected zone that will not interfere with each other.

ii. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

iii. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard intruder movement within sensor's detection patterns, causing an alarm.

k) Microwave Pir Dual technology Motion Sensors

i. Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

ii. An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

iii. Minimum Detection Pattern: A room 30 by 30 feet.

iv. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across 2 adjacent segments of detector's field of view.
v. Microwave Sensor Sensitivity: Adjustable, able to detect standard intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.

vi. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

vii. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard intruder movement within sensor's detection patterns, causing an alarm.

l) Wire and Cable

i. Provide both TPS (Twisted pair Shielded) and TP (Twisted Pair), with the appropriate number of pairs. Provide Cat 5e UTP for emergency telephone signal wiring.

ii. Cable for Low-Voltage Control and Signal Circuits: shall be shielded twisted-pair cable with drain.

iii. HID Card Reader-Weigand-Composite cable part number CSC #702790

   1. 1-22/6 conductor overall shield (Reader)
   2. 1-18/4 conductor (Lock Power)
   3. 1-22/2 conductor (Door Contact)
   4. 1-22/4 conductor (Request to Exit)

iv. RM Style Card Reader-RS485-CSC #112102

   1. 1-18/2 pair individually shielded

v. Inside Card Reader on IN/OUT Door-Weigand-CSC #110253

   1. 1-22/6 conductor overall shield

vi. Alarm Door Contact-CSC #110105

   1. 1-22/2 conductor

vii. Duress/Panic Button-CSC #110105
1. 1-22/2 conductor

viii. RM input/output Modules-RS485-CSC #112102

1. 1-18/2 pair individually shielded

5) Installation Requirements

a) Wiring

i. Install all wiring in raceways

ii. ¾ inch minimum conduit is required

iii. Multiple home runs may be contained in a single conduit of appropriate size.

iv. Conceal raceways except in unfinished indoor spaces.

v. Conduit fill shall not exceed 40%.

vi. Wiring shall be neat and workmanlike.

vii. Cables shall be individually labeled.

viii. Cable Central Services using spools, guides, supports and other devices.

ix. Cable shielding and grounding SHALL be utilized in panels and enclosures.

x. Shield grounding SHALL be at the panel and NOT at the device (to avoid ground loops)

xi. Cable routing within the enclosure or panel shall be neat and workmanlike.

xii. Number of terminated conductors shall be in accordance with manufacturers’ recommendations and/or requirements.

xiii. Un-terminated conductors shall be electrically isolated and secured within the enclosure or panel.

xiv. Appropriate splices, taps or terminations shall be in an approved junction box.

xv. External device power supplies shall be installed in Facilities Central Services approved locations.

6) Naming and Programming

a) Convention:
i. Use the official University of Utah campus building numbers, and the University designated room numbers.

ii. Descriptive abbreviations should be used as most CCure program display boxes are limited in size.

b) iSTARs:

i. Building Number: iSTAR Number L# Door#
   Room Description Ex: 0003:03 L1 0166
   Northwest Comm Rm
   0079:02 L2 2000D L2 Data Closet 0525:19 L4
   East Comm Rm by Elevator.

ii. A more complete description of the iSTAR’s location, access requirements (card access, key number, how to find the room where the iSTAR is located, etc.) should be entered in the description section of the configuration identification screen.

   1. Ex.; Located on level one, room 1001, (or across from elevator) using key RT2674 or access card.

iii. Programming

   1. Leave time zone box blank.

   2. Tamper, AC power fail and Low Battery inputs should all be defined and properly working.

   3. An event should be defined for controller communication failure.

c) iSTAR Clusters:

i. Naming: Building Number: iSTAR L#

   Ex: 0003:03 L1 Cluster
   0079:02 L2 Cluster
   0525:19 L4 Cluster

d) Reader, Input & Output Device:

i. Naming: Building Number: iSTAR number, (IZ, PH, EX, etc) – if included in intrusion zone, pharmacy, exterior door, etc.: (input/output type) (DC, REX, DL, ML, GB, DUR, MOT) Room number, L#, which board
it is controlled by (ACM, I8 or RM) and which port or relay it is wired to on the board to which it is attached.

1. Ex: 0851:01 1125 Lab Reception 1-R6 (reader 6 on ACM 1 of iSTAR 1) 0043:01 (IZ):MOT Safe Rm 1-I7 (motion sensor within intrusion zone) 0086:04 DC L1 DSL/TACC RM-4-I1 (door switch monitor on RM board number 4) 0512:01 DC L1 E101 Conf Rm I8:1-I4 (door switch monitor on I8 board number 1)

ii. Programming:

1. Input and output state changes should not be sent to the Monitoring Station and should only be sent to the Journal if it is part of an intrusion zone, panic button or other life safety or high level security feature; i.e. freezers.

2. Readers should have the continuously active box checked.

3. Reverse sense of input should only be used in exceptional situations and then only temporarily.

4. No unused inputs, outputs, readers, doors or any other element should be defined in the system.

5. After complete installation, no input supervision errors, open loops, or line faults should be reporting in the Monitoring Station.

f) Door:

i. Naming: Building Number: iSTAR number (Door type) – IZ (intrusion zone), EX (exterior door), PH (pharmacy) University assigned room number (if known) Floor (if applicable): Description

   1. Ex: 0019:03 0490 Atmos Comp/Vis 0575:01 (EX) L1 North Entry :13 3C354 Vascular Surgery Back Dr

ii. A more complete description of the door can be entered in the description section of the configuration identification screen.

g) Camera:
i. Naming: Building Number View Description (IP Address) Camera Model Number

1. Ex: 0086 Loading Dock (10.0.86.5) Axi P3346

*Facilities Central Services is generally responsible for programming the following:

h) Event:

i. Naming: Building Number : iSTAR number, (type) – (intrusion zone, duress, etc) : Event Description

1. Ex: 0026:01 (DU) Rm 106 Duress Evt
   0032:01 Unlock Usher Rm Evt 0179:01 (IZ): Arm Event Group Evt

ii. A more detailed description should be entered if the cause of the event or required action to the event needs to be displayed on the General Activity Monitor screen.

i) Clearance:

i. Naming: Building Number – Partition name if other than default, Description, (type) – (IZ-intrusion zone, PH-pharmacy, etc.), time range (D-D 0000-0000)

1. Ex: 0093 Natatorium Men’s Pool Entry Clr
   0179 Ext Ent M-F 0800-1700 Clr

ii. The type and/or location of the doors in the clearance should be clear.

j) Schedule:

i. Naming: Building Number: iSTAR number (if applicable for event activation) – Description, time range (D-D 0000-0000)

1. Ex: 0053:01 Disability Center Unlock M-F 0800-1700 Scd 0722:02 Shop Area Force Arm M-S 2200 Scd 0086 Custodial Day M-F 0600-1500 Scd

2. Since there is no place for a detailed description, the time specification name should supply as much information in as an abbreviated form as possible.

ii. Programming:
1. The time zone box must be left blank when defining a time specification.

k) Groups:

i. Naming: Building Number: Floor (if applicable):
Description

1. Ex: 0512 Ext Door Grp for door group
0556 Patient ElevGrp for elevator group
0865 EvtGrp for event group 0064 InputGrp for input group 0035 OutputGrp for output group

2. There is a description box that can be used to clarify particular group information if necessary

7) Grounding

a) Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and system pre-testing, testing, adjustment, and programming.

b) Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

c) Pre-testing: Align and adjust the system and perform pre-testing of all components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.

d) Testing: Provide at least 10 days' notice of acceptance test performance schedule.

e) Operational Tests: Perform operational system tests to verify conformance with specifications. Test all modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion devices by simulating activities outside indicated detection patterns.

f) Installer Start-up Responsibility: The Installer shall initiate system operation. The Installer shall provide competent start-up personnel until the system is fully functional. Upon reoccurring technical problems, the Installer shall supply factory direct Manufacturer's support in the form of factory technical representation and/or diagnostic equipment until the resolution of those defined problems.
g) Final testing must be observed by a representative of the campus Facilities Central Services Office. Complete security system must be approved and accepted by Facilities Central Services.

b. Video Surveillance Systems

1) General

a) The contractor or sub-contractor installing the video system must be qualified and trained to OnSSI standards and Axis certified.

b) Video Central Services systems shall integrate with the Software House CCURE 9000 software. The IP video surveillance control and Central Services system shall handle an unlimited number of cameras and alerts through a desktop-based or mobile video client.

c) The contractor or sub-contractor installing the video system must be qualified and trained to OnSSI standards and Axis certified.

2) Warranty

a) Manufacturers standard form in which manufacturer and Installer agree to repair or replace components of video surveillance devices and equipment that fails in materials or workmanship within specified warranty period which is two years from date of final walkthrough and sign-off by Facilities Central Services.

3) Equipment

a) Video Surveillance Wire/Cable
The primary cabling is Ethernet cabling, either Cat 5 or Cat 6. Cat 6 cable shall be used for any new or replacement cable installations. Additional cable may be required for the environmental controls of outdoor housings or additional power requirements for PTZ (Pan-Tilt-Zoom) cameras. However, as cameras have continued to evolve, the additional power required for these (Power-Over-Ethernet) standard. Any deviation shall require approval from Facilities Central Services prior to installation of substitute cabling.

i. Ethernet extenders may be used in rare circumstances to provide reliable connectivity. Use of extenders must be approved by Facilities Central Services during the design process.

b) Video Surveillance Equipment
The University of Utah has standardized on the Axis product line for video surveillance. Common Axis camera models used by the university are listed. Other camera models may be required for specific surveillance purposes, but must still contain the remote focus feature. However, any substitution or deviation from Axis camera products, or these specific Axis models, must be approved by Facilities Central Services prior to installation.

i. Legacy analog camera conversion: existing camera installations can be converted to the Ocularis OnSSI system with the addition of conversion hardware. While replacement of analog cameras with newer high-definition models is preferred, the following hardware must be used in situations where analog camera images are determined to be sufficient.

c) OnSSI Video Software and Hardware

i. Facilities Central Services maintains the centrally managed servers the Ocularis Surveillance system as well as the appropriate server(s) for the cameras at various locations throughout the campus. Installations/conversions of fewer than 8 cameras will record to existing Ocularis servers. Installations/conversions of 9 or more cameras will require an additional recording server which will be supplied and maintained by Facilities Central Services. Cost of these servers is covered within monthly camera fees already billed to the departments.

ii. Video Monitoring Workstations require a minimum of:

1. CPU: Intel core i7 (similar or better)

2. RAM: 8GB


4. Graphics Adapter: PCI-Express, 1GB RAM w/dual DVI outputs 35 simultaneous Video Channels – 1GB

5. Software: Microsoft .NET 3.5 Framework and DirectX 9.0 or newer.

iii. Switches: All IP camera installations must be connected to a campus standard PoE rated switch.
d) Raceways, Electrical Boxes, and Fittings shall be per the University Standards found in 3.5 Electrical.

4) Installation

a) Install video surveillance systems and components where indicated, in accordance to NFPA 70, with equipment manufacturer's written instructions, in compliance with National Electrical Code, and with recognized industry practices, to ensure that video surveillance system complies with requirements and serves intended purposes.

b) Wiring Method: Install all wiring only in raceways, 3/4” minimum, or cable trays. Multiple home runs may be contained in a single conduit of appropriate size. Conceal raceways except in unfinished indoor spaces. Conduit fill shall not exceed 40%.

c) Wiring within enclosures: Label, bundle, wrap, and train the conductors to terminal points with 6-inches of slack minimum, 12-inches of slack maximum. Provide and use cable Central Services hardware and distribution spools. Wire shielding, where used, should remain un-cut as much as possible.

d) Number of Conductors: As recommended by system manufacturer for functions indicated.

e) Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures.

f) Tighten connections to comply with tightening torques specified in UL Standard 486A.

g) Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.

h) Install power supplies and other auxiliary components for camera devices at the locations pre-approved by Facilities Central Services.

5) Grounding

A. Ensure that any power supplies are properly connected to an earth ground near the AC input wiring.
B. For devices appropriate for cable shield grounding, ensure that any shield wires are grounded at the power supply end of the cable to the ground referenced above.

C. Do NOT connect the shield to ground at the far end cabled device. (This will avoid the potential for “ground loops”.)

D. When disconnecting wiring, disconnect ground wires last (to provide maximum protection to the equipment and personnel.)

End of 3.5 Electrical
3.0 DFCM REQUIREMENTS

3.7 PLUMBING

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

1. The A/E shall coordinate with the University Project Manager throughout design development to ensure systems are compatible with the University Master Plan, and plans for the user department at the University are coordinated with all required campus agencies.

2. This supplement contains required design elements for mechanical systems at the University, and design professionals are required to adhere to the information provided herein. The designer is also expected to conform to accepted industry design practices in the application of the requirements found in this supplement. Items not specifically addressed are left to the designer's professional judgment, but are subject to review.

3. Each division of the supplement is intended to assist the mechanical designer with design information which is considered unique to the University's mechanical systems. Facilities Management, including the departments of Facility Operations, Campus Planning, and Construction Project Delivery prepared this document to serve as a vehicle to insure consistency, quality, and maintainability in mechanical system design on campus.
4. The A/E's work is subject to review and comment by Facilities Management at any time during design or construction.

a. Progress checks by the University will result in written review comments. The A/E is expected to respond to each comment with written action items.

b. The design engineer (or A/E design team) shall meet with the University Project Manager during the design to coordinate the progress of the work.

c. Design reviews will be conducted whenever deemed necessary, but are considered mandatory for the schematic or design development progress check and final drawing submittal.

d. Each design review comment (regardless of the source) is to be addressed in writing by the design engineer prior to completing the next phase of the project design. This action report shall be submitted to Facilities Management through the A/E team leader.

**ADDED:**

**REVISIONS SUMMARY**

for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.7 Part 1 EE. / 15860 / i.</td>
<td>Spring Return added requirement.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / part 1 / EE. / 15829</td>
<td>Exhaust Fans Updated standard to add performance based requirements for exhaust fans</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / part 1 / EE. / 15770</td>
<td>Custom Air Handling Units Added standard for Custom Air Handling Units</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / Part 1 / CC.</td>
<td>System Commissioning Updated Standard to reflect the requirements for the relationship between the commissioning agent and the design team</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / part 1 / DD.</td>
<td>Metering Added performance based requirements for metering and more detailed requirements for CHW and HTW meters</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 /Part 1 / EE. / 15700</td>
<td>Heat Transfer / Boilers Updated standard to clarify some of the performance based requirements</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / part 1 / EE. / 15100 / e.</td>
<td>Chilled Water and Heating Water Valves Updated Standard and removed specific manufactures from the standard.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / part 1 / EE. / 15061 / f. / i</td>
<td>Chilled Water and Heating Water Piping Updated Standard to eliminate specific manufacturers and to add HDPE and polypropylene piping to the acceptable materials for use.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / Part 1 / EE. / 15995</td>
<td>Test and Balance Updated Standard to reflect current practices. Including adding NEBB to the acceptable licensing of balance contractors.</td>
</tr>
<tr>
<td>Date</td>
<td>Section / Document Number</td>
<td>Topic</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / Part 1 / EE. / 15702</td>
<td>Chilled Water System Updated Standard to reflect more performance based requirements.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / Part 1 / 15450 / J / 6</td>
<td>Auto Faucet Battery Pack Updated standard to eliminate auto faucets with the exception of Handicapped lavatories.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.7 / Part 1 / EE. / 15062</td>
<td>Piping Material below Grade Removed “Blue Brute”</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15700</td>
<td>Heat Transfer Added / Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / C. / (13) / (19) / (20)</td>
<td>Plumbing General Requirements Added / Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15061 / p. / 2</td>
<td>Soil, Waste and Vent Updated Requirement</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15062 / b. / 2 / c.</td>
<td>Piping Material (Underground or Below Grade - &quot;b.g.&quot;) Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15405</td>
<td>Soil and Waste Piping System Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15100</td>
<td>Valves and Accessories Updated / Added Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15400 / b. / 5</td>
<td>Plumbing Systems Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15902</td>
<td>ATC – Controllers Added New Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15907</td>
<td>ATC – Sensors Added New Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15770 / t.</td>
<td>Packaged Air Handling / Rooftop Units Added New Requirement</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15680 / e / 23 / f / 19 / g / 7</td>
<td>Cooling Towers Added New Requirements to Cooling Towers</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15670 / d / 21 / e / 11</td>
<td>Chillers Added new Requirements to Chillers</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15435 / c</td>
<td>Water Conditioning Systems Added New Requirement</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. / 15435 / c / 1</td>
<td>Water Conditioning Systems Added additional Manufacturers</td>
</tr>
<tr>
<td>Date</td>
<td>Code</td>
<td>Section</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / EE. /</td>
<td>Flush Valves</td>
</tr>
<tr>
<td></td>
<td>15450 / j / 5</td>
<td></td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.7 / C. / (17) / a / 6</td>
<td>Fixtures and Floor Drains.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / G. / (6) / e. / 3</td>
<td>Steam System Extensions or Revisions.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / G. / (6) / e. / 4</td>
<td>Steam Condensate to SLC Sewer.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / X.</td>
<td>Start-Up Strainers.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15060 / a. / 1</td>
<td>Pipe and Pipe Fittings.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15060 / a. / 2</td>
<td>Pipe and Pipe Fittings.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15060 / e. / 5</td>
<td>Piping Tests.</td>
</tr>
<tr>
<td>REVISION DATE</td>
<td>LOCATION</td>
<td>SUMMARY OF CHANGE</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15061 / i. / 1) and j. and k. and l. and p. / 3)</td>
<td><strong>Type L Copper Above Grade.</strong> Removed “95-5” and replaced with “lead free” solder</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15061 / n. / 4)</td>
<td>Natural Gas Piping, Above Grade. Added protective paint</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15061 / t.</td>
<td><strong>Cooling Coil Condensate Drain.</strong> Removed Type “M” and replaced with Type “L” copper</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15062 / a. and 3.5 / EE. / 15351 / a. / 2) / e)</td>
<td><strong>Buried Pipe Trace Wire, Warning Tape, Sand Cover.</strong> Added requirements for all buried piping as described in 3.2 Civil</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15062 / b. / 3)</td>
<td><strong>Domestic Water &amp; Fire Prot. Below Grade.</strong> Clarified when copper is approved</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15062 / c. / 6)</td>
<td>Natural Gas Piping, Below Grade. Added protective sleeve when routed through a wall</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15066</td>
<td><strong>HVAC Piping Systems Cleaning, Filling, Treatment.</strong> Added requirements and restrictions</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15400 / a. / 4) / b)</td>
<td><strong>Parallel Reduced Pressure Backflow Preventers.</strong> Changed application from certain water systems to “required on all make-up water lines”</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.7 / EE. / 15400 / b.</td>
<td><strong>Disinfection of Piping Systems.</strong> Much of this section was re-written</td>
</tr>
<tr>
<td>27 February 2012</td>
<td>3.7 / EE. / 15995 / q.</td>
<td><strong>Testing &amp; Balancing:</strong> Removed paragraph “q” (approved T&amp;B firms)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>University Design Standards.</strong> The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>REVISION DATE</td>
<td>LOCATION</td>
<td>SUMMARY OF CHANGE</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Campus Design &amp; Construction.</strong> CD&amp;C has changed to <em>Construction Project Delivery</em> and is shown as <em>Construction Project Delivery</em> or <em>Facilities Management</em> in this document.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Facilities Planning.</strong> Facilities Planning has changed to <em>Campus Planning</em></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Business Services.</strong> Business Services has changed to <em>Facilities Business Services</em></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Plant Operations.</strong> Plant Operations has changed to <em>Facility Operations</em></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>O&amp;M / Warranties.</strong> Removed. Relocated to the Supplemental General Conditions for University of Utah Projects</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / G. / (6) / j.</td>
<td><strong>Glycol Systems.</strong> Glycol systems are to be contained within mechanical rooms (except fire protection piping)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / Q. / (11)</td>
<td><strong>Drawings and Specifications.</strong> Added requirement for sequence of operations</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / EE. / 15405 / b. / 6</td>
<td><strong>Acid Resistant Waste Systems.</strong> Added requirement for direct connection to drain</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / EE. / 15900</td>
<td><strong>Controls (ATC / BAS).</strong> Added Trane US, Inc. and Honeywell only by Wasatch Controls; removed Staefa Systems</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / EE. / 15061 / f. / 3</td>
<td><strong>Piping, Hot Water Heating.</strong> Added temperature ratings for EPDM gaskets</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / EE. / 15061 / f. / 4</td>
<td><strong>Piping, Hot Water Heating.</strong> Added Grinnell, removed Gustin Bacon</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.7 / EE. / 15061 / o. / 5</td>
<td><strong>Piping, Fire Protection.</strong> Added Grinnell, removed Gustin Bacon</td>
</tr>
</tbody>
</table>
ADDED:

H. Water Pressure

Generally the water pressure on campus exceeds 80 psig. A pressure regulator shall be provided on all buildings having a main pressure greater than 80 psig to reduce the pressure. Water pressure shall not be reduced below 45 psig (or 15 psig at the farthest connection in the building). Coordinate with the University Project Manager to obtain the site water pressure.

I. Isolation Valves

Separate rooms or labs shall have isolation valves on hot and cold water supply and recirculation piping, allowing isolated maintenance to proceed in each room without affecting adjacent areas. Back-to-back restrooms shall be individually isolated with valves located in the common or adjoining wall in a 24” x 24” access panel within the restroom the valves serve.

J. Beverage Dispensers - Check Valves and Vent

The water supply connection to carbonated beverage dispensers shall be protected against backflow by a double check valve with an intermediate atmospheric vent (ASSE 1012 or 1022 double check valves and vents). The A/E is to consider the effects of carbon dioxide gas on downstream piping.

K. Capped Piping

Water supply systems which are to be capped shall have their supply (and return) piping removed and capped at an active main or branch line to prevent stagnation in an idle branch pipe. Waste, vent, natural gas, etc., must be capped at the main. All abandoned piping must be removed and not left in place. If piping is considered for abandonment, then it must be documented, and written approval must be obtained from the University Project Manager prior to capping or abandoning any piping.
L. Crossing High Temperature Water Piping

Piping systems which must cross over or under high temperature water lines shall be protected to prevent damage. See 3.7 Plumbing for special requirements.

M. Domestic Hot Water

a. Where a building is provided with HTW or steam from the campus distribution system, this shall be the source for heating the domestic hot water. Alternate energy sources considered to heat domestic water must be approved in writing by the University Project Manager.

1) The following domestic hot water temperatures shall be used for design purposes:

<table>
<thead>
<tr>
<th>ROOM SERVED</th>
<th>DESIGN TEMP</th>
<th>SITE SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet Room, Custodial Room</td>
<td>120°F</td>
<td>110°F</td>
</tr>
<tr>
<td>Laboratories</td>
<td>140°F</td>
<td>120°F</td>
</tr>
<tr>
<td>Kitchen and Laundry Facilities</td>
<td>180°F</td>
<td>140°F</td>
</tr>
</tbody>
</table>

2) If a dishwasher or laundry washer requires a higher temperature, coordinate with the University Project Manager for consideration of a booster heater application at the equipment requiring the higher temperature.

3) A domestic hot water recirculation line with a circulation pump shall be provided for all domestic hot water systems greater than 75 ft. in length.

4) Provide two pumps on the domestic hot water for HTW domestic water converters. Two pumps allow for standby and alternating use. Maintain domestic water circulation through the HTW converter at low use times to prevent damage and extend the life of the converter. Provide lead/lag controls for pumps.

5) In chiller mechanical rooms, provide hot and cold domestic water hose bibs reasonably close to the chiller and floor drain for future maintenance tasks.

N. Auto-Vents Not Approved

Auto-vents are not to be allowed as a substitution for normal venting through the roof in plumbing and drainage systems.
O. Fixtures and Floor Drains

a. Plumbing fixtures in toilet rooms shall be wall hung. Service sinks in custodial closets shall be floor type.

1) Atmospheric vacuum breakers shall be provided on all sink outlets in lab areas; or, a branch line backflow preventer may be installed in a water line supplying an area of a lab or labs. When a branch line backflow preventer is used, the water piping downstream of the device must be labeled as "non-potable water".

2) Provide at least one floor drain in each toilet room.

3) Provide a floor sink near the drains of automatic sprinkler systems.

4) Provide floor drains within 5'0" of all mechanical equipment which have water connections or usage.

5) Provide 3" waste line risers to all urinals with approved fittings. All urinals shall be serviced with individual 2" waste arms and cleanouts (either individual 2" or a common 3" located on the riser).

6) For restroom flush valves, see EE. GUIDE SPECIFICATION / 15450 / 5) FLUSH VALVES herein.

7) Water supply piping to sinks, lavatories, tank mounted water closets, etc., shall be specified as 100% stainless steel braided tube with chrome 1/4 turn ball valve.

P. Roof Drainage

Roof drainage systems shall be designed per code with an overflow or secondary system. Drains and leaders shall not be less than 3 inches.

Q. Cross Connections

a. Cross connections as defined in the IPC shall not be allowed.

1) The University of Utah operates its own water system. Water is purchased from Salt Lake City and stored in three reservoirs. Additionally, the University obtains city water from four connections to the Salt Lake City Water System.

2) As a water purveyor, the University has a responsibility to protect the potable water system. Of the two methods of protection (containment or internal plumbing control) the University uses the internal plumbing control method. The internal plumbing control method involves the installation of the appropriate device at the point of each potential cross connection. This requires the use of air gaps, vacuum
breakers, etc., at each plumbing fixture, equipment, tank, sink, etc., to protect the potable water system from backflow. Since many of the buildings on campus are used for both research and academic purposes, the internal control method is the only positive economical method to protect the potable water system.

3) The design engineer shall identify each cross connection and provide adequate protection as described in the Utah Plumbing Code. The University prefers the use of reduced pressure backflow preventers. All irrigation sprinkler connections must have a reduced pressure backflow preventer installed above ground and will be protected from direct sunlight. Backflow prevention devices will not be allowed in pits.

4) Reduced pressure backflow prevention devices located exterior to the building shall be installed above grade and shall be specified with heated covers of similar construction to “Hot-Box” enclosures. Specify equivalent enclosures, manufacturers, colors, finishes and interior appurtenances which are approved by the University to match the surrounding environment and other needs of the project.

5) Reduced pressure backflow prevention devices specified and installed shall be "Approved," defined as those devices appearing on the current lists issued by the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California, and the Utah Department of Health.

R. Emergency Eye Wash & Shower

a. Eye wash and emergency shower fixtures shall be served by potable water only.

1) Eye wash and emergency shower designs are not to include hose. Specify fixed fixtures only, to prevent hose and drain cross connections.

2) Specify eye wash and emergency shower fixtures with manual open and closing ball valves. Flushometer or self closing valves are not acceptable. Also show accessible isolation valves near each station on the drawings.

3) New laboratories requiring emergency showers must be designed with floor drains located under the emergency shower and away from electrical outlets.

4) Hallway emergency shower/eye wash stations can be combined with refrigerator alcoves. Extend the alcove to include the station within the recess in the wall, tile the floor under the recessed area and slope the tile to the drain. Design without curbs and size each station to accommodate the physically disadvantaged.
5) Specify that all water supplied to eye washes shall be potable tempered water.

S. Water Conditioning Systems

a. Water conditioning systems shall be designed for all buildings which supply potable (or non-potable) hot water for classroom sinks, toilet room lavatories, laboratory sinks, etc. These shall be provided with water softening equipment for this hot water.

1) Additionally, water conditioning equipment shall be provided for secondary steam and water systems connected to HTW generators and converters. Include water conditioning of make up and feedwater to HTW steam generators.

2) On buildings where large quantities of water are consumed, the design engineer shall consider the use of an exterior brine pit.

3) Many applications on campus require conditioned water other than softened water. Requirements may include deionized water, reverse osmosis water, filtered water, or a combination of these to achieve the proper degree of purity or polishing. Coordinate with the University Project Manager as required.

T. Construction Water

a. The A/E shall require Contractor to provide a 3” or larger non-freeze hydrant at the building service on all buildings that require water during construction. The yard hydrant is to be removed at the completion of the project.

1) Water use by the Contractor at the construction site must comply with IPC to protect the public drinking water supplies from contamination and pollution. Common violations include placing the discharge end of a hose directly into storm drain or sanitary sewer systems, water tanks or storage vessels, ditches, and swimming pools. This is termed a "cross connection" and is strictly prohibited. An adequate approved air gap and or backflow protection must be used. Note that an "air gap" is defined as a physical separation between the free flowing discharge end of a hose or pipe and the overflow rim of an open or non-pressure receiving vessel or system, twice the diameter of the incoming supply hose or pipe but no less than 1".

2) Fire hydrant connections may occur within the construction site after obtaining permission from the University Project Manager, and must be protected with an approved air gap or approved (currently tested) backflow assembly in accordance with the IPC. No water meter is required.
3) If water trucks or tanks must be filled outside the construction area, the water station between Buildings 306 and 309 may be used. Fire hydrants on campus may only be used with permission.

U. Existing Manholes, New Penetrations

New piping penetrations up to 12” diameter into existing manholes on campus are to be specified with an inside drop connection and flow diversion device. This device is to be used in lieu of an excavated outside drop.

V. Vacuum Piping Systems

a. Vacuum Piping Systems shall be designed to prevent extraneous liquids in the system from exiting out through the vacuum hose cocks into the labs. Horizontal branch lines shall grade down 1-inch per 40 feet towards the mains and shall enter into the top of the mains. Hose cock shall connect into the top of the branch lines and back-to-back hose cocks shall not be allowed. Vertically dropped lines shall be used only where no other routing method is available, and all remaining piping shall be pitched back to the vacuum source. If terminal vacuum lines are to drop vertically to terminal outlets, such outlets shall be trapped with convenient access and accompanying written instructions describing when and how to clear the trap.

1) A receiver tank shall be required upstream of any vacuum pump or set of vacuum pumps to prevent liquids or solids from entering the pump.

W. Existing Natural Gas Piping

a. Existing buried steel natural gas piping which will be replaced, modified, or removed as part of the project must have a cathodic design with specifications for the application or removal and/or general upgrade of cathodic protection. Any modification or disturbance of steel piping is to include an upgrade of the local cathodic system and provisions for adequate protection to the remaining extended system. Once completed, the system is to be inspected and cathodic readings are to be written in a report to the University Project Manager who will relay the information to the University’s Plumbing Shop. Likewise, the location of new anode bags and test stations shall be plotted and presented to the Plumbing Shop Supervisor.

1) If new plastic piping is to be routed under any road, the pipe must have a PVC or sewer pipe sleeve two pipe sizes larger than the gas line it will protect.

X. Thrust Block Restraints

Specify or detail appropriate piping thrust block restraints. Refer to AWWA standards and include provisions for proper soil load bearing conditions. Mechanical pipe restraints (similar to Megalug) in addition to thrust block restraints are required.

End of 3.7 Plumbing
3.0 DFCM REQUIREMENTS

3.8 HVAC

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016

The University of Utah
FACILITIES MANAGEMENT
V. Randall Turpin University Services Building
1795 E. South Campus Drive, Room 201
Salt Lake City, Utah 84112-9403
Phone (801) 581-4707
FAX (801) 581-6081
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

1. The A/E shall coordinate with the University Project Manager throughout design development to ensure systems are compatible with the University Master Plan, and plans for the user department at the University are coordinated with all required campus agencies.

2. This supplement contains required design elements for mechanical systems at the University, and design professionals are required to adhere to the information provided herein. The designer is also expected to conform to accepted industry design practices in the application of the requirements found in this supplement. Items not specifically addressed are left to the designer's professional judgment, but are subject to review.

3. Each division of the supplement is intended to assist the mechanical designer with design information which is considered unique to the University's mechanical systems. Facilities Management, including the departments of Facility Operations, Campus Planning, and Construction Project Delivery prepared this document to serve as a vehicle to insure consistency, quality, and maintainability in mechanical system design on campus.
4. The A/E’s work is subject to review and comment by Facilities Management at any time during design or construction.
   a. Progress checks by the University will result in written review comments. The A/E is expected to respond to each comment with written action items.
   b. The design engineer (or A/E design team) shall meet with the University Project Manager during the design to coordinate the progress of the work.
   c. Design reviews will be conducted whenever deemed necessary, but are considered mandatory for the schematic or design development progress check and final drawing submittal.
   d. Each design review comment (regardless of the source) is to be addressed in writing by the design engineer prior to completing the next phase of the project design. This action report shall be submitted to Facilities Management through the A/E team leader.

**ADDED:**

**REVISIONS SUMMARY**
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>3.8 GG. / Lab ventilation systems</td>
<td>Laboratory Ventilation Systems Several Small wording changes made</td>
</tr>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>3.8 Part 1 EE. / 15860 / i.</td>
<td>Spring Return added requirement.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / part 1 / EE. / 15829</td>
<td>Exhaust Fans Updated standard to add performance based requirements for exhaust fans</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / part 1 / EE. / 15770</td>
<td>Custom Air Handling Units Added standard for Custom Air Handling Units</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 / CC.</td>
<td>System Commissioning Updated Standard to reflect the requirements for the relationship between the commissioning agent and the design team</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / part 1 / DD.</td>
<td>Metering Added performance based requirements for metering and more detailed requirements for CHW and HTW meters</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 / EE. / 15700</td>
<td>Heat Transfer / Boilers Updated standard to clarify some of the performance based requirements</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / part 1 / EE. / 15100</td>
<td>Chilled Water and Heating Water Valves Updated Standard and removed specific manufactures from the standard.</td>
</tr>
<tr>
<td>Date</td>
<td>Section</td>
<td>Requirements</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / part 1 /</td>
<td>Chilled Water and Heating Water Piping Updated Standard to eliminate specific</td>
</tr>
<tr>
<td></td>
<td>EE. / 15061 / f. / i</td>
<td>manufacturers and to add HDPE and polypropylene piping to the acceptable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>materials for use.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 /</td>
<td>Test and Balance Updated Standard to reflect current practices. Including</td>
</tr>
<tr>
<td></td>
<td>EE. / 15995</td>
<td>adding NEBB to the acceptable licensing of balance contractors.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 /</td>
<td>Chilled Water System Updated Standard to reflect more performance based</td>
</tr>
<tr>
<td></td>
<td>EE. / 15702</td>
<td>requirements.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 /</td>
<td>Auto Faucet Battery Pack Updated standard to eliminate auto faucets with</td>
</tr>
<tr>
<td></td>
<td>15450 / J / 6</td>
<td>the exception of Handicapped lavatories.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>3.8 / Part 1 /</td>
<td>Piping Material below Grade Removed “Blue Brute”</td>
</tr>
<tr>
<td></td>
<td>EE. / 15062</td>
<td></td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15700</td>
<td>Heat Transfer Added / Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / C. / (13) / (19) / (20)</td>
<td>Plumbing General Requirements Added / Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15061 / p. / 2</td>
<td>Soil, Waste and Vent Updated Requirement</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15062 / b. / 2 / c.</td>
<td>Piping Material (Underground or Below Grade - &quot;b.g.&quot;) Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15045</td>
<td>Soil and Waste Piping System Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15100</td>
<td>Valves and Accessories Updated / Added Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15400 / b. / 5</td>
<td>Plumbing Systems Updated Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15902 /</td>
<td>ATC – Controllers Added New Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15907 /</td>
<td>ATC – Sensors Added New Requirements</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15770 / t.</td>
<td>Packaged Air Handling / Rooftop Units Added New Requirement</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8 / EE. / 15680 / e /</td>
<td>Cooling Towers Added New Requirements to Cooling Towers</td>
</tr>
<tr>
<td>Date</td>
<td>Section</td>
<td>Requirement</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Chillers</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Water Conditioning Systems.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Water Conditioning Systems.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Flush Valves.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Fixtures and Floor Drains.</td>
</tr>
<tr>
<td>1 November 2013</td>
<td>3.8</td>
<td>Piping Material.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Steam System Extensions or Revisions.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Steam Condensate to SLC Sewer.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Start-Up Strainers.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Pipe and Pipe Fittings.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Pipe and Pipe Fittings.</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8</td>
<td>Piping Tests.</td>
</tr>
</tbody>
</table>
## Revisions Summary (continued)

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15061 / i. / 1) and j. and k. and l. and p. / 3)</td>
<td>Type L Copper Above Grade. Removed “95-5” and replaced with “lead free” solder</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15061 / e. / 4)</td>
<td>Natural Gas Piping, Above Grade. Added protective paint</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15061 / t.</td>
<td>Cooling Coil Condensate Drain. Removed Type “M” and replaced with Type “L” copper</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15062 / a. and 3.8 / EE. / 15351 / a. / 2) / e)</td>
<td>Buried Pipe Trace Wire, Warning Tape, Sand Cover. Added requirements for all buried piping as described in 3.2 Civil</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15062 / e. / 6)</td>
<td>Natural Gas Piping, Below Grade. Added protective sleeve when routed through a wall</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15066</td>
<td>HVAC Piping Systems Cleaning, Filling, Treatment. Added requirements and restrictions</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15400 / a. / 4) / b)</td>
<td>Parallel Reduced Pressure Backflow Preventers. Changed application from certain water systems to “required on all make-up water lines”</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>3.8 / EE. / 15400 / b.</td>
<td>Disinfection of Piping Systems. Much of this section was rewritten</td>
</tr>
<tr>
<td>27 February 2012</td>
<td>3.8 / EE. / 15995 / q.</td>
<td>Testing &amp; Balancing: Removed paragraph “q” (approved T&amp;B firms)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
</tbody>
</table>
### Design Requirements

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Glycol Systems.</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / G. / (6) / j.</td>
<td><strong>Drawings and Specifications.</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / Q. / (11)</td>
<td><strong>Acid Resistant Waste Systems.</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / EE. / 15405 / b. / 6)</td>
<td><strong>Controls (ATC / BAS).</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / EE. / 15061 / f. / 3)</td>
<td><strong>Piping, Hot Water Heating.</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / EE. / 15061 / f. / 4)</td>
<td><strong>Piping, Hot Water Heating.</strong></td>
</tr>
<tr>
<td>06 January 2012</td>
<td>3.8 / EE. / 15061 / o. / 5)</td>
<td><strong>Piping, Fire Protection.</strong></td>
</tr>
</tbody>
</table>
3.0 DFCM REQUIREMENTS

3.8 HVAC Systems

C. Steam

REVISED:

(10) Steam Meter
   a. Refer to section 5.0 HPBS. For University projects see section 3.1 General, paragraph 3.1, J. University of Utah Design Requirements In General, subparagraph (7) Utility Metering and paragraph 3.8 DD, below for specific University requirements. Provide totalizing type meter which reads directly in pounds of steam.

F. Building Automation

REVISED:

(1) Direct Digital Control:
   a. For new construction, use DDC with an open BACnet or LonTalk communication protocol in accordance with ASHRAE Standard 135.
   b. For repair and alteration projects and new additions to existing projects, the following options are permitted:
      i. Installation of DDC with the BACnet or LonTalk protocol,
      ii. Integrating the existing system with customized gateways to the BACnet or LonTalk protocol.
      iii. Pneumatic control as an extension of an existing system, if specifically required by operating personnel
   c. Provide digital metering of electrical, hot water, steam, and chilled water sources to each facility. Refer to section 5.0 HPBS.
   d. Provide flow metering devices for hot and chilled water heating systems. Refer to section 5.0 HPBS.

ADDED:

N. Mechanical Equipment Rooms and Tunnels

1) Mechanical equipment rooms and tunnels shall be lighted, ventilated and supplied with adequate electrical outlets and floor drains.
2) Floor drains shall be located within 5 feet of equipment using water. Exposed drain piping which must be routed to floor drains must be organized so as not to trip or cause injury.

3) Emergency lighting shall be designed around a light producing tape or panel applied to walls and floors, which directs trapped occupants to the nearest exit. Approved manufacturer is Active Safety Corporation. The material shall be UL approved (UL 94U8) Active Safety Model PSL 11000 capable of producing 6 to 8 hours of emergency self-illumination. Apply with "Durabond 3001" permanent adhesive per manufacturers recommendations. Provide a 5 year warranty for material and workmanship.

b. Tunnels

Tunnels are to be designed for 7 foot walking height after all utilities have been installed and should allow adequate working space for any maintenance procedure required. Safety and egress should be considered in all cases.

c. High Temperature Water Equipment Rooms

High temperature water equipment rooms are to be ventilated with an exhaust system. An emergency high temperature water shut-off switch will be required outside of the HTW equipment room near the door. See GG. (3) k. in 3.8 HVAC.

**ADDED:**

O. University of Utah HVAC Design Criteria

a. Outside Design Temperatures

Outside design temperatures shall be 0 degrees F (-18 degrees C) winter heating and 97\(_{\text{WB}}\)/62\(_{\text{WB}}\) degrees F (36/18 degrees C) for summer cooling. Cooling tower design shall be based on 70 degrees F (21 degrees C) wet bulb.

b. Site Elevation

Equipment selections shall account for a site elevation of 4,750 feet (1,500 meters) above sea level, and equipment schedules shall indicate either "sea level" or "site elevation" capacity.

c. Indoor Design Temperatures

Indoor design temperatures shall be 72 degrees F for heating and 75 degrees F for cooling, unless superseded by the University Project Manager.
d. Ventilation Requirements

Ventilation air shall conform to the latest ASHRAE Standard 62 for Natural and Mechanical Ventilation. Air intakes shall be located so as not to introduce foul air (i.e. near cooling towers, exhausts, vehicle emissions, garbage dumpsters, etc.).

e. Heating Systems

1) The design for space heating will generally require the use of the University's high temperature hot water system (3.8 HVAC), or a secondary central steam system. In buildings located a distance from the high temperature water distribution lines, or which are unsuitable for connection to the system, heating may be provided by boilers (or hot air furnaces in small buildings). The primary fuel for such shall be natural gas. Boiler sizes are limited by current pollution regulations.

2) The Campus Master Plan intends that new heating systems shall be hot water heat exchangers utilizing high temperature water from the campus HTW distribution system. Steam systems shall generally not be generated by use of the HTW system. Low temperature (180° F) hot water heating systems are the preferred medium for heating all new or remodeled buildings. Where steam generators are approved, review the requirements described in 3.8 HVAC regarding HTW steam heat exchangers.

3) Where existing steam systems must be extended or revised, verify the existing demand and generation capacity before adding any steam equipment to the system. The A/E shall detail the locations for each connection point for the Contractor.

4) Since the University’s sanitary sewer system feeds directly into the Salt Lake City system, the A/E shall comply with Salt Lake City standards and requirements for pre-cooling hot condensate waste before it enters the University sanitary sewer system.

f. Humidification Systems

Humidification systems shall be provided which do not use corrosion inhibiting chemicals commonly found in central steam systems. Humidifier equipment shall only discharge potable water or potable steam.

g. Back-Up Systems

Back-up systems must be provided for projects where critical research, experiments, etc., require un-interruptible heating. Coordinate with the
University Project Manager for decisions pertaining to standby fuels or back-up systems.

h. Extensions / Modifications of Existing Systems

Building heating and cooling systems which are to be extended or modified will require analysis of the existing mechanical systems to determine the capacity available for expansion.

i. Common Piping for Hot / Chilled Water

Two pipe or three pipe systems utilizing the same piping for hot water and chilled water shall not be used.

j. Glycol Systems

Glycol systems shall be contained within mechanical rooms (except fire protection piping). Piping throughout the building shall contain no glycol. Any remote systems requiring glycol, service water shall be routed to the location with a plate and frame heat exchanger in a mechanical space with glycol introduced at that point.

k. By-Pass Feeders

Five gallon by-pass feeders shall be designed and shown on drawings at each secondary heating system, each chilled water cooling system, and each condenser water system.

l. Energy Conservation Designs

Systems shall incorporate energy conservation designs such as variable air volume distribution systems (VAV) and variable frequency drives (VFD) for fans and pumps.

m. VFD By-Pass Switch

Variable frequency drive systems shall be supplied with a by-pass switch allowing full speed operation upon VFD failure (see 3.5 Electrical).

n. VFD Fan System Pressure Relief Door

Fan systems served by VFD's shall have a pressure relief door installed in the supply main, set to relieve duct over-pressure when the VFD fails to full speed, and thereby protecting the duct seams downstream of the fan. The approved damper is Ruskin Model PRD18 Pressure Relief Door with a 12 gauge frame and door, and polyurethane foam seals around the door.
perimeter. Other approved manufacturers are Greenheck Fan Corporation and AJ Manufacturing. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the specified Ruskin relief door.

Specifying VFDs

Variable frequency drive systems (VFD) shall be specified in the Electrical section of the design documents. University requirements for VFD is provided in 3.5 Electrical.

Roof-Top Units Require Approval

The use of rooftop units is to be approved in writing by Facilities Management through the University Project Manager prior to design. Approval will be based on unit visibility, maintenance access, noise (both interior and environmental), roof structure, building zone needs, and alternate designs.

Design Air Distribution Systems for Cooling Capacity

Air distribution systems shall provide adequate air quantities for cooling even though cooling may not initially be provided. Air shall be introduced into each space at less than 50 fpm in the occupied zone, and at RC values which do not exceed current ASHRAE limits found in ASHRAE Systems, Sound and Vibration Control.

Dual Duct Constant Volume Systems

Where constant volume dual duct systems are specified, require true constant volume controls on a single constant volume supply box (twin VAV boxes will not be approved).

No Fan Powered VAV Boxes

Fan powered VAV boxes are not to be used.

Access for Maintenance

1) Provide adequate maintenance clearance around all mechanical equipment, piping, valves, fittings, and accessory items. Also provide adequate clearances to allow for removal and re-installation of coils, tubes, tanks, etc. Provide unions and valves to permit disassembly of piping and equipment.
2) Provide adequate maintenance access to mechanical equipment. Access to each equipment item must be in accordance with current OSHA regulations. For elevated equipment design an appropriate platform for convenience and safety. If an access platform is not practical, coordinate with Facilities Management through the University Project Manager for an approved design of a lifting point or other means of maintenance access.

3) Pumps 3 HP and above, which are elevated overhead such that the distance from floor to top of pump/motor assembly is 8’ or higher, shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.

4) Equipment which requires an overhead access hatch at 6’ or more above the floor shall have an access platform with permanent ladders or steps designed and shown on the design drawings.

5) Air handlers with elevated access doors such that the distance from floor to bottom of the door is 3’ or higher shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.

6) Fans with a motors 3 HP and above, which are elevated such that the distance from floor to any maintenance point (access door, belt, motor, etc.) is 6’ or higher, shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.

u. Hydronic Flow Control Balancing Devices

Flow control devices shall be provided at all major terminal devices such as coils, converters, etc. Flow control devices are to have marked memory stop and handles are to be removed after balancing. Additional isolation valves are to be provided to prevent the use of flow control devices as shut-off valves. Pumps with variable speed drives shall not have flow control devices installed on them.

v. Refrigerants

Refrigerant systems are to be limited to HCFC-22 (only for reciprocating systems) or HCFC-123 and HFC-134a (only for centrifugal systems). Note that HCFC-22 screw machines are not to be considered unless directed by Campus Utility Services through Facilities Management and the University Project Manager. All applicable health and safety requirements for specified refrigerants shall be included in the design. These requirements shall include,
but not be limited to, ASHRAE safety items noted in Standards 34 and 35, and NIOSH Workplace Guidelines.

w. Replacing Chillers

For chiller replacements, the extent of response to prevailing code issues will be determined on a “case by case” basis. Project designers will be expected to meet with the University Project Manager for a review of code issues which may affect the replacement of chiller equipment. The University is designated as the “Building Authority” and, as such, will determine the extent of building/systems modifications required for each replacement project.

x. Refrigerant Relief Piping

Evaporator coils located near heating coils; and, pressure relief devices and fusible plugs shall have relief piping, sized and routed per the requirements of ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration".

y. Mechanical Rooms as Return Air Plenums

Mechanical rooms containing refrigerant compressors, coils, tanks, piping, etc., shall not be used as return air plenums.

z. Campus West Side Chiller Loop

1) New or replacement cooling coils intended for areas served by the University's central chiller loop on the west side of the campus shall be sized for low flow and high temperature rise in the coils.

   a) Design the coils for multiple rows and 60 degree F return water temperature (16 degree rise), even if the actual use and intended operation may only require an 8 degree F rise. Computer coil selections shall certify coil operation at both conditions (8 degree rise and 16 degree rise).

   b) Size supporting piping for 8 degrees F temperature rise, effectively providing adequate size for the higher GPM.

   c) Design the coil controls with tight shut-off two-way valves which connect the coil to the central loop. Three-way coil valves will not be approved.

aa. Power for Controls

1) The electrical contractor shall be directed to have breaker circuits designated specifically for control power functions.
2) Provide an emergency power circuit for the control panels and individual room controls where emergency power generators are available.

3) The A/E should coordinate to provide control transformers supplying 24V AC control power for zone controls. Install transformers as needed to meet the requirements of the individual controllers.

bb. Motors for HVAC Service

1) Proper protection and control for all motors must be provided. Starters for 3 phase motors shall have overloads on all three phases. Provide fused protection utilizing properly sized dual element fuses. Starter control circuits must have properly sized fuse protection. Soft starting systems shall be provided for motors 25 HP and larger. Starting characteristics of motors shall be reviewed with Facilities Management (especially Campus Utility Services) through the University Project Manager during design.

2) All motors 1 HP and larger shall be specified as follows:
   a) Class B motor temperature rise
   b) Class H insulation
   c) Designed and warranted for inverter duty use, (Nema MG-31 certified) for VFD motors
   d) Premium efficiency rated
   e) 1.15 Service factor

cc. HVAC Pumps

1) Pumps specified for University projects are to include the following:
   a) Base mounted pumps shall be specified to have bases grouted.
   b) All pumps shall be selected to operate at the Best Efficiency Point.
   c) Piping design at pumping systems shall be specified and shown to follow pump industry guidelines for pump inlet conditions. A minimum of 5 pipe diameters of straight pipe will be required, or appropriately designed suction diffusers will be used.
ADDED – UNIVERSITY OF UTAH REQUIREMENTS:

P. Compliance Verification in Operation and Maintenance Manuals

(1) ASME

American Society of Mechanical Engineers (ASME) Stamp shall be required on all items required by code or specified to conform to the ASME Code, and certificates will be included in the O&M manuals.

(2) Form U-1

Form U-1, the manufacturers’ data report for pressure vessels, is to be included in the operation and maintenance manuals. National Board Register (NBR) numbers shall be provided where required by code, and included in the manuals.

(3) UL or ETL

Underwriters Laboratories (UL) or equivalent ETL labels shall be applied to manufactured equipment represented by a UL classification and/or listing. Included certification in the O&M manuals.

Q. Review of Existing Systems

(1) Campus Site Resource Documents

The University Project Manager will provide resource documents such as building and site plans, when available. Contacts with University shops will be coordinated by the University Project Manager.

(2) Pre-Design Site Inspection / Research

The design consultant is responsible for its design. If insufficient resource material is available, the A/E will be required to research existing conditions at the project site and generate the data required for a complete and workable design.

(3) Existing Systems to Original Working Capacities

Modifications or extensions to an existing system require a thorough analysis and understanding of the impact on the original system. The A/E shall insure that its design includes adjustments to the original building systems (including "as-built" drawings with modified performance values shown) to return all adjacent systems to original working capacities. If the original condition cannot be determined, then the A/E must include the services of balancing technicians in his fee to determine the actual status of the existing systems.
(4) Energy Management Buildings

Many buildings on campus have been retrofitted with energy efficient equipment as part of an energy management plan. When remodeling any building, the energy efficiency and operating characteristics of existing and new equipment must not be diminished by the building revisions.

R. Drawings and Specifications

(1) Scale

Contract drawings shall be drawn to scale no smaller than 1/8" = 1'-0" unless a smaller scale is specifically approved by Facilities Management through the University Project Manager.

(2) Presentation

The drawing presentation is to be organized and sufficiently detailed to fully illustrate the work to be done.

(3) Equipment Rooms / Congested Areas

Equipment rooms, fan rooms, chiller rooms or other congested areas shall be detailed fully with plans and sections showing all equipment. These drawings shall be no smaller than 1/4" = 1'-0".

(4) Equipment Details

Provide details on drawings for equipment showing piping connections, clearance routing, appurtenances, supports, service clearance, and orientation.

(5) Schedule of Building’s Rated Capacities

Each project shall include a schedule on one of the drawing sheets which lists the building's rated capacities for heating, cooling, ventilating and electrical services. Additionally, the schedule shall include the estimated excess capacity of each service for each zone to allow end users to determine the extent of additional load they can place within each zone.

(6) Schedule of Equipment Capacity Requirements

Equipment capacity requirements shall be placed in appropriate schedules on the drawings, noted with catalog sea level performance or site performance at 4,750 feet elevation above sea level.

(7) Schedule of Hydronic Balancing Valves
Balancing valves for hydronic system balance shall be scheduled on the drawings showing valve flow requirements, $C_v$ values, valve size, and maximum pressure drop at the balanced setting.

(8) Schedule of Plumbing Fixtures

A plumbing fixture schedules shall be provided on plumbing plans.

(9) Legend for Valves and Piping

A valve and piping legend shall be provided on plumbing plans.

(10) Legend for HVAC

An HVAC legend shall be provided on mechanical plans.

(11) Sequence of Operations

Sequence of operations for all equipment shall be located both on the drawings and in the specifications.

S. Submittals and Shop Drawings

(1) Six Copies, Marked

In the bidding documents, the Contractor shall be required to furnish six copies of marked catalog data and/or shop drawings for each item of material and equipment to be used on the project prior to commencing the work. Five copies are to be submitted to the A/E and one to the University Project Manager.

(2) One Copy, Concurrent Review

One copy of the submittals and shop drawings shall be delivered to the University Project Manager for concurrent review during the same time the A/E performs its review. Discrepancies and recommendations identified by Facilities Management shall be sent to the A/E.

(3) Submittal Approval

Submittal approval shall not relieve the Contractor of his responsibility to provide material and equipment which meet or exceed specified performance or duty and fit within the space allotted.

T. Equipment Approval

(1) Manufacturers Subject to University Approval
Manufacturers named in bidding documents are to be reviewed by the University Project Manager and approved by Facilities Management (especially Facility Operations) prior to bid.

(2) Requests for Prior Approval

a. In the contract documents, the Contractor shall be required to submit a request for prior approval on substituted material and equipment prior to the bid per the DFCM / University of Utah General Conditions.

1) The A/E shall be responsible for a complete review of requests for prior approval with Facilities Management through the University Project Manager. The University Project Manager will coordinate with Facility Operations and advise the A/E of approval/disapproval status of the items submitted.

2) Prior approval is to be issued for manufacturer's name only. If used in the bid, the substituted item must meet all conditions of the specifications and drawings. Any required adjustment costs for difference in size or arrangement must be borne by the Contractor or A/E, not the University.

(3) Unapproved Material or Equipment

The A/E will be liable for costs to remove or replace unapproved material or equipment installed by direction or approval of the A/E.

U. Factory Witness Tests of Equipment

The University Project Manager shall determine the need for a factory witness test of major equipment items.

V. Coordination of Drawings

The mechanical engineer shall be responsible for coordinating the mechanical and plumbing plans with all other disciplines. Claims by the Contractor resulting from lack of coordination shall be administered by the University with additional project costs to be charged to the A/E.

W. Layout

(1) Service Clearance for Equipment / Valves

a. Adequate service clearance shall be provided around all equipment.

b. All equipment including valves shall be installed so as to permit disassembly for maintenance purposes.
X. Integrity of Fire and Smoke Rated Partitions

The University has experienced a problem in many buildings where projects resulted in untreated penetrations of fire and smoke rated partitions. The designer is referred to 3.3 Architectural for instructions.

Y. Start-Up Strainers

When start-up strainers are replaced with specified strainers prior to test and balance, require the Contractor to place each removed start-up strainer near the pump or Y-strainer it served for inspection by the Facility Operations HVAC Shop Supervisor.

Z. Equipment, Pipe and Duct Identification

All plumbing, heating, air conditioning, automatic temperature control equipment (excluding thermostats and relays), and distribution systems shall be labeled. Electrical switches and starters for mechanical equipment shall also be labeled. See Section 15051 herein and 3.5 Electrical.

AA. Utility Interruptions and Digging Permits

(1) Digging Permits

a. The University has an extensive system of campus utilities into which most projects are connected. Other, non-University, entities also have a number of utility lines on campus.

b. As the project designer, be aware that a University Digging Permit is required before any digging may occur on campus. Contractors are instructed to request digging permits through the University Project Manager in accordance with the Supplemental General Conditions for University of Utah Projects. The request should include drawing(s) showing the contract limit lines and identifying the site work to be done.

c. The University permit will identify utilities known to exist within the affected area. The University will also mark the location of utilities at the site. During excavation, the equipment operator should have a copy of the Permit in his immediate possession for guidance and to document approval of the digging.

d. In addition to obtaining a University Digging Permit, the Contractor or other entity must contact Blue Stakes and other utilities for marking of underground utilities.

e. Designers should also be aware that there may be utilities in the ground of which the University has no record. Caution contractors that any digging, even with a permit, should be done with care.
(2) Utility Shutdown Permit

a. The University has an extensive system of campus utilities into which most projects are connected. A Request for Shutdown is required whenever a shutdown is required including any time connections are made to any utility such as electric power and communication lines; gas, water, distilled water, steam and high-temperature water lines; and sanitary sewers or storm sewers. Utility Shutdown Request procedures are provided in the Supplemental General Conditions for University of Utah Projects. Encourage contractors to discuss shutdown needs with the University Project Manager well in advance. In many cases a utility shutdown is more than a simple inconvenience as many research projects are highly dependent on maintaining equipment functionality and/or climate control.

(3) Approval Required before Proceeding

Digging or shut down requests do not constitute an automatic approval by the University. The Contractor is not to proceed until approval is received from the University Project Manager assigned to the project. No fee is assessed for the permits.

BB. "As-Built" Drawings

(1) Due within 60 Days

Based upon information furnished by the Contractor, and room numbers provided by the University, prepare and furnish to the University within 60 days of the completion of the project, a complete set of record "as-built" drawings. The specific requirements for the submittal are provided in Design Process, 4.4 Design Stages, J. Stage 7 Construction, #4.

(2) Buried Utilities

a. Buried utilities, including piping, conduit, and duct, shall be shown on the "as-built" drawings. The location of each item exposed during construction shall be accurately identified and include the following:

1) Dimensions from prominent (permanent) landmarks
2) The specific material buried
3) The size of pipe, conduit, or duct buried
4) Depth of elevation of each leg of the buried route

CC. Testing and Balancing of Systems
On larger projects, testing and balancing work may contracted separately by the University. This option is to be reviewed and approved by the University Project Manager during design. If this option is found to be in the best interest of the University, and if approved by the University Project Manager, a) include a separate line item cost in the project’s construction cost estimate; b) Facilities Management would then bid the testing and balancing later during construction; and, c) the A/E will be expected to include management and oversight of the third party contractor’s work in the A/E’s fee. If this option is accepted, the specifications must include instructions to the Contractor to fully cooperate with this third party contractor.

DD. System Commissioning

The A/E shall cooperate fully with the commissioning agent during all phases of the project from inception of design through final seasonal testing. Support shall consist of but not be limited to the following items:

1. Provide technical material and project documentation to the commissioning agent
2. Respond to project issues in the commissioning issues log on a timely basis
3. Participate in commissioning meetings and inspections
4. Collaborate with the commissioning agent and contractor to resolve commissioning findings

EE. Utility Meters

(1) All Buildings Shall Have Meters

   a. The University requires all buildings to have meters installed for the following utilities as applicable:

      1) Domestic water (fire lines into buildings need not be metered)
      2) Irrigation water
      3) Natural gas
      4) High temperature water (HTW)
      5) Heating water (HW)
      6) Chilled water (CHW)
      7) Electricity
      8) Steam

(2) Meter Specifications and Drawing Location
a. A meter is to be specified and shown on the drawings for installation wherever the corresponding utility enters the building.

1) All water, gas and steam meters are required to have the capability of communication with the University’s automated Energy Information system using a digital contact closure pulse, a 4-20 milliamp signal or Modbus RTU protocol without the need for a purchase of an upgrade after installation.

2) All high temperature water, chilled water, heating, and electric meters are required to have the capability of communication with the University’s automated Energy Information system using only Modbus RTU protocol without the need for a purchase of an upgrade after installation.

3) All exterior under slab meter communication wiring shall be sealed in water tight conduit.

4) University preferences for Metering heating and high temperature water serving buildings shall be as follows:

   (a) V-cone differential pressure type meter on the primary side of the heat exchanger.

   (b) If metering on the primary side of the heat exchanger is not feasible, then all secondary utilities from the heat exchanger shall be metered and totalized.

   (c) If all secondary metering of utilities are not feasible, then ultrasonic type shall be installed on primary side of the heat exchanger

5) Documentation pertaining to each installed meter, including but not limited to design drawings and specifications, shall be a required responsibility of the Contractor. Both hard copies and digital copies of the Meter documents are to be approved by the designer and University Project Manager, and delivered to the University’s Utility Analyst as well as to the shop supervisor of the shop which manages the corresponding utility.

(3) Domestic Water Meters
a. Specify and show on the drawings a water meter location inside the building in a well-lit and easily accessible area.

b. Specify a by-pass system which will allow routine maintenance of all meters installed in-line.

c. Specify meter installation in accordance with manufacturer’s specifications (i.e., the distance of the meter from piping elbows, T’s, or valves in the water line).

d. An inline strainer is required for lines 3” and larger for meters installed in-line.

e. Specify meter display to be in cubic feet, 10’s of cubic feet, or 100’s of cubic feet as applicable to the designed use of the facility.

(4) Irrigation Water Meters

Use the same specification provided for domestic water meters. The meter may be installed inside the building or outside as close to the building as possible. If installed outside, the display for remote reading must be located inside the building. Route the communication lines which connect the sensor to the display through conduit.

(5) Natural Gas Meters

a. The natural gas meter should meet all Questar requirements even when applied to the University’s gas system. The gas meter should be installed outside the building at an easily accessible and well vented area away from any building air-intake.

b. Specify a by-pass system for routine maintenance on the meter. Design Requirements – 3.8 HVAC– University of Utah Supplement 31

c. The meter shall have at least 99% accuracy.

d. The meter shall be utility grade

e. Pressure test ports are required to be installed after any regulators

f. Require the Contractor to deliver meter submittals which include load sizing calculations. Inlet pressure, outlet pressure, pipe size, zone load capabilities, building maximum load, and average load calculations must be submitted for review and approval.

g. If the maximum input for the average load capability is found to be 1000 MBH or higher, then a roto, or rotary type meter is to be installed with an in-line strainer included.

h. Meters shall display no less than 100's of cubic feet.
i. Terminate communication wiring inside the building. Route all communication lines connecting the sensor to the display through conduit.

(6) HTW Meters
High temperature water (HTW) meters are described in GG. below (3.8 HVAC).

(7) Chilled Water and Heating Water Meters
a. The University requires metering of CHW and HW
b. Building meters shall meter in ton-hours of refrigeration (ton-hr) and British Thermal Units (BTUs)
c. Meters shall provide instantaneous information via on-screen local displays as well as integrate into the University’s Energy Server.
d. Meters shall have the ability to provide instantaneous energy consumption in tons and Btu/h.
e. All CHW/HW meters shall guarantee the following performance levels at all operating (pressure and temperature) scenarios:
   1) Accuracy: ±2 percent
   2) Repeatability: ±1 percent.
   3) Pressure drop
   4) Flow sensor turndown: No less than 15 to 1.
   5) Volumetric flow rate shall be measured in gallons per minutes (gpm).
f. Meter and BTU computer shall be capable of communicating with the University’s building automation system and Energy Information System. The following data shall be provided:
   1) Ton-hrs
   2) Tons
   3) Fluid temperatures
   4) Flow (GPM)
   5) BTU
   6) Btu/h
g. Primary Flow Sensor

1) Flow element shall be an insertion-type magnetic-type flow element.

2) RTDs shall be provided to measure supply and return temperature at building interface piping or at building heat exchangers.
   
   (a) RTDs shall be 316 stainless steel.

3) Flow sensor size shall match installed pipe size.

h. Temperature Sensors and Transmitters

1) Spring-loaded dual element 100 ohm platinum resistance temperature detector (RTD) temperature sensor.
   
   (a) RTD accuracy: ±0.5 percent at 32 °F.
   
   (b) Temperature range: 40 °F to 400 °F.

2) Install RTDs with 316 stainless steel thermo-well.

(8) Electric Meters

Electric meters are described in 3.5 Electrical.

(9) Steam Meters

a. The type of meter to be used is dependent on where the steam is produced:

1) University Steam Plant
   A water meter with the ability to withstand 230 deg F temperature is to be installed in the steam condensate return line after the condensate return pump.

2) Building Gas Boiler

   A gas meter should be installed in the gas line feeding the boiler per University gas meter specs. The meter shall display no less than 100's of cubic feet.

3) Building Electric Boiler

   A power meter should be installed for the boiler per University electricity specs.

4) Building HTW Converter
If steam is produced by a HTW converter then it need not be metered directly. The energy usage can be obtained by the HTW Btu meter to the converter.

5) Other Applications

Obtain direction from the University Project Manager who will include the University utility analyst and the University staff mechanical engineer.

FF. The Guide Specification for Mechanical Systems

15050 Basic Materials and Methods
15051 Identification for HVAC Piping and Equipment

a. Equipment labels shall be black face Formica with white engraved lettering 3/16" high or larger, and shall be attached securely.

b. Equipment nameplates shall include the following minimum information:

1) Plan identification
2) Capacity specified at designed operating conditions
3) Actual capacity as balanced at site operating conditions
4) Area or zone served
5) Non-potable, industrial, DI/RO water outlets and faucets shall be labeled with 1” high white lettering with black background and read “NON-POTABLE WATER DO NOT DRINK HERE.”

c. All valves, regardless of size, shall have brass tags at least 1” by 3” in size and 0.051 inches thick. Lettering on the tag shall be engraved at least 1/8 inch high. Each valve on the drawing shall be identified separately, and valve tags shall match the drawing identification.

d. Valve tags shall be connected to valve stems by steel rings and include the following minimum information:

1) Plan identification
2) Normal position
3) Duty
4) Area served

5) Valve type

6) Additionally, heating water valves, steam valves, and all valves located in the secondary (low pressure) side of HTW heat exchangers shall include the manufacturer, size, grade, and pressure-temperature service rating.

e. All accessible duct and piping shall be color coded and identified with wording and arrows every 50 feet, at each riser, at each junction, at each access door, and where required to easily identify the medium transported.

f. Duct and piping systems shall be identified by:

1) Background color

2) Lettering color, and

3) Flow direction arrow

h. Duct and piping background color shall be applied to all exposed piping (either over bare pipe or the insulation) in mechanical rooms. Identifying lettering and arrows shall then be added as indicated above, and as necessary to be visible from anywhere in the room.

1) For duct in mechanical rooms, chases, and other exposed areas, as well as piping routed in other exposed areas such as chases, background color shall be applied in a two foot (2'-0") wide band with identifying lettering and a flow direction arrow.

2) Background and lettering shall be semi-gloss enamel paint by DeVoe (Mirrolac), Pratt and Lambert, Glidden, Rust-Oleum, Sherwin Williams or prior approved equal. The colors specified herein shall not vary.

<table>
<thead>
<tr>
<th>Color</th>
<th>Sherwin Williams</th>
<th>Pratt &amp; Lambert</th>
<th>Rust-Oleum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>SW4081 Safety Red</td>
<td>1007 Vibrant Red</td>
<td>964 Federal Safety Red</td>
</tr>
<tr>
<td>Orange</td>
<td>SW4083 Safety Orange</td>
<td>S4507 Safety Orange</td>
<td>956 Federal Safety Orange</td>
</tr>
<tr>
<td>Yellow</td>
<td>SW4084 Safety Yellow</td>
<td>1732 Spectrum Yellow</td>
<td>944 Federal Safety Yellow</td>
</tr>
</tbody>
</table>
Green | SW4085 Safety Green | Safety Green | 933 Federal Safety Green |
---|---|---|---|
Blue | SW4086 Safety Blue | 1228 Anchors Aweigh | 925 Federal Safety Blue |
Purple | SW4080 Plum | Bright Medium | Bright Medium |
Silver (Aluminum) | B59S11 Silver Brite | -- | -- |
Black | Black | Effecto Black | 634 Black |
White | White | Effecto White | 2766 White |
Brown | SW4001 Bolt Brown | 2278 Char Brown | -- |

University experience has shown that Mirrolac works well in this application, being durable with excellent coverage.

3) Identifying lettering shall be painted or stenciled on duct or pipe over the background color. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2” high for duct and larger piping 3” or more, 1” high for 1-1/4” to 2-1/2" pipe, and 1/2” high for 1” pipe and smaller.

4) Arrows to indicate direction of flow shall be painted over the background color in the same color as the lettering. The arrow shall point away from the lettering. On duct and large piping 3” or more in diameter, the "shaft" of the arrow shall be 2” long and 1” wide. Smaller piping, 2-1/2” or less, shall have arrows with a shaft 1/2” wide and 2” long. Use a double-headed arrow if the flow can be in either direction.

5) Piping and duct shall be identified with the following colors:

<table>
<thead>
<tr>
<th>Medium in Pipe or Duct</th>
<th>Background Color</th>
<th>Identifying Lettering</th>
<th>Lettering Color</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compressed Air</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab Service</td>
<td>Silver</td>
<td>COMPRESSED AIR</td>
<td>Black</td>
</tr>
<tr>
<td>Automatic Controls</td>
<td>Silver</td>
<td>CONTROL AIR</td>
<td>Black</td>
</tr>
</tbody>
</table>

| **Compressed Gas** | | | |

Design Requirements – 3.8 HVAC – University of Utah Supplement 29
<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Color</th>
<th>COLOR</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>Brown</td>
<td>HYDROGEN</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Brown</td>
<td>NATURAL GAS</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Silver</td>
<td>NITROGEN</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>Brown</td>
<td>OXYGEN</td>
<td>Black</td>
<td></td>
</tr>
</tbody>
</table>

**Refrigerant**

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Color</th>
<th>COLOR</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freon</td>
<td>Black</td>
<td>FREON</td>
<td>White</td>
<td></td>
</tr>
</tbody>
</table>

**Steam – Low Pressure (0 – 15 PSIG)** *(Note: No bands for Low Pressure)*

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Color</th>
<th>COLOR</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam – Low Pressure</td>
<td>Orange</td>
<td>LOW-PRESS. STEAM</td>
<td>Black</td>
<td></td>
</tr>
</tbody>
</table>

**Steam – High Pressure (over 15 PSIG)** *(Note: Two black bands required for High Pressure)*

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Color</th>
<th>COLOR</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam – High Pressure</td>
<td>Orange</td>
<td>HI-PRESS. STEAM</td>
<td>White</td>
<td></td>
</tr>
</tbody>
</table>

**Vacuum**

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Color</th>
<th>COLOR</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum</td>
<td>Silver</td>
<td>VACUUM</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Medium in Pipe or Duct</td>
<td>Background Color</td>
<td>Identifying Lettering</td>
<td>Lettering Color</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------</td>
<td>---------------------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td><strong>Note:</strong> Directional arrows are required on HTW Piping.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler Blow-Off</td>
<td>Yellow</td>
<td>BLOW-OFF WATER</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>Blue</td>
<td>CHILLED WATER SUPPLY</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>Blue</td>
<td>CHILLED WATER RETURN</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Blue</td>
<td>COOLING WATER SUPPLY</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Blue</td>
<td>COOLING WATER RETURN</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Condensate Return</td>
<td>Orange</td>
<td>CONDENSATE RETURN</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>(Note: One white band is required for Steam Condensate Return.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Water (Potable)</td>
<td>Green</td>
<td>DOMESTIC COLD WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Non Potable</td>
<td>Green</td>
<td>UNSAFE WATER</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water (Potable)</td>
<td>Green</td>
<td>DOMESTIC HOT WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water Return</td>
<td>Green</td>
<td>DOMESTIC HOT WATER RETURN</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Fire Protection Water</td>
<td>Red</td>
<td>FIRE PROTECTION</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Glycol Solution</td>
<td>Purple</td>
<td>GLYCOL SOLUTION</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>High Temperature Supply</td>
<td>Yellow**</td>
<td>HIGH TEMPERATURE WATER SUPPLY</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>High Temperature Return</td>
<td>Yellow**</td>
<td>HIGH TEMPERATURE WATER RETURN</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Secondary Heating Water Supply</td>
<td>Brown</td>
<td>HEATING WATER SUPPLY</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Secondary Heating Water Return</td>
<td>Brown</td>
<td>HEATING WATER RETURN</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Deionized</td>
<td>Green</td>
<td>DEIONIZED WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Distilled Water</td>
<td>Green</td>
<td>DISTILLED WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Reverse Osmosis</td>
<td>Green</td>
<td>REV. OSMOSIS WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Softened</td>
<td>Green</td>
<td>SOFTENED WATER</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Roof Drain</td>
<td>Green</td>
<td>ROOF DRAIN</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>System Make-Up</td>
<td>Green</td>
<td>MAKE-UP WATER</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Treated Water</td>
<td>Green</td>
<td>TREATED WATER</td>
<td>Black</td>
<td></td>
</tr>
</tbody>
</table>
### Medium in Pipe or Duct

<table>
<thead>
<tr>
<th>Medium in Pipe or Duct</th>
<th>Background Color</th>
<th>Identifying Lettering</th>
<th>Lettering Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid-Resistant</td>
<td>(unpainted)</td>
<td>ACID WASTE</td>
<td>White</td>
</tr>
<tr>
<td>Building Waste</td>
<td>(unpainted) or Black</td>
<td>WASTE</td>
<td>White</td>
</tr>
<tr>
<td>Polluted Water</td>
<td>Black</td>
<td>POLLUTED</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

### All Equipment or Piping Located Outside Buildings

<table>
<thead>
<tr>
<th>All Equipment or Piping Located Outside Buildings</th>
<th>Brown</th>
<th>- -</th>
<th>- -</th>
</tr>
</thead>
</table>

### 15060  Pipe and Pipe Fittings

**a. General**

1) All piping and fittings shall be of domestic manufacture unless approved in advance by Facilities Management through the University Project Manager.

2) Fittings shall be seamless only.

3) All piping in mechanical rooms shall be exposed. Do not conceal or imbed pipe in walls, floors, or other structures.

4) Changes in direction and changes in pipe size shall be accomplished with manufactured pipe fittings.

5) Anchor and support piping with allowance for free expansion and movement without causing damage to piping, equipment, or the building. Pipe expansion and contraction shall be controlled by expansion loops. No mechanical expansion joints will be allowed in any system.

6) All pipe shall be installed parallel to walls and ceilings. The installation shall present a uniform appearance, and long lengths of pipe shall be grouped together.

7) Piping in the mechanical room shall be arranged to maintain adequate head room and clear passageways.
8) Provide unions or flanges at connections to equipment, valves, etc., as shown to facilitate maintenance.

9) Install piping full size through shutoff valves, gas cocks, balancing valves, etc.

10) Where changes in the pipe size are required at equipment connections, change the pipe size within a maximum length of three pipe size diameters of the final connection. Where changes in pipe sizes occur in horizontal straight lengths of pipe, install eccentric reducers with the straight side on top for water, and the straight side on the bottom for steam piping.

11) Pull Tees in copper pipe (formed by pulling out a section of pipe to form a connection point) are not acceptable.

b. All piping shall be installed to insure proper drainage.

1) Steam mains and condensate mains shall be pitched down in the direction of flow, a minimum of 1” per 20 feet.

2) Steam branch lines to equipment shall have a slope at a minimum of 1” per 20 feet back towards the main.

3) Vacuum and compressed air piping shall pitch down in the direction of flow a minimum of 1” per 40 feet.

4) Domestic water, chilled water, heating water, and condenser water piping shall slope down a minimum of 1” per 40 feet towards the drains.

5) Dry standpipes shall pitch down to the fire department connections at a minimum of 1” per 40 feet.

6) Refrigerant suction lines shall slope a minimum of 1/2” per 10 feet. Slope the pipe in the direction of gas flow (discharge line sloping to the condenser, and suction line sloping towards the compressor).

7) Soil, waste, and vent lines shall slope in accordance with the requirements of State adopted codes.

8) Roof drain lines shall slope down a minimum of 1/4” per foot on all University projects.

c. Welding Certification
1) Each welder shall have passed a qualification test in accordance with ASME Boiler and Pressure Vessel Code, ASME, and ANSI within the past 6 months. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.

2) The test report shall certify that the welder is qualified to weld the material to be used at the job site.

3) The Contractor shall submit three copies of each welder's qualification test report to the University Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified.

d. Welding

1) Electric metallic arc process shall be used on all welding. End preparations shall conform to ANSI and ASTM Standards.

2) Use only one welder for each joint.

3) Weld slip-on flanges on both front and back sides.

4) Thermometer wells and test wells shall be back welded.

e. Piping Tests

1) Prior notification of at least 10 days will be required for an intent to perform hydrostatic testing. The Contractor's notice shall be reviewed and approved by the University Project Manager prior to commencement of the required testing.

2) Piping tests shall be performed in accordance with the ANSI Code for Pressure Piping.

3) Piping tests shall be completed prior to painting, insulating, or covering the pipe.

4) At option of the Contractor, welds not hydrostatically tested may be x-ray tested. Each test shall comply with the requirements of industry standards, prior notification, and bid allowance Inspector as specified above.

5) The University may elect to hire a third party testing company for piping tests. During the design phase determine who will be responsible for piping tests and include this information in the specifications.
f. The allowable depth of bury for piping below grade should be should be determined by consultation with the University Project Manager. Generally the following minimum depths of bury will apply:

<table>
<thead>
<tr>
<th>BURIED PIPE</th>
<th>DEPTH of BURY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTW and Steam</td>
<td>60&quot;</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>36&quot;</td>
</tr>
<tr>
<td>Water</td>
<td>36&quot;</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>24&quot;</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

g. Direct buried domestic water piping mains and branch mains shall be no less than 6" pipe size.

h. Water service piping connections to existing mains and branch mains shall include saddle taps and service valves. Service valves are to be located at the connection and fully accessible via curb boxes. The service valve shall be submitted for approval before installation.

15061 Piping Material (Above Grade - "a.g.")

a. High Temperature Hot Water (HTW)\textsubscript{a.g.}

See 3.8 HVAC.

b. High Pressure Steam (125 to 250 PSIG)\textsubscript{a.g.}

1) Specify ASTM A53 Grade B seamless black steel pipe, Schedule 80 for pipe 2" and smaller, and Schedule 40 for pipe 2-1/2" and larger. Grade A shall be specified for pipe 1-1/2" and smaller.

2) For 2" and smaller specify 300 LB malleable iron screwed fittings or socket weld fittings.

3) For 2-1/2" and larger specify ASTM A234 standard weight forged steel butt weld fittings.

c. Medium Pressure Steam (15 to 125 PSIG)\textsubscript{a.g.}

1) Specify ASTM A53 Grade B Schedule 40 black steel pipe. Grade A shall be specified for pipe 1-1/2" and smaller.

2) For 2" and smaller specify 125 LB cast iron screwed fittings or 150 LB malleable iron screwed fittings.
3) For 2-1/2” and larger specify ASTM A234 standard weight forged steel butt weld fittings.

d. Low Pressure Steam (15 psig or less), a.g.

1) Specify ASTM A53, Grade B Schedule 40 black steel pipe. Grade A shall be specified for pipe 1-1/2” and smaller.

2) For 2” and smaller specify 125 LB cast iron screwed fittings or 150 LB malleable iron screwed fittings.

3) For 2-1/2” and larger specify ASTM A234 standard weight forged steel butt weld fittings.

e. Steam Condensate, a.g.

1) Specify ASTM A53, Grade B, Schedule 80 black steel pipe. Grade A shall be specified for pipe 1-1/2” and smaller.

2) For 2” and smaller specify 300 pound screwed malleable iron fittings.

3) For 2-1/2” and larger specify ASTM A234, ASA B16.9, ASA B10, Grade B, Schedule 80 forged black steel butt weld fittings.

f. Hot Water Heating, a.g.

1) Specify one of the following materials: a. ASTM A53, Grade B, Schedule 40, black steel pipe. Grade A shall be specified for pipe 1-1/2” and smaller. b. ASTM B 88, type K copper pipe with brazed or Propress style fittings.

2) For 2” and smaller, specify 150 pound, screwed, malleable iron fittings.

3) All specified EPDM gaskets shall have temperature ratings from -30°F to +230°F.

4) For 2-1/2” and larger, specify ASTM A234 standard weight forged steel butt weld fittings, or 150 pound malleable iron fittings with mechanical grooved pipe couplings.

g. Chilled Water, a.g.

Same requirements as for hot water heating.

h. Condenser Water (Cooling Tower), a.g.

1) Specify ASTM A53, Grade B, Schedule 40 black steel. Grade A shall be specified for pipe 1-1/2” and smaller.
2) For 2" and smaller specify 150 LB screwed malleable iron fittings.
3) For 2-1/2" and larger specify ASTM A234, ASA B16.9, ASA B10, Grade B, Schedule 40 forged black steel butt weld fittings; or, grooved pipe and couplings may be specified.

i. Cold Water, Domestic Hot Water, and Recirculating Domestic Hot Water

1) Specify Type L hard drawn copper with wrought copper fittings and lead free solder.

2) Where existing lines are galvanized, specify Type L hard drawn copper, wrought copper fittings, and dielectric unions; or, ASTM A53 Schedule 40 galvanized steel with 150 LB galvanized malleable iron screwed fittings.

3) Copper piping is preferred over galvanized piping for domestic water where possible.

4) All automatic faucets and flush valves shall be piped with copper tube or pipe (No plastic tubing is allowed).

j. Soft Water

Type L hard drawn copper with wrought copper fittings and lead free solder.

k. Compressed Air and Vacuum

Specify Type L hard drawn copper with wrought copper solder fittings and lead free solder; or, ASTM A53 Grade A or B, Schedule 40 galvanized steel with 150 LB galvanized malleable iron screwed fittings.

l. Medical Gases

Specify Type L hard drawn seamless copper pipe chemically cleaned, degreased, evacuated, capped, and especially prepared for oxygen usage as required in NFPA pamphlet No. 56F. Specify wrought copper fittings and lead free solder.

m. Medical Acetylene

Specify stainless steel only. Neither copper nor alloys with any copper content will be allowed.

n. Natural Gas

1) Specify ASTM A53, Grade B, Schedule 40, black steel pipe. Grade A shall be specified for pipe 1-1/2” and smaller.

2) For 2" and smaller specify 150 LB malleable iron screwed fittings.
3) For 2-1/2" and larger specify ASTM A234, ASA B16.9, Grade B Schedule 40 forged black steel butt welding fittings.

4) All exterior above ground natural gas piping shall be painted with an exterior grade gray protective paint suitable for the intended purpose.

o. **Fire Protection**

1) All piping shall meet the ASTM standards as listed in NFPA 13.

2) Schedule 40 black steel pipe or Allied Tube-Sprinkler “Dyna-Thread” pipe shall be specified for piping sized 2” and smaller. Schedule 10 black steel pipe shall be specified for piping sized 2-1/2” and larger. The use of “Dyna-Flow” and other types of thin-wall pipe are not approved.

3) The use of CPVC pipe is acceptable for use in Residential Occupancies and Light Hazard Occupancies. CPVC pipe must be used according to its listing as prescribed by the manufacturer’s specifications. Approved manufacturer is Lubrizol BlazeMaster. All other manufacturers / products must be reviewed and approved by the University Fire Marshal prior to bid.

4) For 2” and smaller specify 150 LB malleable iron, screwed fittings.

5) For 2-1/2” and larger specify 150 LB malleable iron fittings with mechanical grooved pipe couplings. Approved manufacturers are Victaulic, Gruvlok, and Grinnell. All other manufacturers must be reviewed and approved by the University Fire Marshal prior to bid.

p. **Soil, Waste and Ventilation**

1) For 2" and larger (above ground), specify cast iron pipe and fittings, with resilient gasket joints; or, 'no-hub' cast iron pipe and fittings with stainless steel bands. Piping located 6" above the ground may be ASTM A53 Schedule 40 galvanized steel pipe with screwed cast iron drainage fittings.

2) Do not allow plastic pipe or fittings except as noted below, and except for approved acid waste piping systems as described in this supplement to the DFCM Manual.

   a) For temporary or short term projects that have a building or system life cycle of less than 25 years, alternate materials may be considered. A variance request for these considerations shall be submitted to the Design Standards
Committee through the University Project Manager for approval.

3) Indirect piping shall be Type L hard drawn pipe with wrought copper fittings and lead free solder.

4) Ejector pump discharge lines shall be Schedule 40 galvanized steel pipe with 150 LB galvanized malleable iron screwed fittings.

q) Acid Resistant Waste and Vent_{w.g.}

1) Three options are approved for installation at the University.

2) The designer is responsible for choosing suitable piping material based on the type of acids which will be used in the pipe.

3) CPVC is generally acceptable but not approved for use in hydrofluoric applications.

4) Where hydrofluoric chemicals will be used, the designer shall meet with the University Project Manager and the Plumbing Shop Supervisor to review design limitations and system requirements during the Design Development phase.

5) The three approved options, considering the above limitations, are:

a) Tempered and annealed borosilicate glass Fed. Spec. DD-G-541-A with stainless steel compression fittings, Buna-N rubber compression liners, and tetra-fluoro-ethylene seal rings. Approved manufacturers are Kimax, CHEM Flowtronics, or H.S. Martin, Inc.. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

b) Schedule 40 flame retardant polypropylene using socket weld fittings and electric fusion coil or mechanical joint couplings. Approved manufacturers are GSR Fuseal, Enfield, or Orion. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

c) CPVC (chlorinated poly [vinyl chloride]) pipe and fittings specifically designed for acid waste systems, using solvent cement welded joints, suitable for intermittent non-pressure drainage to 220° F, with a 25/50 flame spread/smoke development rating. Solvent cement shall be the product of the CPVC manufacturer,
specifically designed for the acid waste piping system. Approved manufacturer is Spears LabWaste. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

r. Roof Drain \( a,g \):

1) Specify the same pipe as specified for soil, waste and vent.

2) As an option, specify Schedule 40 ASTM A53 Grade B galvanized pipe with 150 pound galvanized iron fittings. Mechanical grooved pipe couplings may also be used.

s. Refrigerant (Freon)\( a,g \).

Specify Type L hard drawn copper tubing, degreased, scaled-at-the-mill, with wrought copper refrigerant fittings. Specify 15\% Sil-Fos solder or with wrought copper refrigerant fittings. Specify 15\% Sil-Fos solder or 45\% silver solder. Piping shall be cleaned, dehydrated, charged with nitrogen, and sealed at the mill.

t. Cooling Coil Condensate Drain\( a,g \).

Specify Type L hard drawn copper with wrought copper solder fittings.

u. Distilled Water, Deionized Water, Demineralized Water, Reverse Osmosis Water \( a,l \) all \( a,g \).

1) Coordinate with the University Project Manager prior to specifying the pipe required for these services. The level of water purity shall dictate the type of pipe material required \( i.e. \) polyethylene or polypropylene.

2) Most cases will require polypropylene pipe with the following properties:

a) Pipe and fittings shall be GSR/Sloan fusion coil type virgin un-pigmented polypropylene pipe grade material manufactured to Schedule 40 iron pipe dimensions. Additional approved manufacturers are Harvel and Pure Tech Plastics. The products of other manufacturers not listed here will be considered only after successful site testing at the University. Specific products furnished and installed into the project must be equal or superior to the specified GSR/Sloan product.

b) The addition of normal antioxidants or slip agents will not be allowed.
c) The pipe shall be furnished in 10 foot lengths; shall be cylindrical and straight; and, shall be sterile capped at the time of manufacture.

d) The pipe and fittings shall meet ASTM D2146 (but without additives), and be manufactured to meet dimensional tolerances of ASTM D2447-74.

e) Long straight lengths of polypropylene pipe will require expansion joints. Piping installed in a cold environment will require expansion joints.

f) Support horizontal piping with continuous channel or angle iron.

v. Ultra-Pure Water\textsubscript{a,g.}

Ultra-pure process piping and fittings are to be specified low-extractable PVC with a Cell Classification of 12343 per ASTM D1784, Schedule 80 with a Type II pressure rating. Manufacturing Company. Additional approved manufacturers are Harvel and Pure Tech Plastics. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Spears product as defined herein.

w. Fuel Oil (supply & return)\textsubscript{a,g.}

Specify Type L soft copper with flare fittings.

15062 Piping Material (Underground or Below Grade - "b.g.")

a. Buried Site Piping, Trace Wire, Warning Tape, Sand Cover Over Pipe

1) All underground conduit and pipe exterior to the building 4" diameter and larger shall be installed with an 18 gage continuous copper wire 8" over the pipe to serve as trace wire.

2) See 3.2 CIVIL / L. SITE UTILITIES FOR CAMPUS PROJECTS / (3) for specific design instructions including warning tape, approved methods for trace wire terminations, testing requirements, buried plastic or natural gas piping, sand cover, etc.

b. Domestic Water and Fire Protection\textsubscript{b,g.}

1) Specify PVC or Class 150 ductile iron cement lined pipe and fittings, with mechanical joint couplings for piping 4" and larger.
2) PVC Pipe shall not be installed any closer than 10 feet from the outside building line.

3) Copper will be approved for the smaller piping. Specify Type K with brazed joints for areas where high and or heavy traffic is anticipated.

c. Sanitary Waste and Roof Drain

Specify HDPE pipe, cast iron "no-hub" pipe and fittings or cast iron pipe and fittings with bell and spigot joints using resilient seals such as "Ty- Seal" gaskets. (The pipe and gasket shall be of the same manufacturer). The “no-hub” couplings shall have ASTM C 564 neoprene gaskets. .008” stainless steel shields with transverse corrugations cross longitudinal corrugations, standard 304 stainless steel clamps and 305/ s/s screws. All underground “no-hub” couplings shall be specified with “extra heavy duty” bands. Entire assembly shall accommodate deflection.

d. Acid Resistant Waste and Vent

1) Specify Schedule 40 flame retardant polypropylene using socket weld fittings and electric fusion coil, or CPVC solvent cement welded pipe and joints specifically designed for acid waste systems.

2) The designer is responsible for choosing suitable piping material based on the type of acids which will be used in the pipe.

3) CPVC is generally acceptable but not approved for use in hydrofluoric applications.

4) Where hydrofluoric chemicals will be used, the designer shall meet with the University Project Manager and the Plumbing Shop Supervisor to review design limitations and system requirements during the Design Development phase.

5) Where CPVC is used, solvent cement shall be the product of the CPVC manufacturer, specifically designed for the acid waste piping system.

6) Approved CPVC manufacturers are GSR Fuseal, Enfield, Orion, or Spears LabWaste. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

e. Natural Gas
1) For each project, the A/E shall obtain the current Questar approved specification for plastic pipe. The pipe specification

2) No gas lines shall be run under-ground down-stream of the building regulator/meter set.

3) Projects that install new plastic gas lines, that replace old steel lines, shall install new cathodic protection to the remaining steel pipe.

4) All gas risers shall be anoidless style for (1/2”-2”).

5) If new plastic piping is to be routed under any road, the pipe must have a PVC or sewer pipe sleeve two pipe sizes larger than the gas line it will protect.

6) If new plastic piping is to be routed through a wall, the pipe must have a protective sleeve and the pipe/sleeve system must be completely sealed to prevent water from entering the building.

7) See 15351 NATURAL GAS PIPING ON CAMPUS herein for more information.

f. Fuel Oil (supply & return)\(b,g\).

Specify Type K soft copper with flair fittings.

g. Refrigerant Piping\(b,g\).

Specify the same materials specified for "above grade" service, but route in oversize PVC conduit. Bury the system in sand backfill.

h. Heating Water Piping\(b,g\).

Piping shall be schedule 80 seamless steel pipe.

i. Chilled Water Piping

Piping material shall be one of the following:

1. AWWA C900 PVC pressure class 235 psi (DR 18) pipe or prior approved equal. Fuse joints and slip joints are permitted. Install per manufacturer’s installation guide.

2. ASTM D3035-08 HDPE joined by fusion welding. Pipe joined by fusion welding shall be reamed to remove flashing from the weld site.
3. ASTM F2389-10 polypropylene pipe joined by fusion welding. Pipe joined by fusion welding shall be reamed to remove flashing from the weld site.

15063 Protective Coatings for Pipe

a. Natural gas pipe below grade should be plastic pipe without additional coating. Where black steel pipe is approved for use, pipe shall be wrapped and bitumen or plastic coated. Provide anode bags for cathodic protection of buried steel piping.

b. Cast iron soil, waste, and roof drain piping shall be coated inside and out with coal tar pitch.

c. Ductile iron pipe shall be capsulated in polyethylene wrap.

15064 Pressure Tests

a. All water mains and services to the PRV valve will be hydrostatic tested to 200 psi for two hours. All interior water (domestic & industrial), heating and steam lines will be hydrostatic tested to 150 psi for two hours in addition to code requirements. All pressure tests will be witnessed by Facility Operations personnel. Soil pipe, roof drain, waste, vent, and acid waste and vent piping shall be tested in accordance with the IPC and AWWA Standards.

b. Hot water heating, chilled water, high pressure steam, medium pressure steam, low pressure steam, steam condensate, condenser water, fire protection water, compressed air, and vacuum lines shall be tested in accordance with the IMC (International Mechanical Code).

c. Natural Gas lines shall be tested in accordance with NFPA 54.

d. Medical Gases, Medical Vacuum, and Lab Gases shall be tested in accordance with NFPA Pamphlet 99 Standard for Health Care Facilities.

e. Test requirements for high temperature water (HTW) systems are found in 3.8 HVAC.

f. Oxygen Piping systems shall be pressure tested in strict accordance with NFPA #56F. Specific attention is directed to the absolute prohibition of the use of oil pumped compressed air or oil pumped nitrogen, and the prohibition of the use of a hydrostatic test. The testing medium must be water pumped compressed air or vapor pumped nitrogen.

g. Refrigeration piping shall be tested in accordance with the IMC and ASHRAE 15.
15065 **Pipe Hangers and Supports**

a. All piping is to be supported in accordance with the International Plumbing and International Mechanical Codes.

b. Approved manufacturers are ITT Grinnell, B-Line, and Anvil International. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

15066 **Piping System Cleaning, Filling, and Treatment**

a. All new piping systems for heating hot water, steam, chilled water and condenser water shall be thoroughly flushed and cleaned before being placed into service.

1) Do not flush into the storm drain system. Piping shall be cleaned with an appropriate cleaning agent certified to remove all construction debris and oxidized metal by a University authorized water treatment specialist. The chemical applied should be guaranteed to be compatible with all system piping, gasket and component materials. A written procedure for the correct application of the chemical including all safety precautions and methods for confirming success of the application must be provided. Supervision of the cleaning process shall be provided by the chemical supplier or a designated contractor.

2) The cleaning of these piping systems shall be accomplished only by the University’s current chemical treatment contractor. The designer shall contact the University’s HVAC shop via the University Project Manager to obtain the latest contact information for the specific chemical treatment contractor currently under contract with the University, and include this information in the construction documents.

b. After the cleaning and flushing procedure has been completed, heating hot water and chilled water systems shall be filled with softened water which includes appropriate chemicals or antifreeze compatible with the contents of the existing system before isolation valves are opened to the building system. Steam systems shall be filled with treated make-up water as described in 3.8 HVAC. Condenser water systems shall be filled with cold water.

c. The cleaning of domestic systems is specified in Section 15400 Plumbing Systems.

d. Closed loop systems shall have the correct level of a chemical corrosion inhibitor fed into the system as determined by the University’s authorized water treatment specialist. The University’ specialist shall confirm the correct level of protection through analytical testing.
e. Open loop systems shall have the correct level of a chemical corrosion inhibitor fed into the open loop system as determined by the University’s authorized water treatment specialist. Additionally, sodium hypochlorite should be added to achieve a tested level of 0.5 to 1.5 ppm free residual chlorine. The University’s specialist shall confirm the correct level of protection through analytical testing.

f. Glycol systems shall use industrial type inhibited propylene glycol (minimum of 30%) such as Jeffcool P150, Dowfost, or prior approved equal. Automotive type ethylene glycol shall not be used.

15090 Floor Penetrations

All floor penetrations to be water tight in addition to meeting other code requirements. Depending on project specific conditions, some penetrations will require a sleeve or other device extended a certain distance above finish floor to be above an anticipated water level.

15100 Valves and Accessories

a. General: The following requirements apply to all valves:

1) Isolation Valve

The University will require an isolation valve near the main pipe line on branch piping which serves each specific area of the building (such as a single toilet room or a single lab, and at each floor) for all supply systems serving the building. The designer is to provide direction to the Contractor to locate these valves for easy access, allowing local isolation for repairs without affecting adjacent areas.

2) Access Door

All valves must be accessible. Specify an “approved” access door for any valve located above a hard ceiling or in a wall.

3) Pressure Reducing Valve Location

  a) All pressure reducing valves (PRV) are to be located in an accessible space 5 feet above finished floor for servicing. All pressure reducing valves shall have a PVC drain line from the device to an approved floor sink.

  b) All pressure reducing valves shall have PSI gages on the upstream and downstream side of the valve.

4) Valves 2-1/2" and larger must be flanged.
5) Specify valve stem installation to be horizontal or higher than the valve.

6) All valves of the same type shall be specified to be of the same manufacturer.

7) Valves shall be domestically manufactured wherever possible.

8) Control valves must be specified to be compatible with either Johnson Controls, Inc., Trane US, Inc., or Wasatch Controls Honeywell, as described in the Controls section of this supplement. No others will be approved except where the controls of another vendor/manufacturer must be matched on an existing facility.

9) Specify heating water valves, steam valves, and all valves located in the secondary (low pressure) side of HTW heat exchangers to have end bores matching the pipe bore.

10) Valves shall meet all applicable MSS Standards.

b. High temperature water valves are described in 3.8 HVAC.

c. Low Pressure Steam (15 PSI or less) and Steam Condensate Valves

1) Gate valves 2” and smaller (MSS SP-80) for steam and condensate service shall be based on Nibco T-111, bronze, threaded, 125#, with solid wedge disc and rising stem. If clearances will not allow a rising stem valve, specify a Nibco T-113 non-rising stem valve. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco gate valve.

2) Gate Valves 2-1/2” and larger (MSS SP-70) for steam and condensate service shall be based on Nibco F-617-O, iron body, flanged, 125#, OS&Y valve with bronze trim. If clearances will not allow a rising stem valve, specify a Nibco F619 non-rising stem valve as a basis for the specification. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco gate valve.

3) Globe Valves 2” and smaller (MSS SP-80) for steam and condensate service shall be based on Nibco T-235-Y, bronze, threaded, 150# with
No. 1 replaceable composition disc. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco globe valve.

4) Globe Valves 2-1/2" and larger (MSS SP-85) for steam and condensate service shall be based on Nibco F-718-B, iron body, flanged, 125#, with No. 1 replaceable composition disc. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco globe valve.

5) Check Valves 2" and smaller (MSS SP-80) for steam and condensate service shall be based on Nibco T-413-B, bronze, threaded, Y-pattern, 125# steam swing check valve with replaceable disks. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco check valve.

6) Check Valves 2-1/2" and larger (MSS SP-71 Type 1) for steam and condensate service shall be based on Nibco F-918-B, iron body, flanged, 125#, with bronze trim with replaceable disks. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco check valve.

7) Strainers 2" and smaller for steam and condensate service shall be based on Watts No. 77S, 250 LB iron body, threaded, Y-pattern, 20-mesh stainless steel screen, with a full size drain connection and gate valve (described elsewhere herein). Additional approved manufacturers are Conbraco and Armstrong International. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Watts strainer.

8) Strainers 2-1/2" and larger for steam and condensate service shall be based on Watts No. 77F-125, 125 LB iron body, flanged, Y-pattern, stainless steel screen, with a full size drain connection and gate valve (described elsewhere herein). Additional approved manufacturers are
Conbraco and Armstrong International. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Watts strainer.

9) Unions 2" and smaller for steam and condensate service shall be specified as 300 LB ground joint malleable iron, hexagonal, threaded.

10) Unions 2-1/2" and larger for steam and condensate service shall be specified as flanged (raised face), and bolted with gaskets to suit the specific service.

11) Dielectric unions for steam and condensate service shall be specified to be rated for 175 PSIG WSP at 250° F

d. High Pressure Steam (greater than 15 PSIG)

1) Gate Valves 2" and smaller (MSS SP-80) for high pressure steam service shall be based on Nibco T-154-SS, bronze, threaded, 200#, with Exelloy seats and rising stem. If clearances will not allow a rising stem valve, specify a Nibco T-176-SS non-rising stem valve. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco gate valve.

2) Gate Valves 2-1/2" and larger (MSS SP-70) for high pressure steam service shall be based on Nibco F-667-O, iron body, flanged, 250#, OS&Y valve with bronze trim. If clearances will not allow a rising stem valve, specify a Nibco F-669 non-rising stem valve. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco gate valve.

3) Globe Valves 2" and smaller (MSS SP-80) for high pressure steam service shall be based on Nibco T-256-AP, bronze, threaded, 200# plug type with stainless steel removable seat and disc. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco globe valve.

4) Globe Valves 2-1/2" and larger (MSS SP-85) for high pressure steam service shall be based on Nibco F-768-B, iron body, flanged, 250#,
with bronze trim. Additional approved manufacturers are Crane, Stockham and Powell. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco globe valve.

5) Check Valves 2” and smaller (MSS SP-80) for high pressure steam service shall be based on Nibco T-453-B, bronze, threaded, 200# steam swing check valve with replaceable disks. Additional approved manufacturers are Crane and Stockham. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco check valve.

6) Check Valves 2-1/2” and larger (MSS SP-71 Type 1) for high pressure steam service shall be based on Nibco F-968-B, iron body, flanged, 250#, with bronze trim with replaceable disks. Additional approved manufacturers are Crane and Stockham. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Nibco check valve.

7) Strainers 2” and smaller for high pressure steam service shall be based on Watts No. 77S, with a 250 LB iron body, threaded, Y-pattern, 20-mesh stainless steel screen, with a full size drain connection and gate valve (described elsewhere herein). Additional approved manufacturers are Conbraco and Armstrong International. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Watts strainer.

8) Strainers 2-1/2” and larger for high pressure steam service shall be based on Watts No. 77F-250, 250 LB iron body, flanged, Y-pattern, stainless steel screen, with a full size drain connection and gate valve (described elsewhere herein). Additional approved manufacturers are Conbraco and Armstrong International. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Watts strainer.

9) Unions 2” and smaller for high pressure steam service shall be specified as 300 LB ground joint malleable iron, hexagonal, threaded.

10) Unions 2-1/2” and larger for high pressure steam service shall be specified as flanged (raised face), and bolted with gaskets to suit the specific service.
Hot Water Heating, Chilled Water, and Condenser Water Valves:

1) Ball Valves (MSS SP-110) shall be rated for 125 psig WOG at 220° F, with bronze construction, threaded ends, full port, bubble tight teflon seat (at 100 psig under water), with a hard chrome plated brass or stainless steel ball. Specify the valve to operate with flow in either direction and tight shut off.

2) Gate Valves (MSS SP-80) are to be specifically identified on construction drawings, due to their limited approval for use at the University.

3) Globe Valves 2” and smaller (MSS SP-80) shall be bronze, threaded, 200# WOG, with No. 6 replaceable composition discs. For all applications, specify the composition disc to be suitable for hot water up to 220° F maximum.

4) Globe Valves 2-1/2” and larger (MSS SP-85) for heating water, chilled water and condenser water service shall be iron body, flanged, 200# WOG, with No. 6 replaceable composition disc. For applications, specify the composition disc to be suitable for hot water up to 220° F maximum.

5) Butterfly Valves 2-1/2” and larger shall be 150 LB and rated for a minimum of 200 degrees F, full lug type, with a carbon steel or case iron body, 316 stainless steel disc material, and EPDM seat material. Specify gear operation for all valves 8” and larger. Butterfly valves shall not be specified for balancing valve service.

6) Swing Check Valves 2” and smaller (MSS SP-80) shall be bronze, threaded, Y-pattern, and rated for 200# WOG.

7) Swing Check Valves 2-1/2” and larger (MSS SP-71 Type 1) shall be iron body, flanged, 200# WOG, valve with bronze trim.

8) Non-Slam Check Valves 2” and smaller shall be 125 psig WSP, silent, spring loaded, and all stainless steel.

9) Non-Slam Check Valves 2-1/2” and larger shall be 125 psig WSP, silent operating, with semi-steel body, bronze trim and discs. Specify the bronze seats to have a center guide and be "renewable" with special reseating tools. Specify the spring for operation in any position.
10) Strainers 2" and smaller shall be 250 LB iron body, threaded, Y-pattern, 20-mesh stainless steel screen, with a full size drain connection and ball valve.

11) Strainers 2-1/2" and larger shall be 125 LB iron body, flanged, Y-pattern, stainless steel screen, with a drain connection and ball valve. Note that condenser water lines require a basket type strainer rated for 125 PSIG WSP, cast semi-steel body, flanged ends, stainless steel basket with 1/8" perforations.

12) Balancing cocks 2" and smaller shall be 175 PSIG WOG, with a cast iron body, square head, screwed ends, wrench operated and pre-lubricated.

13) Balancing cocks 2-1/2" and larger shall be 200 PSIG WOG, with a cast iron body, square head, flanged ends, wrench operated and pre-lubricated.

14) Balancing valves for shall be positive shut-off valves with a memory stop on the valve and a locking tamper proof setting. Specify valves to be supplied with preformed polyurethane insulation. As stated in other sections, gate valves and butterfly valves shall not be used as balancing valves. The valve manufacturer shall provide documentation showing the flow-pressure relationship for the valve.

f. Domestic Cold Water Valves, Domestic Hot Water Valves, Domestic Hot Water Return Valves, and Industrial Hot and Cold Water Valves in Copper Pipe:

1) Ball valves (MSS SP-110) for use in domestic water applications (copper pipe) shall be specified as Watts B-6080 rated for 125 PSIG WOG at 220° F, with bronze construction, threaded ends, bubble tight teflon seats (at 100 PSIG under water), with a hard chrome plated brass or stainless steel ball. Ball valves must be full port valves. Additional approved manufacturers are Nibco or Apollo. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Watts ball valve.

a) Specify the valve to operate with flow in either direction, suitable for both throttling and tight shut off.

2) Gate valves (MSS SP-80) for use in domestic water applications (copper pipe) shall be specifically shown on construction drawings, due to their limited approval for use at the University. Ball valves are preferred over gate valves for 2" and smaller sizes. Specify butterfly valves for 2-1/2" and larger sizes. Gate valves must never be specified for balancing service. When required for valves 2" and
smaller, gate valves shall be based on Nibco T-111, Crane 428, bronze, threaded, 200# WOG, with solid wedge disc and rising stem. If clearances will not allow a rising stem valve, specify Nibco T-113 or Crane 438 non-rising stem valve. Other valves must be reviewed by Facilities Management and approved before being added to project specifications.

3) Globe valves for use in domestic water applications (copper pipe) shall be specified as Crane Model No. 7TF or Nibco S-235, bronze, threaded, 200# WOG, with TFE discs. Specify the composition disc to be suitable for hot water up to 200° F maximum.

4) Butterfly valves for use in domestic water applications (copper pipe) shall follow the University’s requirements for heating water service. Valve selections shall be rated suitable for potable water applications.

5) Check valves for use in domestic water applications (copper pipe) shall be based on Crane Model No. 37 or Nibco S-480-B, bronze, threaded, Y-pattern, and rated for 200# WOG. Selections shall be rated suitable for potable water applications.

6) Strainers for use in domestic water applications (copper pipe) shall be based on Watts No. 777, specified with a WWP of 250 psig at 210° F, with a cast bronze body, threaded ends, solid retainer cap, and a 20 mesh stainless steel screen (except the 3” size must have 3/64” perforations).

g. Compressed Air Valves:

1) Ball valves for use in compressed air piping shall follow the University’s requirements for domestic water applications.

2) Butterfly valves for use in compressed air piping shall be based on Crane “Monarch” 21 (molded seat), ductile iron body, 200# WOG valve with bronze disc and type 304 stainless steel stem. The seat shall be specified Buna N rubber. Note that valves 5” and smaller are to be specified with 10-position locking levers; and, valves 6” and larger are to be specified with manual gear operators. Butterfly valves must be rated for temperatures up to 180° F maximum and must be capable of tight shut-off at rated pressure without the need for downstream blind flanges. Additional approved manufacturer is Nibco (WD2100 or LS2100). All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Crane “Monarch” butterfly valve.

3) Check Valves in compressed air service are “tricky” and should be engineered for each application.
a) Lift check valves 1-1/2" and smaller or use in compressed air piping shall be based on Crane Model No. 117 ATJ bronze, threaded, and rated at 150 PSI at 200° F maximum. Specify horizontal lift check valves with PTFE replaceable composition disc.

b) Swing check valves 2" and smaller for use in compressed air piping shall be based on Crane No. 41TF, bronze, threaded, Y-pattern, 200# WOG at 200° F maximum, with PTFE disc.

c) Swing check valves 2-1/2" and larger (MSS SP-71 Type 1) for use in compressed air piping shall be based on Nibco F-918-B, Crane 373, iron body, flanged, 200# WOG, with bronze trim.

4) Strainers for use in compressed air piping shall follow the University requirements for heating and air conditioning water service.

h. Vacuum Valves:

1) Ball valves for use in vacuum piping shall follow the University requirements for domestic water applications.

2) Butterfly valves for use in vacuum piping shall follow the University requirements for heating and air conditioning water service, except that all sizes are to be specified for non-leakage performance up to and including 29.9 inches of mercury (Hg).

i. Natural Gas Valves:

1) Natural gas valves 2" and smaller shall be specified as Apollo Ball Valves G-B-10 series. Nibco GB1A or GB2A may be used for 1/2" and 3/4" sizes. Other valves must be reviewed by Facilities Management and approved before being added to project specifications. Specify three piece dielectric unions where applicable.

2) Natural Gas Valves 2-1/2" and larger shall be specified all iron, 125 PSIG WOG, with square head and flanged connections. Specify three piece dielectric unions, where applicable.

3) Earthquake actuated automatic gas shut-off valves are to be required downstream of each meter set. Each valve shall be specified with a UL label and be capable of complete gas line closure within 5 seconds of a wide amplitude seismic disturbance. Specify three piece dielectric unions where applicable. Include in the specifications a requirement that the valve shall allow short duration nuisance bumps without disturbing the gas supply. The manifold assembly must be
designed with supports and appropriate barriers to isolate the valve and prevent vandalism. Approved manufacturer is PSP California KOSO. State that other manufacturers will be considered after University monitored field testing on campus.

a) Earthquake actuated automatic gas shut-off valves are to be required downstream of each meter set.

b) Each valve shall be specified with a UL label and be capable of complete gas line closure within 5 seconds of a wide amplitude seismic disturbance. Include in the specifications a requirement that the valve shall allow short duration nuisance bumps without disturbing the gas supply.

c) Specify three piece dielectric unions where applicable. The manifold assembly must be designed with supports and appropriate barriers to isolate the valve and prevent vandalism.

d) Do not locate valves on or next to loading docks or other areas where vehicles can cause the valve to shut off.

e) Approved manufacturer is PSP California KOSO. State that other manufacturers will be considered after University monitored field testing on campus.

j. Refrigeration Valves and Accessories:

1) Expansion valves used in refrigerant piping shall be specified as Alco pressure type distributors, externally equalized, with a stainless steel diaphragm. Specify the same refrigerant in the thermostatic elements as is found in the system. Size the valves to provide the rated capacity of the cooling coil being served. Additional approved manufacturers are Parker Hannifin (including Sporlan), Henry Technologies, and Mueller Refrigeration. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Alco expansion valve.

2) Filter-driers 5/8” and smaller shall be specified as an Alco sealed filter drier using sweat copper fittings, full line size. Additional approved manufacturers are Parker Hannifin (including Sporlan) and Mueller Refrigeration. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Alco filter drier.
3) Filter-driers 3/4” and larger shall be specified as an Alco replaceable core filter drier with nonferrous casing and Schraeder type valves, full line size. Additional approved manufacturers are Parker Hannifin (including Sporlan) and Mueller Refrigeration. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Alco filter drier.

4) Sight glasses used in refrigerant piping shall be specified Alco and have combination moisture and liquid indicator with a protection cap. The sight glass shall be full line size. Additional approved manufacturers are Parker Hannifin (including Sporlan) and Mueller Refrigeration. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Alco sight glass.

5) Solenoid valves used in refrigerant piping shall be specified Alco O.D.F. type with manual opening stem and shall be completely moisture proof. The designer shall size the valve to adequately meet equipment tonnage requirements. Coordinate the voltage required on the valve operator to match the requirement for automatic temperature controls. Additional approved manufacturers are Asco and Parker Hannifin (including Sporlan). All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Alco solenoid valve.

6) Manual refrigerant shut-off valves shall be specified Apollo Conbraco ball valves with cap seals designed for refrigeration service, full line size. Specify installation of these valves on each liquid and suction line at the compressor. If service valves are supplied as integral part of the equipment served, additional service valves are not required. Additional approved manufacturers are Superior Refrigeration Products, Mueller Refrigeration, Henry Technologies, and Virginia. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Specific products furnished and installed into the project must be equal or superior to the Conbraco valve.

7) Flexible connectors used in refrigerant piping shall be designed specifically for refrigerant service with bronze seamless corrugated hose and bronze braiding. Specify flexible connectors on each liquid line and suction line, both at the condensing unit and at the evaporator on systems larger than 5 tons. Direct the Contractor to anchor the pipe near each flexible connector. Approved manufacturers are
Packless Vibration Absorbers Model VAF and Style "BP" Spring-flex freon connectors by Vibration Mountings and Controls.

k. Distilled Water Valves, Deionized Water Valves, Reverse Osmosis Valves, and Demineralized Water Valves:

1) Approved manufacturer is Chicago Model 869A. PVC valves will not be approved. All isolation valves must be specified as “ball-type” valves with valve materials matching the pipe material and system service requirements. Valves of other manufacturers must be prior approved after review and approval by University Facilities Management before bidding.

l. Medical gas piping shall be served by ball valves (4” and smaller) rated at 400 PSIG WOG, with solder joints, conforming to NFPA 56F. Specify each valve to have a double o-ring stem seal, teflon seat, service identification on handle (see valve tagging requirements herein), and shall be a swing-away design. Approved manufacturers are Chemtron and Ohio Medical.

15106 Flow Meters and Temperature & Pressure Gauges

a. Provide where shown, venturi flow meters with meter fittings and a metal identification tag showing location, GPM and pressure drop to 2% accuracy.

1) Venturis 2” and smaller shall be brass with screwed connections. Units larger than 2” shall be steel machined for butt welding.

2) Venturi flow meters for heating and air conditioning water service shall be Armstrong APV, Rinco, or Barco.

b. Provide where shown, glass thermometers, constructed of a die cast aluminum case, finished in baked epoxy enamel, glass front, spring secured, and 9” long.

1) The tube and capillary shall be Mercury filled with magnifying lens, 1% scale range accuracy, shock mounted.

2) The scale shall be satin faced, non-reflective aluminum, with permanently etched markings.

3) Approved manufacturers include Ametek, Marsh, Marshalltown, Trerice, and Weiss. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

c. Provide where shown, pressure gauges, bourdon tube type, stress relieved, constructed of Grade A phosphor bronze, with joints silver brazed, and the socket and tip of brass.

1) The scale shall be white coated aluminum with permanently etched markings.
2) Provide pressure gage cocks between the gauges and gage tees. Gage cocks shall be 1/4” female NPT forged brass compact ball valve (equal to Apollo 77-100). Syphons, if required, shall be brass.

3) Provide a snubber of 1/4” brass, including a corrosion resistant porous metal disc, selected for the pressure rating and fluid served.

4) Approved manufacturers include Ametek, Marsh, Marshalltown, Trerice, and Weiss. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

d. Provide where shown, pressure/temperature connector plugs pressure rated for 500 psi and 200° F.

1) Plugs are to be nickel plated brass with 1/2” NPS fittings.

2) The valve core is to be a self-sealing neoprene gasketed orifice, suitable for inserting a 1/8” O.D. probe assembly.

3) Provide a gasketed screw cap with a chain permanently affixed to the plug.

4) For insulated lines, provide plugs with neck extensions of a length equal to the insulation thickness.

5) Approved manufacturer is Flow Design Inc./Super Seal. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

e. Chilled and Heating Water BTU Meters.

1) The University requires metering of chilled water service to its buildings. Analyze the proposed system and estimate the total building load and capacity. Specify an appropriately sized Fluxus ADM 7407 Liquid Ultrasonic Digital Flowmeter. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

2) When the system is designed for both high temperature water service and chilled water, select and specify an appropriate dual channel meter.

3) Provide load calculations and product specifications to the University Project Manager for each project. Copies of computer programming, wiring diagrams, manuals, and certifications are required. Submit these to the HVAC Shop and University Utility Analyst.
4) BTU meters shall be wall mounted for fixed installation, and include a BTU computer, BTU totalizer, and display device capable of measuring and reporting. The BTU computer shall be a microprocessor unit to calculate, store, and display the following properties:

a) Water flow rate

b) Supply and return temperatures and the difference between

c) Instantaneous MBH

d) Password protected MBtu totalizer which uses an even multiplier of 10,000 Btu, 100,000 Btu or 1,000,000 Btu

5) BTU meters must be capable of transmitting calculated flow rate, energy flow rate, supply and return temperatures and an energy totalizer to the campus central computer using Modbus Rtu protocol.

6) Loss of main power or battery back-up must not erase Btu total.

7) Locate the BTU meter display in the mechanical room and not in a high temperature water mechanical equipment room due to high ambient temperature and humidity in the HTW room.

8) BTU meters must be capable of operation at a water temperature range 0-100° F chilled water and 0-250° F heating water.

9) Specify that the Contractor is responsible for parts not specified, but required for meter installation and wire terminations.

10) The flow sensor element can be installed in either the return line or the supply line in a location approved by flow meter manufacturer to guarantee performance. The flow sensor is to be clamped on rather than welded. Sensors requiring silicone grease which will then require scheduled maintenance are not acceptable. Pilot tube or orifice plate technology is not acceptable.

11) The Contractor must provide upstream/downstream straight piping distances as required by piping specifications and manufacturer’s guidelines.

12) Minimum accuracy of the flow transmitter, unless more stringent accuracy is required by the University, should be +/- 0.8% of reading with +/- 0.2% repeatability of flow rate.
13) A minimum of 2 temperature sensors shall be furnished and installed in heavy duty stainless steel wells which are back welded in locations approved by the meter manufacturer.

   a) Temperature sensors shall be resistance type, 100 ohm RTD. Signals should be transmitted to the Btu computer via separate wiring with system accuracy of +/- 0.1%. Temperature measurements using gas or mercury filled bulbs are not allowed for Btu calculations.

   b) Supply and return RTD’s shall be a matched pair and connected directly to the flow computer. The Contractor shall follow the meter manufacturer’s specifications, including the number of wires transmitting the signal from the RTD to the calculator.

14) Specify installation by a trained instrument service engineer and require special supporting documentation. The trained service engineer shall determine the location of the flow meter and temperature element at the site prior to installation of the Contractor’s piping; and, shall calibrate all instruments and certify accuracy of installation. System start-up and wire terminations at the field instrument location and panel location shall be accomplished by the trained service engineer.

   a) A record of this information along with a copy of the Btu computer’s programming, wiring diagrams, manuals and certifications shall be included in O&M manuals, marked to show the accessories and appurtenances installed at the site, and the building name and number.

   b) Include any manufacturer’s web-based information with URL address clearly marked. Specify that in addition to the O&M information, 2 extra copies of these documents shall be bound separately and addressed to the HVAC shop and the University’s Utility Analyst respectively with the building name and number designated on the covers.

15175 Tanks

   a. General

      1) Tanks shall be shop fabricated and ASME Coded and stamped as required to meet the State of Utah Boiler and Pressure Vessel Rules and Regulations.

      2) The tanks shall be arranged and piped as shown on detail drawings included with 3.8 HVAC.
3) All piping connections and openings shall be welded both externally and internally. Connections and openings shall be fabricated from ASTM A53 Grade A or B steel. Connections shall match the grade and quality of pipe for which intended.

4) Provide structural steel and/or pipe supports. Include cradles of welded construction arranged for bolting to the floor, structure, or slab.

b. Condensate Receivers

1) Size each condensate receiver for a minimum storage capacity of 10 minutes.

2) Unit construction shall be based on ASTM A283 Grade C steel plate. In addition to the required openings and connections, include an access port sized for inspection entry, cleaning, and coating maintenance.

3) Condensate receiver tanks shall have protective coatings. The exterior shall have the manufacturer's shop coat suitable for the operating temperatures expected. The interior shall have a protective coating suitable for the pressure, temperature, and material stored in the tank.

4) Prior to start-up, thoroughly clean the tank.

c. Blowdown Tanks

1) Fabricate blowdown tanks using ASTM A283 Grade C steel plate and/or ASTM A53 Schedule 40 pipe with welded end caps. The assembly shall have a minimum wall thickness of 0.365" (plate or pipe wall).

2) In addition to necessary openings and connections, coat the tank exterior with the manufacturer's shop coat suitable for the anticipated operating temperatures.

3) Prior to start-up, thoroughly clean the tank.

4) Note that all blowdown tanks shall be supplied with soft water for cooling to reduce calcium deposits in the tank and drains.

15200 Seismic Restraints
a. All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed, or supported to withstand seismic disturbances and remain operational.

b. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer or supplier, qualified with seismic experience in bracing for mechanical equipment.

c. Submittals shall include shop drawings, calculations, and printed data for all isolators, seismic restraints, snubbers, concrete inertia bases and anchors.

15250 Insulation - General

a. Insulation shall conform to the current Utah Energy Code.

b. No insulation shall be applied to piping or ductwork until all pressure tests are complete, leaks repaired, and the system is successfully retested.

c. Insulation shall be installed in accordance to manufacturer's recommendations.

15251 Piping Insulation

a. Insulation for systems other than HTW piping shall be fiberglass one-piece preformed pipe insulation with an all-purpose (ASJ) fire retardant jacket.

b. Insulation for HTW equipment and piping is described in 3.8 HVAC.

c. Insulate all refrigerant suction piping and fittings with flexible foam pipe insulation equal to Armaflex.

d. Fittings and valves shall be insulated and covered with Zeston covers.

e. All cold water, chilled water, condenser water, roof drains, and any pipe line which could carry cool water upon which condensate moisture could form, shall have a vapor-proof jacket over the insulation. In lieu of fiberglass insulation, foam glass, thermacell, and expanded polyurethane are also approved for these systems.

f. Fire and smoke hazard for a complete insulation system shall not exceed:

1) Flame spread - 25
2) Fuel contribution - 50
3) Smoke development - 50
g. Insulation protection inserts and shields equal to Grinnell Fig. 167 shall be installed on all insulated pipe 1” and larger. Insulation inserts shall be the same length as the protection shields. Hangers shall not contact the pipe where insulation specified.

1) Seismic points of support shall be protected by a 360° sheet metal shield. Insert insulation shall be of the same thickness as the adjoining pipe insulation.

2) The seismic sheet metal shield wrapped around the insert shall be fabricated to the following lengths and gauge thicknesses:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>SHIELD LENGTH</th>
<th>MINIMUM GAUGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; TO 1-1/2&quot;</td>
<td>4&quot;</td>
<td>20 GA.</td>
</tr>
<tr>
<td>2&quot; TO 6&quot;</td>
<td>6&quot;</td>
<td>20 GA.</td>
</tr>
<tr>
<td>8&quot; TO 10&quot;</td>
<td>9&quot;</td>
<td>16 GA.</td>
</tr>
<tr>
<td>12&quot; TO 18&quot;</td>
<td>12&quot;</td>
<td>16 GA.</td>
</tr>
<tr>
<td>20&quot; AND LARGER</td>
<td>18&quot;</td>
<td>16 GA.</td>
</tr>
</tbody>
</table>

h. Minimum pipe insulation for fiberglass systems shall be as follows:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>BRANCH #to 2&quot;</th>
<th>Up to 1&quot;</th>
<th>1-1/4&quot; to 2&quot;</th>
<th>2-1/2&quot; to 4&quot;</th>
<th>5&quot; and 6&quot;</th>
<th>8&quot; and LARGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam, High Press.</td>
<td>1.5&quot;</td>
<td>2.5&quot;</td>
<td>2.5&quot;</td>
<td>3.0&quot;</td>
<td>3.5&quot;</td>
<td>3.5&quot;</td>
</tr>
<tr>
<td>Steam, Med. Press.</td>
<td>1.5&quot;</td>
<td>2.0&quot;</td>
<td>2.5&quot;</td>
<td>2.5&quot;</td>
<td>3.0&quot;</td>
<td>3.0&quot;</td>
</tr>
<tr>
<td>Steam, Low Press.</td>
<td>1.0&quot;</td>
<td>1.5&quot;</td>
<td>1.5&quot;</td>
<td>2.0&quot;</td>
<td>2.0&quot;</td>
<td>2.0&quot;</td>
</tr>
<tr>
<td>Steam, Condensate</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
<td>1.5&quot;</td>
<td>2.0&quot;</td>
<td>2.0&quot;</td>
<td>2.0&quot;</td>
</tr>
<tr>
<td>Heating Water</td>
<td>0.5&quot;</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
<td>1.5&quot;</td>
<td>1.5&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.75&quot;</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>--</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
<td>1.5&quot;</td>
<td>1.5&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>Recirculating</td>
<td>--</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
<td>1.0&quot;</td>
</tr>
<tr>
<td>Domestic Cold</td>
<td>--</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
</tr>
<tr>
<td>Roof Drain</td>
<td>--</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
<td>0.5&quot;</td>
</tr>
</tbody>
</table>

*BRANCH PIPING TO INDIVIDUAL TERMINAL UNITS NOT EXCEEDING 12 FEET IN LENGTH.*

15258 Duct Insulation

a. High velocity ducts shall be insulated externally with 1-1/2" thick fiberglass faced duct wrap Type IV with factory applied flame retardant foil reinforced Kraft facing FRK-25, U.L. Label.
b. Insulation on high velocity ducts shall be wrapped snugly on the duct while maintaining the maximum thickness specified. All circumferential joints shall be butted and longitudinal joints overlapped a minimum of 2”. Adhere insulation with 4” strips of insulation bonding adhesive at 8” on center.

c. On circumferential joints of high velocity duct insulation, the 2” flange of the facing shall be stapled with 9/16” flare-door staples on 6” centers and taped with 3” wide (minimum) foil reinforcing Kraft tape.

d. On longitudinal joints of high velocity duct insulation, the overlap shall be stapled (9/16” flare door staples) on 6” centers and taped with 3” wide (minimum) foil reinforced Kraft tape. All pin penetrations or punctures in facing shall also be taped.

e. Acoustical Duct Lining

All supply, return, toilet room exhaust (where appropriate), mixed air and outside air ductwork shall be lined with acoustical insulation. The lining shall be one inch thick fiberglass, 1-1/2 pounds per cubic foot density, a minimum noise attenuation factor of NRC = 0.55 per ASTM C 1071 and NFPA 90A and 90B, and shall have a resistance to fungal and bacterial growth per ASTM C 665 and ASTM G21 and G22. The lining shall have a maximum heat conductivity (k factor) of 0.28 Btu-in/hr-ft²-F at a mean temperature of 75°F. The required fire hazard classification is flame spread not over 25, and smoke developed not over 50 per U.L. 723 test. The following products are approved: Schuller (formally Johns-Manville) ”Permacote Linacoustic,” CertainTeed “Ultralite with Certa*Edge Coat,” and Owens Corning “QuietR”. All other manufacturers / products must be reviewed and approved by University Facilities Management prior to bid.

15350 Special Piping Systems

15351 Natural Gas Piping on Campus

a. General:

1) When work is required on any gas line, require the Contractor to submit for prior approval worker qualification sheets for each worker in accordance with Pipeline Safety Regulations Part 191 and Part 192, published by The Department of Transportation Research and Special Programs Administration, Office of Pipeline Safety, current edition. See 15062 PIPING MATERIAL (UNDERGROUND OR BELOW GRADE) / e. NATURAL GAS herein for more information.

   a) Require the Contractor to submit qualification sheets to the A/E, then the A/E shall submit two sets to the University Project
Manager, who will submit one set to the Supervisor of the Plumbing Shop for review and approval.

2) Questar Gas Company owns and maintains some natural gas fuel piping found on campus. Each piping system supported by Questar Gas has a meter set. Most of the natural gas lines on the campus, however, are the University's own distribution system. The Contractors will be required to provide coordination with Questar Gas and pay all required fees associated with Questar Gas line extensions, where applicable.

a) The contractors will be required to verify system pressure requirements prior to construction. The pressure varies according to location and system, and may range from 1 PSIG to approximately 50 PSIG pressure. Much of the distribution system carries intermediate high pressure natural gas at approximately 38 PSIG.

b) All natural gas piping on the campus should be in accordance with the latest edition of Questar Gas Company's "Good Practices for Gas Piping and Appliance Installations," regardless of the system to which it is being connected.

c) A gas meter shall be installed for each building on the campus.

d) When new plastic piping is routed under any road, the pipe must have a PVC or sewer pipe sleeve two pipe sizes larger than the gas line it will protect.

e) For underground natural gas piping exterior to the building, direct the Contractor to install an 18 gage continuous copper wire over the pipe. See 3.2 CIVIL / L. SITE UTILITIES FOR CAMPUS PROJECTS / (3) for specific design instructions including warning tape, approved methods for trace wire terminations, testing requirements, buried plastic or natural gas piping, sand cover, etc.

15352 Compressed Air Equipment

a. Laboratory Air Compressors

1) Laboratory air compressors shall be capable of scrubbing inlet air with water and delivering a minimum of Grade "D" air. Units are to be factory tested prior to shipment. Certified test data, performance curves, and spare parts lists are to be included in the operation and maintenance manuals. Include the following:
a) Single stage, oil-free, positive displacement, non-pulsating liquid ring operation.

b) Capacity adjusted for elevation.

c) Matched motor and power loadings such that motor overload will not occur at any operating pressure.

d) An electrical control panel in a NEMA 12 enclosure with starter(s); automatic lead-compressor alternator (if multiple compressors are specified) which will start the next compressor in sequence if the lead compressor fails to carry the load; sequencing control to prevent more than one compressor from starting at any one time; a hand-off-automatic selector switch; a 115 volt control transformer; and, a fused disconnect switch. Also include safety shut down on high receiver water level; and, compressor shut down/lag compressor start on high separator water level.

e) An external display including indicator lights to show each compressor “ON” and warning lights with horn and reset buttons to show thermal overload, high receiver water level, and high separator water level.

f) For each compressor, include inlet check valve; a discharge separator with integral ball float valve; relief valve; gauge glass; level switch; discharge check valve; discharge filter with automatic drain trap; pressure switch; flow control valve; 115 volt solenoid valve; strainer and backflow preventer; and, an inlet manifold serving all compressors with a common filter.

g) An ASME and National Board Stamped 125 PSIG working pressure galvanized steel pressure control tank or receiver with pressure gauge, safety valve, gauge glass, high-level float switch, and automatic drain trap.

h) Accessories including shock arrestor, flexible inlet connections, flexible discharge connection(s), flexible seal water line connection(s), inlet air filter, flow switch, and constant pressure valve.

i) Each lab shall be supplied with a separate readily accessible dryer and oil separator.

j) Each lab shall be supplied with a separate readily accessible dryer and oil separator.
b. Control Air Compressors

1) Control air compressors provide compressed air for control systems at 90 psi and shall include the following:

   a) An automatic bleed to drain water from the storage tank. The valve shall have a dedicated receptacle and the piping run to drain.

   b) An oil and water separator between the compressor and the building.

   c) An air drier designed for a leaving air pressure dew point of 40°F. Dryer shall have a by-pass for maintenance.

   d) System shall have a pressure transducer providing an input to the controls system in a 0-10v or 4-20mA signal.

   e) An alarm through the BAS and shown on the graphics indicating low pressure.

   f) Tank must be ASME stamped.

c. Acceptable manufacturers for both general laboratory and control air compressors are Quincy Compressor, FS-Curtis Air Compressors, and Ingersoll-Rand Company. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

15353 Vacuum Systems Equipment

a. Vacuum pumps are to be packaged central vacuum systems capable of passing fluids and soft solids through the vacuum pump directly to waste. Units are to be factory tested prior to shipment. Certified test data, performance curves, and spare parts lists are to be included in the operation and maintenance manuals. Include the following:

1) Single stage, oil-free, positive displacement, non-pulsating liquid ring operation.

2) An electrical control panel in a NEMA 1 enclosure with starter(s); automatic lead-pump alternator (if multiple pumps are specified); sequencing control to prevent more than one pump from starting at any one time; a hand-off-automatic selector switch; a 115 volt control transformer; and, a fused disconnect switch.

3) An external display including indicator lights to show each compressor “ON” and warning lights with horn and reset buttons to
show thermal overload, high receiver water level, and high separator water level.

4) For each pump, include inlet check valve; a discharge separator-silencer; vacuum switch; strainer; flow control valve; 115 volt solenoid valve; and an anti-siphon fitting (this fitting may be common to multiple pumps).

5) An ASME and National Board Stamped painted steel vacuum control tank with vacuum gauge, relief valve, and gauge glass.

6) Accessories including shock arrestor, flexible inlet connections, flexible discharge connections(s), flexible seal water line connection(s), and flow switch.

7) Acceptable manufacturers are Quincy Compressor, FS-Curtis Air Compressors, and Ingersoll-Rand Company. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

15400 Plumbing Systems

a. General: Piping and valves are specified elsewhere in this document.

1) All exposed branch water supply piping in toilet rooms and custodial rooms shall be chromium plated.

2) Water hammer arresters shall be provided on both hot and cold water lines serving fixtures and equipment using flushometer valves or quick-closing valves. One water hammer arrestor may serve more than one fixture. These devices must be installed in the upright position. Where utility access has not been provided, access panels shall be provided for access to maintain these devices.

3) Maximum water velocity in pipes shall be 7 fps.

4) Backflow preventers and vacuum breakers shall be installed as required by the Utah Plumbing Code and as required by the University.

   a) Install two (2) full size reduced pressure backflow preventers piped in parallel at the building water entry of lab and research buildings. Install one (1) full size and one (1) half size reduced pressure backflow preventer in parallel at the building water entry of office and classroom buildings.

   b) Parallel reduced pressure backflow preventers are also required on all make-up water lines. One reduced pressure
backflow preventer shall be full line size and the other one shall be one pipe size smaller.

c) All devices shall be tested. Test Reports shall be submitted to the University Project Manager before Substantial Completion.

d) Approved devices are as follows:

<table>
<thead>
<tr>
<th>DEVICE TYPE</th>
<th>APPROVED MODELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>REDUCED PRESSURE TYPE</td>
<td>Febco Model 825Y, Watts Series No. 909*</td>
</tr>
<tr>
<td>((PRESSURE TYPE))**</td>
<td>((Febco Model 765, Watts Series No. 800))**</td>
</tr>
<tr>
<td>ATMOSPHERIC TYPE</td>
<td>Febco Model 710/715, Watts Series No. 288A***</td>
</tr>
<tr>
<td>DOUBLE CHECK TYPE</td>
<td>Febco Model 805Y, Watts Series No. 700***</td>
</tr>
</tbody>
</table>

* Required by the University.
** Generally not approved for use at the University unless special conditions warrant.
*** For Atmospheric and Double Check Type devices, all other manufacturers and models must be reviewed and approved by University Facilities Management prior to bid

5) Transformer vaults and electrical rooms shall have no water, waste, storm drain nor any other pipe conveying water (except fire sprinkler systems required for the vault).

6) Vending machine areas shall have a minimum of one floor drain or floor sink for every 10 feet of wall length. Each vending machine area shall also have a 1/2 inch (minimum) cold water line with a hose bib and atmospheric vacuum breaker at 4'-0" above the finished floor.

7) Cross connections (any connection or arrangement of piping between two otherwise separate piping systems, one of which contains potable water and the other non-potable water or industrial fluids of questionable safety) may cause non-potable fluid to enter the potable water system by either backflow, backpressure, or backsiphonage, and shall not be allowed without protection as required by code. Reduced pressure backflow prevention devices shall be installed so as to be accessible for testing. Adequate drainage shall be provided near each device. These devices shall be located on a wall at approximately 4'6" above the floor. All devices installed shall be "Approved". "Approved" is defined as those devices appearing on a current list issued by the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California, the Utah Department of Health, and Facilities Management through the University Project Manager.
b. Disinfection of Piping Systems shall be in accordance with Utah State Department of Health requirements and AWWA C651 Standard for Disinfecting Water Mains (*Table of Required Flow and Openings to Flush Pipelines*).

1) Require the Contractor to flush the piping system with clean, potable water until dirty water is no longer observed at all outlets.

2) Require the Contractor to sterilize domestic water system with a solution containing at least 50 PPM of chlorine. The solution shall remain in the system for 24 hours (or 200 ppm for 3 hours). All valves, faucets, etc. shall be opened and closed during this time.

3) Require the Contractor to contact the Salt Lake City Sewer Department prior to discharge. Salt Lake City must be notified that highly chlorinated water is coming to them.

4) Require the Contractor to flush the system with clean water until the residual chlorine content equals the ppm level of the domestic water supply on campus.

5) The water system will not be accepted until a negative bacteriological tests are obtained from water taken from the system (two tests are required, 24 hours apart).

6) For piping smaller than 4" (smaller pipe sizes are not shown in the AWWA Table) the University will require the blow-off line to be one pipe size smaller than the line size down to 2" main or branch size pipe. For 2" main or branch size pipe or smaller, the blow-off line is to be line size.

15401 Cold Water Systems

a. Install a water pressure regulator where shown on the drawings. Water pressure shall not be reduced below 45 PSIG (or 15 PSIG at the farthest connection in the building).

1) The pressure regulator shall be a diaphragm type of bronze construction. Regulator pressure shall be adjustable. An inlet strainer shall be provided.

2) Approved manufacturers are Watts Model U5B for 2" and smaller, and CLA-VAL Model 790 for units larger than 2".

b. Install a positive displacement, direct reading water meter at each building. The meter shall be located inside the building in an accessible location and approximately 4' from the floor.
c. A valve and valve box shall be provided on the water service line to the building close to the main line.

d. No water line shall be less than 1/2”, except where shown on drawings.

e. Provide an isolation valve on branch piping to each toilet room which shall be located within each restroom in a 2 ft. x 2 ft. access door two (2) feet above finished floor in the plumbing chase wall, each lab, etc., and at each floor of the building. Valves shall be provided so that distinct areas may be isolated without affecting the remainder of the building.

15405 Soil and Waste Piping Systems

a. Building Waste Systems:

1) All horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than 1/4 inch per foot (2%) toward the point of disposal. Drainage piping 4” and larger may slope at 1/8” per foot with approval by administrative authority (the University Project Manager and the Supervisor of the University Plumbing Shop).

2) All waste piping exposed below sinks or fixtures shall be chromium plated.

3) Vents shall extend full size through roof and shall project 18” (minimum) above the roof. "Flag-poling" of vents is not approved.

4) All fixture traps shall be provided with vents.

5) No water having a temperature greater than 140° F shall be discharged into the sanitary sewer.

6) Special venting for island sinks is discouraged. If an island sink is required, it should discharge into an approved floor sink below the counter, except for acid waste which shall not be allowed to be drained in this manner. This floor sink shall be accessible and shall have at least a half grate.

7) No sanitary sewer or sanitary waste systems shall be pumped except as a last resort and then only with permission of the University Project Manager. A duplex pump system shall be used if a pumped system is approved.

8) Trap primers shall not be used. Where a trap is subject to loss by evaporation, a deep-seal trap consisting of a 4-inch seal shall be installed. However, a cold water hose bib installed in the restrooms shall be acceptable as per the IPC.
9) Cleanouts shall be installed at the base of all vertical stacks, at each change of direction if the total aggregate change exceeds one hundred and thirty five (135) degrees, and on straight piping runs not to exceed 50 feet apart.

10) No floor drains or floor sinks are allowed in built-up fan systems.

11) Floor drains, floor sinks, etc., shall be provided with 30" square safety pans.

b. Acid Resistant (AR) Waste Systems:

1) Acid resistant waste systems shall be provided in all lab areas or other areas such as lecture rooms, etc. using chemicals.

2) AR waste systems shall be installed in accordance with current adopted codes and approved acid resistant material shall be used.

3) Neutralization tanks shall be used on systems less than eight (8) fixture units or 30 gallons per day.

4) Dilution tanks shall be used on system greater than eight (8) fixture units or 30 gallons per day.

5) Where movable laboratory ventilation systems are used they shall discharge into an approved AR floor sink through an approved air gap, except acid waste which shall not drain into the floor sink.

6) AR systems shall be directly connected to drain. Indirect drain systems shall not be acceptable.

c. Manholes requiring an inside drop connection and flow diversion device shall be specified with a Royal IntraFlow device manufactured by Royal Environmental Systems. Specify a slim design no greater than 7 inches, 90° sweep at the invert, EPDM gasketed joints, removable inspection hood, polyethylene construction, and H2S gas containment cover (where applicable).

15422 Roof Drainage

a. Roof drains shall not be less than 3 inches.

b. Horizontal roof drainage pipe shall be installed at a uniform slope of not less than 1/4 inch per foot (2%) toward the point of disposal.

15435 Water Conditioning Systems

a. All water conditioning systems shall have totalizing water meters on the inlet line and on the conditioned water supply line.
b. Verify water pressure at the conditioning system. Feed pressure at the inlet shall exceed the manufacturer’s recommended minimum pressure by 20%.

c. The design of all water conditioning systems shall include a hose bib in close proximity to installed equipment for mixing and tank filling activities. Include a floor drain when chemicals will be used in the equipment.

d. Water softeners shall have duplex resin tanks, a single brine tank which shall not exceed 48” in height, and an automatic regeneration system activated by the amount of flow, not by time clock. Provide sufficient floor space adjacent to the water softener for storage of bags of salt.

1) Water softening or conditioning equipment shall be based on GE Osmonics, or equal by Pacific Water Incorporated, Water Specialties, or McCook Sales. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

e. Automatic blowdown and chemical feed systems are to maintain a desired level of dissolved solids concentration in the water of the shell side of HTW steam generators with the use of a Lakewood conductivity controller.

1) Provide a Lakewood Model 250 Conductivity Controller with a Worchester Motorized Ball Valve and Orifice Union.

2) The chemical feed system shall include a Neptune Model 500 or 500A chemical feed pump and tank assembly complete with foot valve, check valve, pressure relief valve, and strainer. The system shall be mounted under a non-metallic 55 gallon chemical mixing tank, complete with agitator, low level switch, hinged tank cover, and suction assembly. The chemical feed tank shall have soft water for mixing.

3) Both the solenoid valve (located on the air line controlling the regulator valve) and the chemical feed pump shall be wired into the steam generator's level controller. When the steam generator calls for water, the chemical feed pump and blowdown system will begin operation (only upon activation of the make-up feed system). This system shall stop operation when the make-up valve serving the steam generator is closed.

4) The system is to include a liquid sample cooler. The device shall cool blowdown samples from 220° F to 100° F.

5) The approved water treatment supplier is W.E.S.T., Water and Energy Systems Technology. Other suppliers must be prior approved with University field tests before bidding.
f. Chiller condenser water chemical treatment shall utilize a controller designed to continuously protect the condenser water system from the harmful effects of scaling, corrosion, and microbiological growth. The controller shall operate via microprocessor technology and shall be Pulsafeeder PULSAtrol MCT210-B-C-F-L1-M3-WE. The products of other manufacturers will be considered only after successful site testing at the University. Any other prior approved product furnished and installed into the project must be equal or superior to the specified Pulsafeeder product. The controller shall include:

1) High resolution 10 bit A/D converter with adjustable analog sample sensitivity for accurate sensor inputs
2) Control of conductivity (user selectable scales 0-500, 0-2000, 0-5000, 0-10000, and 0-20000 micromhos
3) Fully isolated differential inputs for all circuits to prevent ground loops
4) Keyboard activated hand/off/auto control of all relays
5) Modular hardware and software for easy access and service
6) Pre-wired NEMA 4X enclosure
7) Hi-Lo alarm indicator
8) Mounted flow assembly
9) Selectable chemical feed timer: "percent", "limit", or "pulse"
10) 28 day dual biocide feed
11) Serial line with communications software
12) 4-20 mA isolated programmable proportional output for remote monitoring of system conductivity
13) 110/220/1/60 power requirement

15450 Plumbing Fixtures and Trim

a. All water closets, urinals, and lavatories in rest rooms shall be wall hung. Any intent to use countertop lavatories shall be prior approved with the University during design of the facility.

b. Provide floor type service sinks in custodial closets
c. Atmospheric vacuum breakers shall be provided on all sink outlets in lab areas; or, where shown on plans, a branch line backflow preventer may be installed in a water line supplying an area of a lab or labs. When a branch line backflow preventer is used, the water piping downstream of the device must be labeled as "non-potable water."

d. Provide floor drains within 5’0” of all mechanical equipment which has water connections or use.

e. Provide atmospheric vacuum breakers for all service sinks.

f. All sinks, lavatories and wash basins shall have stainless steel braided flex tube and chrome plated ¼ turn ball valves.

g. All lavatories in public toilet room shall be provided with open grid strainers and not pop-up or other type of closeable drains.

h. All floor sinks shall be provided with at least a half grate.

i. Fixtures in one building shall be of one manufacturer.

j. Approved manufacturers for fixtures and trim:

1) Emergency Eye Wash and Emergency Shower Fixtures

Haws, Bradley or Guardian Equipment. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

2) Fixtures

American-Standard (including Eljer), Kohler, Zurn, and Elkay. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

3) Floor & Roof Drains, Carriers, Etc.

Zurn, J. R. Smith, Josam, and Wade. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

4) Trim

Chicago Faucets, Elkay, and T & S Brass. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

5) Flush Valves
a) Each flush valve selected for the design shall be verified to match the fixture manufacturer’s model it will serve.

b) Manual flush valves shall be specified except for urinals and ADA toilets as described below.

(i) Manual valves shall be lever operated diaphragm flush valves manufactured by either Sloan or Zurn (if Zurn, specify valves from the Z6000 Series only), or approved equal as described below.

c) Urinals and ADA water closet fixtures are preferred to be specified with automatic flush valves. Specify battery operated valves equal to Zurn ZERK-CPM or TC HDM-TC-401186.

(i) Select automatic flush valves that can be refitted with a standard lever operator.

(ii) Each automatic flush valves shall include a manual flush button for use when the valve fails to function automatically.

d) Piston type operators shall not be allowed.

e) Valves by other manufacturers may be approved after site testing by the Plumbing Shop at the University.

6) Automatic Faucets

Automatic faucets are not allowed except for handicapped lavatories (wash basins), and only for no more than one lavatory in each restroom. The automatic faucets are to be specified with integral battery packs and not hard wired.

k. Provide at least one set of hose bibbs (hot and cold) under the lavatories in each public toilet room.

l. Provide a floor sink near the drains of automatic sprinkler systems.

15500 Fire Protection - General

a. Fire lines serving each building shall be separately connected to the water main.

b. Each fire line shall be hydraulically engineered.
c. No part of any building shall be more than 150 feet from a fire hydrant.

d. The automatic fire protection for computer rooms shall be the standard sprinkler system at a minimum.

e. Automatic fire sprinkler plans and subsequent submittals shall be submitted to the University Fire Marshal, who is also a Deputy Utah State Fire Marshal, for approval prior to installation.

f. At a minimum, fire extinguishers shall be located at each required exit stairwell on each floor, and shall be monitored by the fire alarm system.

g. Fire extinguisher special-hazard areas as mentioned in Section 906.1, item 6 IFC (2009) shall include the following: laboratories, primary electrical and mechanical rooms, computer server rooms, kitchens/kitchenettes, and chemical storage areas.

h. The University Fire Marshal shall inspect and witness all fire alarm and automatic sprinkler system tests.

i. The University Fire Marshal shall reserve the right to inspect the installation, material, and equipment at any time or phase of the project.

15501 Automatic Fire Extinguishing Systems

a. See Section 15061 Piping Material (Above Grade – “a.g.”) o. Fire Protection a.g. for approved piping usage.

b. The University does not permit automatic fire sprinkler systems to be fabricated in combination with systems for heating or cooling, such as water source heat pumps connected to fire sprinkler piping.

c. The fire department connection to the automatic fire sprinkler system shall be located on the "front" or main access side of a building at a maximum distance of 100 feet from a fire hydrant.

d. Each valve in the fire protection system shall be provided with an approved supervisory switch or "tamper" switch (including post indicator valves and antifreeze loop control valves) wired into the fire alarm system of the building.

e. Each valve switch is to report on a separate zone.

f. A flow switch shall be required at the main riser and at each isolated zone. New systems shall be separated into a different zone at each floor with a floor control assembly that shall include a flow switch, control valve and main drain tie-in. Each flow switch shall include an automatic flow switch tester.
and shall be monitored as required by NFPA 13. The flow switch testing assembly is to be UL listed or FM approved.

1) Approved system is the Zonecheck Automatic Flow Switch Tester by Global Vision, Inc. or equivalent. All other manufacturers / products must be reviewed and approved by the University Fire Marshal prior to bid.

2) The system is to be installed in accordance with the manufacturer’s instructions. An example of the installation requirements can be found at http://www.systemsensor.com/pdf/A05-0272.pdf.

g. Fire protection non-glycol sprinkler systems require drain valves at all low points and a system test/drain valve at the building riser.

h. The design is to include a floor sink at all drains discharging from non-glycol sprinkler systems, including the inspector’s test drains, low point drains and the system drain at the building riser. Connect the floor sinks to the nearest sanitary sewer or storm drain system, and provide an air gap at the floor sinks. The system drain requires a larger line designed for quick drainage, and it is advisable to locate the riser close to the building sewer main, if possible.

i. Where antifreeze is used in an automatic fire extinguishing system, that section of the system which has the antifreeze shall be protected from the rest of the system with a reduced pressure backflow preventer. Antifreeze loops shall be separated from the remainder of the system with an isolation valve.

j. Glycol fire sprinkler system drain/test valves are to be located where a container can be provided to catch the glycol solution for reuse. Provide a sanitary sewer floor sink in the area to collect spillage, etc. Do not run a glycol system test/drain line to a storm sewer.

k. Sprinkler heads in equipment rooms, storage rooms, etc. shall be furnished with guards.

l. The use of flex heads shall be approved by the University of Utah’s Fire Marshal on a case by case basis.

15532 Hose Cabinets

Refer to State adopted codes.

15535 Fire Extinguishers

a. A minimum 4A:40BC rated fire extinguisher shall be provided in all corridors. The maximum distance to any fire extinguisher shall be 75 feet.
b. "4:40 BC" rated fire extinguishers shall be provided in kitchens.

c. The top of the fire extinguisher, or cabinet if used, shall comply with code requirements.

15554 Computer Rooms and Other Applications

a. Computer rooms and all other applications requiring fire protection shall be provided with standard sprinkler systems.

b. All electrical systems serving the computer room shall cease to operate prior to the release of water.

c. Coordinate with the University Project Manager regarding fire extinguishing systems in other areas such as kitchen hoods, etc.

15650 Refrigeration - General

a. Window units shall be Comfort-Aire or Amana.

b. Split systems are to be Fujitsu or Mitsubishi.

c. Ducted split systems shall include suction and discharge service valves, crankcase heaters, liquid sight glass, filter driers, vibration isolation, lift traps, and solenoids.

d. Room side noise shall be limited to RC values found in ASHRAE Systems, Sound and Vibration Control.

e. Evaporator coils located near heating coils, pressure relief devices, and fusible plugs shall have relief piping, sized and routed per the requirements of ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration."

f. Mechanical Rooms which contain mechanical refrigeration shall be ventilated; and, shall have sensors and alarms installed per ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration."

15670 Chillers

a. New chillers shall operate with EPA approved refrigerants. Required refrigerant sensors, alarms, and controls shall be supplied and installed in the Mechanical Room in accordance with current UMC, ASHRAE, etc., standards. Additionally, install a visual alarm outside the Mechanical Room near the entry. Refrigerant alarms are to include an interface connection for the campus central control system. Relief/purge systems shall be piped outdoors.
b. Acceptable refrigerants are those with an ozone depletion potential (ODP) of 0.02 or less, and a global warming potential (GWP) of 700 or less (GWP based on CO₂ = 1).

c. All new piping shall be thoroughly flushed and cleaned before being placed into service. The cleaning of these piping systems shall be accomplished by the Contractor using the University’s approved water treatment supplier.

d. Reciprocating chillers shall include the following features:

1) Provide dual independent refrigerant circuits complete with lead-lag switch.

2) Unit shall be factory tested at full and part load conditions.

3) Unit shall be factory charged with a certified leak test.

4) The chiller shall be UL or ETL listed.

5) Provide thermal protection on all three phases of the compressor motor, where applicable.

6) Compressor accessories shall include suction and discharge service valves, oil crankcase heater, suction strainer, oil strainer, oil sight glass, and oil charging connection.

7) Compressors shall be mounted on vibration isolation pads to minimize noise and vibration transmission.

8) Evaporator shell shall be insulated with 3/4" closed cell insulation.

9) The evaporator shall be designed, constructed, tested and stamped in accordance with ASME requirements.

10) Condensers shall be cleanable thru-tube type.

11) Condenser accessories shall include liquid shut off valve, removable water heads, vent and drain plugs, purge valve, and spring loaded relief valve per ANSI/ASHRAE 15 Safety Code.

12) The condenser shall be designed, constructed, tested and stamped in accordance with ASME requirements.

13) Provide a minimum of 15° F. sub-cooling through a sub-cooling circuit in the condenser.

14) Control panel shall have dead front panel doors to protect service personnel against accidental contact with line voltage components.
15) Power and starting components shall include separate fusing for the control circuit, starting contactors per compressor, solid state overload protection in all three phases, and solid state compressor sequence start timers.

16) Safety and operating controls shall include an external unit control stop switch with indicating lights, recycling pump-down control, manual pump-down switch, compressor lead lag switch, oil safety switch, high and low pressure switches, water temperature controller, freeze protection thermostats, five minute solid state lock-out timer, and unloaders.

17) Unit controls and wiring shall be completely factory labeled for ease of service and replacement.

18) Factory installed refrigerant piping shall include insulation on the suction lines, filter/drier with replaceable core, liquid sight glass/moisture indicator, liquid line solenoid valve, manual liquid line shut-off valve with charging connection, and thermal expansion valve. Each compressor circuit is to be independent and should include a complete set of these items.

19) Factory installed gauges, each with its own manual isolation valve, shall be provided for displaying high and low side refrigerant pressures and oil pressures.

20) Approved manufacturers for reciprocating chillers are Carrier, Trane, or York. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

21) The piping design supporting the chiller and any air handler in the vicinity shall include a hose bib in close proximity to installed equipment for cleaning coils, etc.; and, shall include a floor drain to the sewer system (not the storm drain system) when chemicals will be used in equipment.

e. Centrifugal chillers shall have the following features:

1) KW meter for measuring the electrical input to the chiller.

2) Soft start or VFD control on chillers 480V and above.

3) Chiller controls shall communicate with the campus building automation system.
4) Provide service valves or other factory-installed accessories required to facilitate transfer of refrigerant from the chiller to a remote storage and recycling system.

5) Provide automatic purge system on sub-atmospheric refrigerants.

6) Condenser and evaporator tubes shall be smooth internal finish and enhanced exterior finish.

7) Supply an adequate lifting attachment point for head removal.

8) Epoxy coat the end bells on the condenser at the factory.

9) Provide 5 years parts and labor warranty on the unit, and 3 years on the compressor.

10) Approved manufacturers for centrifugal chillers are York, Trane, and Carrier. All manufacturers must be reviewed and approved by University Facilities Management prior to bid.

11) The piping design supporting the chiller and any air handler in the vicinity shall include a hose bib in close proximity to installed equipment for cleaning coils, etc.; and, shall include a floor drain to the sewer system (not the storm drain system) when chemicals will be used in equipment.

f. Rotary screw chillers will not be approved.

15680 Cooling Towers

a. Provide a concrete structure or fiberglass structure modular induced draft cooling tower as shown on the drawings. Only specify cooling towers with ceramic fill.

b. All tower fans shall be controlled on supply water temperature via VFD.

c. Towers used for “free cooling” during winter months shall have a provision for de-icing.

d. Tower blow-downs shall be fitted with a meter and information recorded on controls graphic.

e. Concrete cooling towers shall include:

1) Basin floor slab of continuous pour high density type II air entrained concrete. The mix shall meet a compressive strength test of 4,000 psi minimum (28 days).
2) Reinforcing steel shall be designed for use in the basin structure.

3) A continuous stripping of molded polyvinyl plastic water-stop (6" dumbbell) is to be located on the centerline position of all basin wall sections, basin floor slab intersections, and at all other cold pour joints, including vertical wall joints.

4) Standard curing measures shall be used to protect the concrete while "green".

5) Basin wall sections shall be constructed in a second continuous pour, with structural steel as designed by a structural engineer.

6) Wall sections shall interlock with the water-stop seal in the basin slab to form a completely waterproof basin.

7) All exposed concrete shall be rub-finished to provide a smooth and uniform surface free of form marks and defects. No honeycomb concrete will be allowed.

8) Provide tile fill and cast iron fill support lintels guaranteed for 25 years.

9) Provide a minimum of 3 pass cellular type PVC mist eliminators. Free water carryover shall not exceed 0.0005% of the design water flow.

10) Eliminator access doors shall be stainless steel.

11) Provide a vibration switch with a time delay for start-up.

12) Gear type speed reducers shall be provided with an oil level alarm switch, sight glass, fill/drain line, and vent line. These appurtenances shall terminate outside the tower stack for maintenance.

13) All wetted parts shall be non-corrosive. Fan blades shall be stainless steel or fiberglass reinforced resin. Drive shafts shall be carbon fiber with stainless steel. plate type flexible couplings. Pulleys, if used, shall be stainless steel.

14) Each drive shaft coupling shall be provided with a galvanized steel guard to protect the tower from shaft failure.

15) Motors shall be TEFC, and one size larger than selected for the rated duty of the tower.
16) Distribution system shall have no metal parts. Piping, fittings and nozzles shall be low pressure distributor type PVC or fiberglass reinforced resin. ABS nozzles may be used. Nozzles shall be bayonet coupling style with o-ring seal.

17) The fan deck shall be concrete constructed to the same specifications as the basin and walls.

18) Provide an aluminum fan screen for the tower stacks.

19) Provide adequate tower access via galvanized steel access doors and ladder rungs cast in concrete.

20) Cooling towers are to be designed with remote sumps to prevent freezing. Where impractical, provide a basin heater sized to maintain 40 degrees in the basin at an ambient temperature of -10 degrees F.

21) Cooling tower fans are to be controlled by water temperature and shall shut down when water is not present.

22) Approved manufacturers are Tower Engineering, Inc.; Marley Cooling Technologies; and, Composite Cooling Solutions, L.P. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

23) The piping design supporting the tower shall include a hose bib in close proximity to facilitate cleaning and tank mixing activities; and, shall include a floor drain to the sewer system (not the storm drain system).

f. Fiberglass structure cooling towers shall include:

1) Casing, fan deck, internal supports, and basin shall be fire retardant glass reinforced polyester resin.

2) All structure connecting surfaces and attachments shall be stainless steel (s.s.), including s.s. bolts.

3) All joints shall be sealed with a continuous type sealant.

4) All interior and exterior surfaces shall be coated with an all weather material to protect against UV deterioration on the outside, and to protect against wear on the inside.

5) The tower shall be built to withstand 160 degrees F. and 30 PSF wind loading. Flame spread shall be 25 or less.
6) Provide tile fill and fiberglass reinforced polyester fill support lintels guaranteed for 25 years.

7) Provide PVC mist eliminators with free water carryover not to exceed 0.02% of the design water flow.

8) Provide a vibration switch with a time delay for start-up.

9) All wetted parts shall be non-corrosive. Fan blades shall be stainless steel, fiberglass reinforced resin, or aluminum. Pulleys, if used, shall be stainless steel.

10) Motors shall be TEAO, chemical duty, with sealed non lubrication bearings, when the motor is in the air stream otherwise the motor shall be TEFC, and one size larger than selected for the rated duty of the tower.

11) Distribution system shall have no metal parts. Piping, fittings and nozzles shall be low pressure distributor type PVC or fiberglass reinforced resin. ABS nozzles may be used. Nozzles shall be bayonet coupling style with o-ring seal.

12) Provide an aluminum fan screen for the tower stack.

13) Provide adequate tower access via access doors.

14) Provide ABS air intake louvers to shield the interior from sunlight and eliminate tower basin splash.

15) Provide a stainless steel or fiberglass ladder mounted to the tower exterior.

16) Cooling towers are to be designed with remote sumps to prevent freezing. Where impractical, provide a basin heater sized to maintain 40 degrees in the basin at an ambient temperature of -10 degrees F.

17) Cooling tower fans are to be controlled by water temperature and shall shut down when water is not present.

18) Approved manufacturers are Tower Engineering, Inc.; Marley Cooling Technologies; and, Composite Cooling Solutions, L.P. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

19) The piping design supporting the tower shall include a hose bib in close proximity to facilitate cleaning and tank mixing activities; and, shall include a floor drain to the sewer system (not the storm drain system).
g. Metal cooling towers shall include:

1) Low noise, low vibration, high efficiency fan.

2) All stainless steel construction.

3) Hinged access doors.

4) Distribution system shall have no metal parts. Piping, fittings and nozzles shall be low pressure distributor type PVC or fiberglass reinforced resin. ABS nozzles may be used. Nozzles shall be bayonet coupling style with o-ring seal.

5) TEAO motor.

6) Approved manufacturers are EVAPCO, BAC and Marley Cooling Technologies. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

7) The piping design supporting the tower shall include a hose bib in close proximity to facilitate cleaning and tank mixing activities; and, shall include a floor drain to the sewer system (not the storm drain system).

15700 Heat Transfer

a. Pulse combustion, high-efficiency condensing, copper finned water tube, and scotch marine type boilers shall be designed in accordance with the American Gas Association; manufactured in accordance with the ASME Power Boiler Code, Section I; and shall meet the Utah State Boiler Code - CSDI.

1) Boilers shall be furnished with an adequate number of tappings and inspection openings to facilitate internal inspection and cleaning.

2) Include a factory installed insulated metal jacket, with 2" (minimum) fiberglass insulation, and a heavy gauge (18 GA minimum), rust-resistant, zinc coated steel casing, painted with heat resisting primer and finish coat. The jacket assembly shall be easily removable for maintenance.

3) Provide unions or flanges in all connecting piping for future maintenance. Factory furnished trim shall include gauges, controllers, air and gas safeties, Industrial Risk Insurers (IRI) gas train, UV sensor combustion safeties, and alarm contacts for the University's central controls computer.
4) Hydronic / steam boilers 90,000 to 1,000,000 BTUH input shall be pulse combustion or copper-finned water tube type. Approved manufacturers are Fulton, RBI, KN Lochinvar or approved equal
   a) Boiler and burner shall be the product of the same manufacturer.
   b) Provide ASME safety valves

5) Hydronic / steam boilers above 1,000,000 BTUH input shall be scotch marine fire-tube or water-tube types equipped with an ultra-low NOX modulating burner. Approved manufacturers are Cleaver Brooks, Burnham, Rite Boilers, and Hurst or approved equal.

b. Fully Condensing Hot Water Boilers

1) Minimum Required Certifications
   a) ASME certification (an ASME Stamp on the product), and a completed and signed data sheet.
   b) ASME CSD-1 certification in the form of a completed data sheet.
   c) CSA or UL certification in the form of a label affixed to the product.
   d) For any factory tests specified by the A/E, require verification that the tests have been satisfactorily performed and include confirming test data.
   e) For any field tests specified by the A/E, require verification that the tests have been satisfactorily performed and include confirming test data.

2) Condensing Boiler Fabrication Requirements
   a) Condensing boilers shall be specified to be “compact” with a non-aluminum heat exchanger.
   b) The boiler pressure vessel shall be completely insulated with a minimum of 2” of insulation and shall be encased in an 18 gauge metal cabinet with powder coated finish or equal. Specify that external convection and radiation heat losses to the boiler room from the boiler shall be less than 0.5% of the rated input. Boiler submittals shall verify this requirement.
3) Venting

a) The boiler shall be specified to be UL certified as an indirect or direct vent boiler.

b) Require stainless steel, double-wall vent piping installed in accordance with applicable national and local codes.

c) Specify that the Contractor shall perform or provide a boiler venting analysis. The analysis shall include combustion air shop drawings to ensure that boilers will operate properly and to manufacturer’s specifications with the size and routing of vent and combustion air ducting.

4) Emissions

a) The equipment shall be guaranteed to limit NOx emissions to the best available control technology (BACT). The BACT requirement shall be based on the current State of Utah requirements.

b) Specify that written documentation of the emission levels from the manufacturer will be required as part of the University’s permitting process. Verification via stack testing will only be required for large, central heating plant boilers.

c) NOx emission levels shall not be exceeded at full operating conditions and at designed turndown of the burner.

5) Computerized Control System

a) The boiler shall include a computerized control system which shall be integrated into the campus building automation system (BAS) through BacNet communication.

b) Coordinate with Facility Operations through the University Project Manager for specific system requirements in addition to Section 15900 in EE. THE GUIDE SPECIFICATION FOR MECHANICAL SYSTEMS.

6) Condensing Boiler Warranties and Guarantees

a) The package boiler shall be warranted for a period of one year from date of substantial completion.
b) The pressure vessel shall be guaranteed against thermal shock for 20 years when utilized in a closed loop hydronic heating system with a temperature differential of 120 °F or less. The boiler pressure vessel shall be guaranteed accordingly without a minimum flow rate or return water temperature requirement. The boiler shall not require the use of flow switches or other devices to ensure minimum flow.

c) The pressure vessel,(heat exchanger) shall be guaranteed against flue gas corrosion and materials/workmanship for a period of 10 years.

d) The condensate collection box shall be guaranteed for 20 years.

e) The burner cylinder shall be warranted for a period of 5 years.

f) All parts not covered by the above warranties shall carry a 1 year warranty from date of substantial completion. This shall include all electrical components and burner components.

7) Hydrostatically test the boiler and piping in accordance with the ASME Boiler and Pressure Vessel Code. Provide the services of an inspector certified by the National Board of Boiler and Pressure Vessel Inspectors during the boiler site tests.

8) Boiler start-up shall be performed by a factory authorized service representative. Require copies of certification and test results prior to start-up / commissioning, and require that these be included in project O&M manuals per the Supplemental General Conditions.

9) The factory authorized service representative shall instruct the University in the operation of the boiler. The operation demonstration shall include a review of the operating and maintenance manual, a description of the preventative maintenance schedule and procedures, an outline of the process required to obtain repair parts, and the method of contacting factory trained technicians for technical assistance. The representative shall demonstrate all phases of operation including start-up and shut-down for the University's maintenance technicians.

10) The contractor shall schedule an inspection by the Utah State boiler inspection at the completion of installation and shall correct all deficiencies identified by the inspector.
15701  Hot Water Heating Systems

a. Provide a reverse return piping system to equalize pressure at each terminal.

b. Air separators and expansion tanks shall be provided on all hot water heating systems. The air separator shall be located on the suction side of the pump.

c. Manual air vents shall be located at all high points in the piping system. Auto air vents are allowed only in mechanical spaces. Drain valves shall be provided at low points.

d. The piping system shall allow for expansion through the use of expansion loops, swing joints, offsets, etc. as may be required.

e. If hot water is used for preheat coils, provide an additional converter and use an inhibited propylene glycol system. Plate and frame type heat exchangers are preferred.

f. An outdoor thermostat shall reset the system hot water temperature with respect to the outside air temperature.

15702  Chilled Water Piping Systems

a. Chilled Water:

1) Air separators and expansion tanks shall be provided on all hot water heating systems. The air separator shall be located on the suction side of the pump.

2) Manual air vents shall be located at all high points in the piping system. Auto air vents are allowed only in mechanical spaces. Drain valves shall be provided at low points.

3) All chilled water systems shall include an automatic water treatment system.

4) Isolation valves shall be provided at each riser and each building level.

5) Pressure and temperature test ports (PTs) shall be provided across each device in the pipe system.

b. Condenser Water (Cooling Tower) Systems:

1) Provide remote sumps or basin heaters for cooling tower freeze protection.
2) Adequate vertical elevation shall be maintained between the cooling tower sump and inlet of the pump to maintain the proper NPSH of the pump.

3) A suction strainer equipped with inlet and outlet pressure gauges shall be provided between the cooling tower and the pump. A sidestream solids separator with nozzles in the sump shall be provided.

4) Make-up water shall be provided through an automatic electric ball valve serving a fill line connected inside the building and actuated by sump probe control. Make-up water shall not be routed outside.

5) Free cooling condenser water systems shall use a plate and frame heat exchanger between the condenser water and chilled water side.

c. Glycol Cooling Systems:

1) Any piping system with components exposed to freezing temperatures shall be protected. Glycol solutions shall be used in outdoor-mounted applications subject to freezing. Heat tape is prohibited.

2) Glycol shall be industrial type inhibited propylene glycol. Ethylene glycol is prohibited.

15703 Steam Heating Systems

a. Two pipe steam systems shall be provided. One-pipe steam systems are not acceptable.

b. Duplex condensate pumps shall be provided where necessary to return condensate to boiler or converter.

c. All steam radiation shall be individually valved and trapped.

15710 Hot Water Specialties - Pumps

a. Pumps shall be the centrifugal type with mechanical seals.

b. Install pressure gauges with gauge cocks as close to pump suction and discharge as possible.

c. Provide a suitable balancing valve on the pump discharge, with lock down memory stop and removable handle on all non-VFD controlled pumps. Balancing valves shall not be installed on VFD controlled pumps provide additional isolation valves.
d. Provide suction diffusers on floor mounted pumps. Include strainers except for condenser water systems where a separate basket strainer shall be installed.

e. Floor mounted pumps are to include back pull-out of all pump parts without disturbing system piping.

f. Hand/off/auto switches are required for all pumps (primary and secondary). These shall be specified in 3.5 Electrical.

g. Acceptable manufacturers are B&G, Taco, Paco, and Armstrong. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

h. Provide redundant pumps on the secondary systems for HTW heating converters. Redundant pumps allow for standby and alternating use. Maintain secondary water circulation through HTW converter at low use times to prevent damage and extend the life of the converter. Provide lead/lag controls for pumps.

i. All base mounted pumps shall be grouted unless the manufacturer recommends against it.

15730 Heat Exchangers and Converters

a. High temperature water heat exchangers are described in the high temperature water section. 3.8 HVAC.

b. Steam generated from the University's HTW system shall not be used to generate hot water.

c. Plate and frame heat exchangers are preferred over shell and tube type. However, note that only shell and tube heat exchangers shall be used with high temperature water. Specifications for plate and frame heat exchangers shall include:

1) 150 LB ASA rated flanged ports.

2) ASME code Section VIII stamp on the unit. Also include Form U-1 in the O & M manuals.

3) Computerized selection to be included in submittals and O & M manuals. Also, include the plate material, plate type, and pricing for additional plates and gaskets.

4) Approved manufacturers are Tranter Bell and Gossett, Armstrong and Alfa-Laval. All other manufacturers must be reviewed and approved
15740 Terminal Units - Variable Air Volume

a. The variable air volume terminal box shall be a factory manufactured assembly with external control linkage.

b. Coordinate with the control specifications to provide controls which match the operation specified and approved manufacturer; and, coordinate with the University Project Manager to determine if the Systems Operations Shop desires to install and prove the controls. Otherwise, installation and proving will be done by Contractor.

c. Variable air volume terminal units shall be pressure independent and shall adjust to any air flow between zero and the maximum catalogued CFM.

d. Dampers on terminal units shall not exceed 2 percent leakage as rated by ADC standards.

e. Terminal units shall be internally lined with a minimum of 1 inch 1-1/2 pound insulation.

f. Design layout of VAV terminal boxes shall include noise attenuating ell's and lined duct as required to meet ASHRAE RC criteria in the occupied space.

g. Units shall be Anemostat, Krueger or Titus. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

h. Fan powered terminal boxes are not allowed at the University.

i. VAV terminal boxes may not be used on existing constant volume systems unless the VAV terminal boxes are controlled in the constant volume mode.

j. VAV terminals shall be provided with a removable velocity cross for flow measurement and a discharge temperature sensor.

15750 Heating and Cooling Coils

a. Heating and cooling coils must be designed to prevent freezing. Inhibited propylene glycol may be required. If cooling coils are to be drained to prevent freezing, they should drain completely. Where heating coils are combined with cooling coils, the heating coil shall be first in the air stream to prevent freezing.

b. Provide gauge cocks on inlet and outlet of all coils.
c. A drip pan shall be provided under each section of every field assembled cooling coil. Pans shall extend at least 12” beyond the leaving face of coil. The drain pan shall meet all IPC requirements.

d. Coils are to be selected, submitted, and approved with an ARI certified computer program.

e. Coils are to be selected with a fin spacing equal to or less than 10 FPI.

f. Coils are to be factory tested at 350 PSI prior to shipment.

g. The space between and around coils must be at least 24” to allow cleaning. Provide access doors for cleaning and maintenance.

h. Coil filters shall be easily accessible. Where pre-filters protect higher efficiency filters downstream, either set of filters must be easily replaced without disturbing the other set.

15755 Terminal Units - Heating

a. All terminal heating units shall have automatic control valves and isolation valves, accessible for maintenance.

b. Exposed cabinets shall be 14 gauge with institutional grade construction.

c. Ceiling concealed units are to be provided with secondary drip pans under the valves and fittings, with drain piping to protect ceilings.

d. All direct drive units shall be selected to provide design capacities at low or medium speed.

15770 Packaged, Rooftop, and Custom Air Handling Units

a. Access doors for inspection and cleaning must be provided for all internal parts including dampers. Coils are to have access to both inlet and outlet air sides. Doors shall be hinged and open against pressure.

b. Dampers are to be low leak type. Leakage rate for new dampers should be designed to meet 3 cm/sf at 1” W.C. per AMCA Standard 511.

c. Provide fans with easy removable belt guards (including internal mounted drives).

d. Provide a 120 V duplex convenience outlet with ground fault protection, a 220v outlet, and a hose bib in the vicinity for coil cleaning.

e. Sump pumps are required to be low profile and completely submerged. Ball
floats will not be acceptable.

f. If indirect coils are installed they shall be run from both sides and must not be installed back to back. Coils shall be run from one side of the unit to the other.

g. Units shall have stainless steel drain pans that are positively sloped. Slope shall be 1/8’ per foot, and sloped front to back and side to side.

h. Air Washers to be stainless steel.

i. Copper piping should be used for air wash.

j. Provide unit with auto blown down system and auto rinse.

k. Provide unit with a water detection system, to send an alarm and shut off the water supply to the evaporative cooling module.

l. The minimum outside air must have an air flow monitoring system.

m. Reinforcing must be designed into the damper bank to ensure that dampers do not flex.

n. Freeze stats must protect entire coil surface.

o. Unit shall be designed to prevent snow and water carry over into the filter bank. At minimum, intermediate space should be provided between the snow and water intrusion and the filter bank with drains located within that space.

p. Specify that upon substantial completion a new set of filters shall be provided for each unit.

q. Minimum MERV rating for filters shall be MERV 13.

r. Coil tubing wall thickness shall be .035”

s. Units shall be provided with a differential pressure transfer meter across each filter, fan, and coil. The meter shall be connected and monitored by the campus BAS system.

t. Soft water shall not be designed to run to the air wash medium.

u. Cooling coils shall be design with a minimum delta T of 16 degrees.

v. All units shall be provided with a pre-heat coil. The heating water circulating through the pre-heat coil shall contain a minimum 30% propylene glycol.
w. Minimum outside air must be covered by a pre-heat coil, if the pre heat coil does not cover the entire unit then it must be supplied with its own fan.

x. Fans are to be welded construction only.

y. Motors over 5hp must have a rigging point included as part of the design.

aa. No scaffolding or structure may be designed on top of fans. Scaffolding or structure that interferes with the proper operation of equipment including seismic and vibration devices, is prohibited.

bb. Units shall be supplied with access to all sections and levels. Larger units may require cat walks to reach coils. Cat walks and platforms shall provide access to all equipment sections and points that require maintenance. Access shall not be by ladder.

c. Units shall be a minimum 4” of double wall insulated construction. Insulation shall not be visible within the unit.

d. LED lighting shall be provided in each section of the units, and provide a 5 foot candle minimum light level.

e. All floors of the units shall be welded construction to prevent leakage.

ff. Floors and Walls shall be constructed from 18 gauge metal. The unit shall be constructed of the following materials:

1) Floors shall be 18 gauge, 316 stainless steel diamond plate or greater if required by application.

2) Walls shall be 20 gauge galvanized steel or greater if required by application

g. Equipment that is not directly related to the unit shall not be mounted anywhere on the unit.

hh. Provide 3 years parts and labor warranty on the unit.

15775 Computer Room Units

Liebert shall be the basis for design of computer room units. Other manufacturers will be considered only after an on-site inspection and “hands-on” demonstration on the alternate equipment for the A/E, University HVAC Shop, and Facilities Management engineers (Facility Operations and Construction Project Delivery).
15800  Air Distribution - General

Air intakes are to be located away from exhausts, vehicle emissions, cooling towers, flues, etc.

15821  Built Up Fan Systems

a. Centrifugal fans are to include belt guards and protective screens around drives and fan wheels. Include vibration isolation bases for the fans and drives. Approved manufacturers are New York Blower, Alladin, Barry Blower, or Pace. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

b. The use of vane-axial fans must be prior approved by Facilities Management through the University Project Manager. Prior approval for such designs will be based on noise, maintenance, application, and alternative design considerations. Manufacturers to be considered are Strobic-Air and Joy fans.

c. Provide ample clearance around the fan for servicing of bearings, replacement of wheel, motor, drives, and cleaning.

d. Motors for belt driven fans shall operate at speeds not to exceed 1800 rpm. Motors on high velocity fan systems and variable air volume systems shall be provided with variable frequency drive (VFD) motor speed controls including power factor correction capability, as specified in 3.5 Electrical.

e. Built-up fan enclosures shall be a sandwich shell design equal to IAC (Industrial Acoustics Company), designed and constructed to withstand 8" wg static pressure or one and one-half times the pressure of the fan, whichever is greater. Access doors should be limited in size to approximately 20" wide by 54" high and shall open against air pressure.

f. There shall be a set of filters upstream of any coil, fan or evaporative media.

15829  Exhaust Fans

a. Roof mounted exhaust fans which are visible from other locations must be painted char brown. Visibility of these devices must be limited.

b. Exhaust fans are to be located at or near the termination of the discharge of the exhaust system. Such systems shall be installed with additional capacity to allow for future additions to the exhaust system. Exhaust fans should be installed in a location that eliminates the need to install exhaust duct under positive pressure (i.e. past the fan discharge) in an interior space. This arrangement will decrease the likelihood of discharging hazardous materials into the building interior.
c. Fume hood exhaust systems are described in 3.8 HVAC.

d. Prepare a comprehensive equipment schedule for use on project drawings, and label each fan in the schedule to match a corresponding label location on the drawings.

e. All exhaust fans with motors larger than 5hp, and any exhaust fan having the motor installed higher than 6 feet over the working surface, shall be designed with a platform or rigging in order to remove and transport the motors and that will allow safe access to all service points on the fan and motor without the use of a ladder.

f. Exhaust Fan Selection

1) Select fans from manufacturers that provide fan ratings based on tests made in accordance with AMCA Standard 210 and are licensed to bear the AMCA Certified Ratings Seal for Air Performance.

2) All fans designed for the project shall be UL or ETL Listed.

3) Fans selected for the project shall have a sharply rising pressure characteristic extending throughout the operating range to assure quiet and stable operation from wide open to closed off.

4) Select fans from manufacturers that provide fan equipment tested for sound power level ratings in accordance with AMCA Standards 300 and 301. Select fans which have been tested in an accredited AMCA laboratory, and with sound power ratings provided in decibels.

g. Exhaust Fan Specifications

1) Fans shall be specified as single-width single-inlet and capable of operating over the entire Class II range as defined in AMCA Standard 99-20408.

   a) Designs not in accordance with AMCA Standard 99-2401 are not acceptable.

   b) Fans representing other styles may only be used in the design after approval is received via the Design Standards Project Variance Request Form submitted through the University Project Manager.

2) Select fans with fan housings that are heavy gauge, continuously welded, and reinforced with rigid bracing to increase structural integrity and prevent vibration. Housings with lock seams or partially welded construction are not acceptable. Aluminum housings are not acceptable.
3) Housing inlet cones shall be aerodynamically designed and spun providing a minimum separation of air flow. All part connections shall be welded in lieu of riveting. No aluminum parts are to be allowed.

4) Fan wheels shall utilize non-overloading flat, single thickness blades in all sizes. Wheel diameters and outlet areas shall be in accordance with the standard dimensions adopted by AMCA for centrifugal fans.
   a) Require fan wheels to be dynamically balanced on precision balancers at the factory. Prior to shipment, completed fans shall receive a final test balance at the specified operating speed.
   b) Fan guards shall be specified as quick release type.

4) Bearings are to be specified as precision anti-friction ball self-aligning type, 4 lug or pillow block. All bearings are to be specified as grease lubricated and provided with Zerk fittings. Select fans from manufacturers that locate the Zerk fittings in places to allow sufficient maintenance clearance.

5) Shafts are to be specified as ASTM A-108 steel, grade 1040/1045, precision turned, ground and polished. Grade 1018 steel is not acceptable. The shaft’s first critical speed shall be at least 120% of the fan's maximum operating speed. The drive end of the fan shaft shall be counter-sunk for tachometer readings.

6) Corrosion resistant fasteners. Bearings and drives mounted on a minimum 10 gauge welded steel power assembly. The motor shall be mounted on a minimum 14 gauge steel motor base welded to a minimum 14 gauge welded steel fan housing. Minimum 10 gauge adjustable motor plate. Minimum 16 gauge motor weather cover.

**15840 Ductwork**

a. HVAC Duct shall be fabricated from galvanized steel in accordance with SMACNA requirements. Abrasive, corrosive, or hazardous materials shall be conveyed by systems described in Industrial Ventilation, latest edition, in harmony with 3.8 HVAC. Nonmetallic duct shall not be used.

b. All seams of ducts shall be sealed with mastic or mastic plus tape or gasketing as appropriate to limit the air leakage to SMACNA requirements.

c. Flexible ductwork shall only be used at terminal units and shall not exceed eight feet. Hard turns, offsets, or kinks will not be allowed. Provide duct supports every three feet.
d. High pressure ductwork shall be galvanized steel spiral lockseam construction.

e. The high pressure duct and fittings shall be manufactured by the same firm.

f. High pressure ductwork shall be tested and total allowable leakage of the system shall not exceed SMACNA requirements.

15848 Duct Lining

a. All supply air, return air, mixed air, and outside air ductwork shall be internally lined with 1" thick acoustical duct liner, as specified above.

b. Dimensions shown on plans of ductwork with duct liner shall be "inside clear dimensions" and shall be so noted on the drawings.

15860 Duct Accessories

a. Filters shall be specified to have a minimum efficiency of MERV 9 for pre-filters and MERV 11 for final filters by ASHRAE standard 52.5 Minimum Efficiency Reporting Value. Filter face velocity shall not exceed 350 FPM.

b. Coil filters shall be easily accessible. Where pre-filters protect higher efficiency filters downstream, either set of filters must be easily replaced without disturbing the other set.

c. A diaphragm actuated direct reading dial type differential pressure gauge shall be installed with static pressure tips across each filter section. The differential pressure gauge shall be similar to Dwyer 605 Series with appropriate operating range.

d. All roof hoods, roof exhausters, louvers and fresh air intakes shall include insect screens or bird screens. Louvers shall be anodized extruded aluminum.

e. Sound traps shall be installed wherever NC levels in the occupied space cannot be reduced to ASHRAE limits by other means.

f. Manual balancing dampers shall be opposed blade type, galvanized steel, and shall have locking quadrant operators or extended concealed ceiling operators where access is limited.

g. Fire dampers and/or fire/smoke dampers shall be installed in locations required by code and/or as directed by the Code Official. Combination fire/smoke dampers shall be auto-reset via the fire alarm panel. No pipes or conduits shall pass through any fire damper. Access doors shall be provided for all such dampers.
h. Flexible duct connections shall be installed where ducts connect to fans or other units which may cause vibration.

i. All non-motorized outside air dampers shall have spring return features.

15870 Air Outlets and Inlets

a. Provide aluminum registers, grilles, and diffusers where humid conditions may occur.

b. Grilles, registers and diffusers shall be selected to perform without distracting noise. Throw, drop, and NC valves shall be analyzed during design layout.

c. Grilles and diffusers shall generally not include attached opposed-blade dampers. Air balance shall be accomplished by branch dampers in the duct.

15900 ATC - Automatic Temperature Control Systems, General

a. The University Master Plan for control systems is based on the following:

1) The Automatic Temperature Control (ATC) systems will be either "Metasys" by Johnson Controls, Inc; Trane US, Inc.; or, "Honeywell" controls furnished and installed by Wasatch Controls. The most recent revision level of either of these three manufacturers shall be used as a basis of design and operation. Five revision updates shall be provided by the Contractor at no additional charge.

2) The campus building automation system (BAS) will be either "Metasys" by Johnson Controls, Inc; Trane US, Inc.; or, "Honeywell" controls by Wasatch Controls. The most recent revision level of either of these three manufacturers shall be used as a basis of design and operation.

3) Modifications or additions to the campus central communications system which provides direct communication to both a) building-to-building, and b) building-to-System Operation's Central Control, shall be compatible with the fiber optic networks established for either the three "Metasys", Trane, or "Honeywell" systems. The extension or remodel shall include the electronic interface required to provide fully operational fiber optic communications to the central control point.

4) The integration of the control system shall be compatible with the University’s BACnet data communication protocol, unless existing conditions require differently.
b. The controls work shall include all programming and fine tuning of the ATC system, including interfacing with the central campus automation system, and in coordination with Facility Operations.

c. Control systems software shall not interfere with any other control software installed on any servers/computers.

15901 ATC - Remodeling and/or Additions to Existing Buildings

a. Large additions or major remodeling projects will require the use of ATC and BAS systems described under the general heading 15900.

b. Mechanical equipment (air handlers, pumps, chillers, etc.) may require a compatible extension of the BAS system in the building. In such cases, the vendor’s submittal shall provide information detailing compatibility with competitors’ systems.

c. ATC installation on small remodeling projects may be accomplished by Facility Operations at their option. The University will require each pre-qualified controls vendor to allow University installed systems using the vendor’s products, and honor warranty and service commitments described herein.

d. Coordinate with the University Project Manager for central control requirements when new controls are to be specified for buildings not managed by Facility Operations (such as University Student Apartments).

e. Decommissioning of any points or processes no longer used shall be included in the ATC ad BAS system described under general heading 15900.

15902 ATC - Controllers

a. Controllers for the ATC system shall be either "Metasys" by Johnson Controls, Inc; Trane US, Inc.; or, "Honeywell" by Wasatch Controls.

b. ATC system controllers shall communicate via trunks to the BAS system panel.

c. For any controller being installed, the controller may not exceed 80% of the CPU usage to prevent over programming.

15903 ATC - Wiring Methods

a. Exposed wiring in equipment rooms (both line and low voltage) shall be routed in conduit per the National Electric Code. Installation shall be square with the walls of the buildings.
b. In concealed locations such as return air ceiling plenums, follow applicable codes.

c. All control wiring and pneumatic tubing shall be labeled and the labeling shown on the control drawings.

15904 ATC - Control Power Sources

a. Provide an emergency power circuit for the control panels and individual room controls where emergency power generators are available. The electrical contractor shall be directed to have breaker circuits designated specifically for control power functions.

b. New transformers shall have a design load not to exceed 75% of maximum load to provide for future expansion.

c. Since all control circuits on campus require University pre-approved sine wave tracking filters, the vendor’s submittal should address the use of EFI, Inc. or equal by the ATC manufacturer.

d. All control cabinets shall be provided with UPS power.

15905 ATC - Control Valves

a. Control valves shall be by valve manufacturers approved in the valve descriptions in the DFCM Design Manual, University of Utah Supplement.

b. Valves for the control of terminal units (VAV reheat, fan coils, unit ventilators, etc.) shall be characterized ball valves.

15906 ATC - Dampers

Damper motors may be pneumatic or electric. Pneumatic motors will require an air supply system. Electric spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05” diameter. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall have a manual positioning mechanism accessible on its cover. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Run time shall be constant and independent of torque. If required, 2 SPDT auxiliary switches shall be provided with one switch having the capability of being adjustable. Actuators must be constructed to meet the requirement for double insulation so an electrical ground connection is not required to meet agency listings. Actuators shall be UL listed and CSA certified, have a 5 year warranty, and be manufactured under ISO International Quality Control Standards.
15907 ATC - Sensors

a. At terminal units, central fan controls, etc., flow measurements shall be made by thermal anemometry or differential pressure transmitters. High resolution and repeatability in low velocity regions are required. All devices shall be easily removed for cleaning. All supply air terminal units will have an outlet temperature sensor.

b. Humidity transmitters shall have an accuracy of +/- 3%.

c. Duct mounted sensors must be easily accessed by maintenance personnel. Wall mounted thermostats in common areas are to have no means for occupant adjustment. Office areas may have adjustment capability.

d. Pneumatic systems are normally open on heating, normally closed on cooling.

e. When installing wireless thermostats or any other control devices, the devices shall be permanently attached using anchors, screws, etc. The use of double stick tape or other adhesives will not be permitted.

15908 ATC - Control Panels

a. All controllers, relays, switches, etc., located in equipment rooms shall be mounted in enclosed control panels with hinged locking doors. Key locks for all panels shall be CAT-38 or CAT-102 (Corbin cabinet locks).

b. Indicating devices shall be mounted on the face of the control panel door.

c. All control devices, including digital indicators, located in areas subject to outside weather conditions shall be mounted inside weatherproof enclosures.

d. The location of each panel is to allow convenient access for maintenance. Panels shall be mounted in specified equipment rooms, not in offices or public access areas.

e. Name plates of engraved plastic or metal shall be permanently attached beneath each panel mounted control device describing the function of the device.

f. Power control switching must be located inside the panel (never mounted on the panel face).

g. Controllers within the cabinet are to be fully labeled.

15909 Building ATC Controller (ATCC)

a. The ATCC shall be housed in a NEMA 12 enclosure.
b. The ATCC panel shall include the following features:

1) The panel shall contain battery backup for CMOS RAM memory and the real time calendar clock. The battery shall have a minimum installed life of eight years. In the event of a power failure, the ATCC’s application database, stored data, and real time clock calendar shall be maintained for a minimum of six months.

c. The ATCC shall contain the complete building operating system and operate as a stand-alone system. Failure or disconnection of the central system computer shall not affect the ATCC.

d. The University’s operator is to be able to rapidly retrieve information by using the central PC or central computer.

e. The ATCC shall be capable of communicating over the fiber optic trunk to the central control station maintained by the University.

f. The ATCC shall be capable of receiving a new program or database from the central PC or central computer.

g. A manual control menu shall be provided to allow the University’s operator to start, stop, adjust values, set to local control, or release points to automatic mode at any time.

h. The network trunk shall be installed into each controller location to provide access to the network at any point.

15910 ATC Controller (ATCC) Software and Operation

a. The controller software shall be Microsoft Windows compatible to the current revision level.

b. Diagnostics

The system shall self-diagnose ATCC failure automatically without necessary query by the University’s operator. In the event of communications failure or power failure, the system shall notify a local operator of the specific occurrence.

15911 Graphical User Interface

a. The graphical user interface shall be fully functional and have the following features:

1) All graphics shall be part of the controls submittal package for each project and must be approved by Facility Operations before implementation.
2) All set points shall be shown on the graphics.

3) Components shown on the graphics that are adjustable shall link to that adjustment.

4) All data on the graphics shall be properly labeled. Labeling shall be such that a University technician can easily identify the information.

5) All alarms shall so indicate (change color, flash, etc.) on the appropriate graphic.

15995 Testing and Balancing of Systems

a. System balance shall be performed by a licensed balancing contractor representing an agency certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau. The Contractor shall have a minimum of five years’ experience in work similar to that required by this project. All work done by this agency shall be performed by qualified technicians under the direct supervision of the AABC Certified Test and Balance Engineer.

b. Testing and balancing shall be performed in complete accordance with current AABC, NEBB and ASHRAE standards.

c. All instruments used by the Contractor shall have been calibrated within the previous 12 months. The final balance report shall contain copies of calibration documents showing calibration tolerances, date of calibration and calibrating firm.

d. Air and water quantities shall be balanced to within 10% of the quantities shown. The balancer shall report discrepancies to the mechanical engineer, who shall resolve them.

e. Balance air flow at duct branch damper with outlet dampers full open.

f. Test, adjust and record fan RPM to design requirements, and record initial and final readings after adjustment.

g. Test and record motor amps and, initial and final readings after adjustment.

h. Make pitot tube traverse readings of main ducts and obtain design CFM for supply, return, outside air, relief air and exhaust systems by adjusting fans and dampers.

i. Test and record the system’s static pressures at both, suction and discharge points. Record initial and final readings after adjustment.
j. Test and adjust each terminal unit. Check and record inlet static pressures and modulation limit CFM values, initial and final readings after adjustments.

k. The balancing contractor shall have a controls mechanic available at all times to assist the balancing personnel in adjusting control devices.

l. Clearly mark the final position of all dampers, diffusers, reheat boxes, and other adjustable devices. With permanent identification material, neatly applied so as to be easily read and understood. Balancing valve settings shall be marked on the valve tags.

m. All mechanical HVAC systems, air and water, shown on the plans shall be tested and adjusted to design flow. If heating air flow values are different than cooling, provide certification that heating CFM values are within design.

n. Replace sheaves and drives where required to meet design conditions.

o. Copies of a formal balance report shall be prepared and submitted to the mechanical engineer and the University project manager within 10 working days for inclusion in the operation and maintenance manuals. The report shall contain a complete, legible schedule of:

1) All equipment outlets/inlets and their respective flows

2) Pitot tube traverse readings and associated calculations

3) Reheat box settings, GPM and CFM

4) Box static pressures at inlets

5) Box CFM limits (maximum and minimum)

6) Status of each pump and fan, including RPM, AMPS, suction and discharge static pressures, flow

7) A set of master plans shall be bound with the schedules (11" x 17" maximum) identifying the location of each inlet/outlet and device tested.

8) Calibration documents

p. The test and balance contractor shall include an extended warranty of 90 days after the completion of the project, during which time the University may request a recheck or re-set of any outlet, inlet, control, or mechanical unit.
GG. Laboratory Ventilation

(1) Basis of Design

a. The American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5 – 2012 (www.aiha.org) shall be the basis of design for Laboratory Ventilation Systems. The following exceptions and or amendments shall apply:

b. Requirements which are noted as ADDED or CHANGED or CLARIFICATION are special University of Utah requirements supplemental to The American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5-2012.

1.4 ADDED Alternative Design

Codes, Ordinances, and Industry Standards: In accordance with the 2012 International Building Code, Section 104.11, and the University Building Official has approved this Laboratory Ventilation chapter as an Alternative Design which meets all enforceable Code (IBC, IFC, IMC, etc.) requirements. Approvals from the State Building Official, Campus Fire Marshal, Director of Risk Management and Office of Legal Counsel have been obtained for this alternative design.

The Alternate Design is to provide a continuously exhausted laboratory laboratory ventilation system system for new and existing research and educational laboratories
under fire alarm and loss of primary building power conditions. This Alternate Design will apply only to laboratories classified as Group B occupancies where the types and quantities of hazardous materials both stored and used per Control Area do not exceed quantities listed in Tables 307.71 (1) and 307.71.(2) of the 2012 IBC. Laboratory ventilation system supply and exhaust systems will be allowed to penetrate fire-rated exhaust shafts without fire and smoke dampers. Upon activation of the fire alarm and notification system or loss of primary electrical building power, the laboratory ventilation system supply and exhaust systems will operate at 50% of their maximum capacity.

Prescriptive Code requirements specify installation of fire and smoke dampers at the penetration of fire-rated shafts and floor assemblies with few exceptions. The intent of the Code for the installation of fire and smoke dampers is to prevent the spread of fire, smoke and fumes through these penetrations to other parts of the building. This requirement effectively cuts off the supply and exhaust air for laboratory ventilation systems under both alarm and loss of primary power conditions. The closure of fire and smoke dampers, when actuated, would prevent the exhausting of hazardous materials thus creating a more hazardous condition by allowing these materials to permeate the laboratory. The Comparison Chart identifies specific Code requirements and the equivalent design characteristics of the Alternate Design. As noted in
the Comparison Chart, the Alternate Design will not deviate from the Code Requirements except for the provisions of the IBC Section 716.5.3.1.

In summary, the following outlines the required characteristics of the Alternate Design.

- The Alternate Design applies only to Group B occupancy laboratories.
- Fire and smoke dampers shall not be installed at the penetration of fire rated shafts and horizontal assemblies serving laboratory ventilation systems.
- The laboratory ventilation systems for new buildings shall include an adequate power source for the laboratory ventilation system, which will operate at 50% of their maximum capacity for a 90 20 minute time period following loss of primary building power.
- Alterations or additions to laboratory ventilation systems in existing buildings shall be connected to an existing alternate power source where available and where spare capacity exists. Otherwise, connection to the building’s primary power is permitted.
- Alterations to an existing laboratory ventilation system that affect 50% or more of a floor or building shall be connected to an alternate power source.
- Any laboratory ventilation system associated with a Group H Occupancy shall comply with all prescriptive code requirements found in the International Code Council set of codes as adopted by the State of Utah.

3.1.1.4 CHANGED  Auto Sash Closers

Automatic Sash Closers: Automatic sash closers are not required.

3.1.1  ADDED  Backflow Protection

Whether or not non-potable water is supplied to the hood, a spill-proof pressure vacuum breaker for high hazard application, with test ports shall be provided on the supply line outside each laboratory ventilation system. The backflow preventer shall be visible and easily accessible for testing. The backflow preventer shall be located 18” to 24” below the ceiling on the outside of the laboratory ventilation system or on an adjoining wall, and its critical line shall be a minimum of 6” above the highest outlet. The installing contractor shall test the backflow preventer and submit results to the University Project Manager.
3.1.4 ADDED Existing Auxiliary Supplied Air Hoods
Existing auxiliary supplied air hoods currently installed shall be converted to conventional or bypass hoods.

3.1.3 ADDED Vacuum Breakers
Vacuum breakers shall not be installed inside laboratory ventilation systems.

3.1.4 ADDED Work Surface
Existing laboratory ventilation systems shall be retrofitted to include provisions for spill protection.

3.2.3 CHANGED Auxiliary Supplied Air Hoods
Auxiliary supplied air hoods shall not be installed.

3.2.7 ADDED Hood Manufacturers
Approved manufacturers include Hamilton, Kewaunee, Labconco, ALC-Collegedale, or Mott Manufacturing, Ltd. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

3.2.8 ADDED Radioisotope Hoods
Radioisotope hoods shall be conventional hoods or bypass hoods. The University Radiological Health Department (RHD) shall be informed of each new radioisotope hood being planned for a project, or any such hoods to be modified or upgraded to radioisotope status. RHD will review the hood application and determine if any special treatment is required, such as charcoal or HEPA filters, nonstandard face velocities, etc.

3.3.1 CHANGED Face Velocity
The face velocity basis of design shall be 100 fpm at a sash height of 18” above the work surface.

The final product shall provide containment below a control level of AU (As Used) 0.1 ppm as determined by methods described in the ANSI/ASHRAE 110-1995 Method of Testing Performance of Laboratory ventilation systems.

3.3.3.1 ADDED Air Flow Monitoring
Air Flow Monitoring shall be mounted on the hood so as to be readily seen by the hood user. The indicator shall sense face velocity either directly or indirectly (belt driven sash sensors are not acceptable). The device shall provide digital display indicating face velocity with low/high flow audible and visual alarms (adjustable). Approved manufacturers include Phoenix Controls, TSI, or approved equal.

3.3.4 CHANGED Hood Location
All hoods should be located to minimize cross currents and turbulence from laboratory furniture arrangements and busy walkways.
3.4 ADDED Asbestos
Do not use materials containing asbestos in new hoods and cabinet installations. Existing laboratory ventilation systems containing asbestos materials can remain provided the asbestos is in good condition. All modifications to a hood that impact the asbestos materials shall be performed by a certified asbestos contractor.

3.5 ADDED Venting
Corrosive and flammable storage cabinets installed under laboratory ventilation systems shall be as follows:

- Corrosive Cabinets
  Provide a vent pipe from the back of the cabinet to the work surface. The pipe must be located in the space behind the baffle. The vent pipe shall extend 0.5” above the work surface.

- Flammable Cabinets
  Two vent pipes shall be connected to the back of the flammable cabinet through factory-installed bungs, one high and one low, and joined at a common vent pipe (minimum 1-1/2” steel) which shall extend to the hood exhaust duct. The vent pipe shall be connected between the venturi damper and exhaust fan rather than between the laboratory ventilation system and the venturi damper.

- Install a flame arrester in the flammable cabinet’s vent opening.

5.2.4 ADDED System Capacity
New makeup air systems are required in all existing buildings where sufficient make-up systems do not exist. Transfer air from other portions of the building is not an acceptable source of make-up air. A thorough investigation of make-up air sources shall be performed prior to installing new laboratory ventilation systems.

5.2.5 ADDED Hoar Frost
Make-up air systems shall include provisions to prevent hoar frost build-up at intake louvers and pre-filters.

5.2.6 ADDED Hydronic Coils
Cooling and heating coils installed in make-up air handlers shall have a glycol solution to prevent the coil from freezing. See 3.5 Mechanical Part 1 for glycol systems requirements.

5.2.7 ADDED Electric Heating Coils
Electric heating coils are discouraged due to the higher energy cost. If electric heat is necessary, minimum two stages heating is required.
5.2.8 **ADDED** Air Filters
   Energy Recovery coils in exhaust fans shall have air filters and access to service filters.

5.3.1.2.1 **ADDED** Duct Material
   Duct material shall be 16 or 18 gauge Stainless Steel Series 316, welded with "MIG" or "TIG" method. Screwed slip joint connections sealed with silicone sealant are acceptable. Other duct material may be used, with prior approval.

5.3.1.3 **ADDED** Fans in Series
   Series exhaust fans shall not be installed.

5.3.1.4 **ADDED** Velocities
   Transport duct velocities shall be 1000-2000 FPM for gases and 3500-4500 FPM for particulates, depending on the particle size and specific gravity.

5.3.1.5 **ADDED** Dampers
   Install a single blade volume control damper with locking quadrant in the hood duct between the hood and venturi damper for all laboratory ventilation system systems.

5.3.1.6 **ADDED** Elbows
   Use long radius elbows to reduce resistance. Three piece stainless steel elbows are acceptable.

5.3.1.7 **ADDED** Flex Duct
   Flex duct shall not be used on laboratory ventilation systems systems.

5.3.2.9 **CLARIFICATION** Fire Dampers
   The accidental activation of a fire damper will shut off airflow from one or more laboratory chemical hoods and may cause worker injury or exposure.

   The activation of a fire damper caused by a fire in a laboratory chemical hood will shut off airflow from that hood making it impossible to remove the combustion products from the hood and forcing the hood to become positively pressurized. This condition makes it likely the fire will escape the fire resistant hood into the laboratory.

   With the exhaust flow from one or more hoods shut off, the laboratory may become positively pressurized with respect to the corridor, encouraging the spread of the combustion products, and perhaps the fire, from the laboratory to adjoining spaces.

5.3.2.12 **CHANGED** Constant Suction, Redundancy, Emergency Power
   - **Manifold Exhaust, New Construction**
     Manifold exhaust and makeup air systems shall be connected to an emergency power supply to ensure hood performance during power outages.
• Manifold Exhaust, Remodel or Renovation
  Emergency power is not required.
• Individual Exhaust Systems (single-hood/single-fan)
  Emergency power is not required.

5.3.3.1 ADDED Exhaust Fan Components
• Shaft Seals
  The case penetration at the shaft is to be sealed with a corrosion
  resistant flexible seal.
• Motors
  The motor may be non-explosion proof if it is located out of the air
  stream and sealed off from any possible exposure to the fumes
  being handled by the fan. If it is located in an enclosed room, the
  room must be adequately ventilated.
• Coatings
  Non-stainless steel fans, sheet-metal, flexible connectors, dampers,
  etc., in contact with the air stream are to be Eisenheiss or Heresite
  coated, or prior approved equal.
• Back draft Dampers
  Stainless steel or coated gravity back draft dampers are to be provided
  on fan discharges.
• Vibration Isolators
  On smaller fans, rubber-in-shear vibration isolators are to be
  provided. These are inherently seismic rated and need nothing
  further. Larger fans may require spring type isolators with seismic
  snubbers.
• Fan Casing Drains
  Where the fan discharge is vertical and open to the weather, a drain
  half coupling should be provided on the bottom of the fan housing. If
  the fan is located indoors, a trapped drain line is to be run to the
  outside to avoid blowing hazardous fumes into the building due to
  the pressurized housing.
• Duct Pressure
  Exhaust duct pressure shall be negative with respect to all
  interior building spaces.
5.3.3.2 ADDED Labeling and Identification

- Laboratory ventilation systems
  All laboratory ventilation systems shall be clearly identified and labeled to indicate which fan or ventilation system they are connected to.

- Exhaust Fans
  All exhaust fans shall be clearly identified and labeled to show which hood(s) and/or ventilation systems they are serving. Exhaust fan labels shall indicate current and future design airflows and shall be updated whenever changes are made to the systems they are serving.

- Corrosive and Flammable Cabinets
  All corrosive cabinets shall be labeled “Corrosive” and all flammable cabinets shall be labeled “Flammable”.

5.3.5.1 ADDED Termination Devices

Horizontal fan discharges, fixed caps, mushroom caps and rotating cap outlets prevent exhausted materials from being freely projected upward into the air stream for removal and are not to be used.

5.3.5.2 ADDED Bird Screens

Bird Screens shall not be installed.

5.3.5.3 ADDED Corrosive Condensate

Refer to ASHRAE 2003 Handbook – HVAC Applications, Chapter 44 recommends a stack velocity of 1000 fpm when corrosive condensate droplets are present and an exit cone to increase the discharge velocity to 3000 fpm to prevent plume downwash.

5.3.6.1 CHANGED General Room Exhaust

Air from the general laboratory containing chemical laboratory ventilation systems (as distinguished from laboratory chemical hoods) shall not be returned back to a central air handling unit where the air is re-circulated to other areas of the building.

8.10.3.1 CLARIFICATION Automatic Fire Dampers

In 2001 at the University of California a fire resulted in an injury and caused approximately $3.5 million in damage. Based on the investigation, it was concluded that not having the fire dampers on the exhaust duct of the ventilation system at the shaft wall appears to have been beneficial in this fire scenario. The investigation observed that the exhaust system was effective at removing significant quantities of combustion products from the building during the fire, thereby reducing the amount of combustion products spreading to other areas of the building. The shutting down of the supply air by fire dampers did not
significantly hinder the exhaust system since fresh air was provided through a broken window. However, if the window had not failed, the team concluded that the exhaust system probably would not have performed as well.

If protection of the openings is desired, one method is to use a subject assembly. Where a branch duct connects to an enclosed exhaust riser located inside a shaft, which has a required fire resistance rating of 1 hour or more and in which the airflow moves upward, protection of the opening into the fire resistance-rated enclosure should be made with a steel subduct turned upward a minimum of 0.06m (22 in.) in length and a minimum thickness of 22 gauge [0.76 mm (.030)]. The steel subduct should be carried up inside the riser from each inlet duct penetration. This riser should be appropriately sized to accommodate the flow restriction created by the subduct.

c. Comparison Table

<table>
<thead>
<tr>
<th>COMPARISON TABLE</th>
<th>ALTERNATE DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IBC:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IBC Tables 307.7(1) &amp; 307.7(2)</strong></td>
<td>Hazardous materials in quantities less than Tables 307.7(1 &amp; 2) per Control Area to be classified as Group B occupancy. All others to be a Group H occupancy. No change to Code requirements.</td>
</tr>
<tr>
<td><strong>IBC Section 707.3.1</strong></td>
<td>Fire resistive rated shaft enclosures at openings between stories for more than 2 stories. No change to Code requirements.</td>
</tr>
<tr>
<td><strong>IBC Section 714.3.1</strong></td>
<td>Unprotected openings for penetrations less than 6” in diameter are permitted at shafts. No change to Code requirements.</td>
</tr>
<tr>
<td><strong>IBC Section 717</strong></td>
<td>Penetrations by ducts and air transfer openings of fire resistive rated shaft enclosures are to be protected with approved fire and smoke dampers. Fire and smoke dampers are not allowed as they would interrupt supply and exhaust air for laboratory ventilation systems. Provides continuous supply air and exhaust for products of combustion and hazardous materials regardless of quantities.</td>
</tr>
<tr>
<td><strong>IMC:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IMC Section 501.4</strong></td>
<td>Exhaust system must maintain negative pressure and make-up air. No change to Code requirements.</td>
</tr>
<tr>
<td><strong>IMC Section 502.1</strong></td>
<td>Exhaust system required for laboratories using hazardous materials. No change to Code requirements.</td>
</tr>
<tr>
<td><strong>IMC Section 502.8.2</strong></td>
<td>No change to Code requirements.</td>
</tr>
</tbody>
</table>
### IMC Section 502.9.5
Flammable and combustible liquids in any quantity shall be provided with an exhaust system.

No change to Code requirements.

### IMC Section 510.2
A hazardous exhaust system shall be required wherever operations involving the handling or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create:

1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25% of the lower flammability limit of the substance for the expected room temperature;
2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration;
3. A vapor, gas, fume, mist, or dust with a health-hazard rating of 1, 2 or 3 is present in concentrations exceeding 1% of the median lethal concentration of the substance for acute inhalation toxicity.

No change to Code requirements. The design professionals will need to demonstrate that for the given project, chemical inventory quantities and list and the anticipated processes, that this provision is not a concern. Otherwise, a hazardous exhaust system will be required.

---

**HH. High Temperature Hot Water System**

1. **Purpose**

   This supplement provides basic design requirements for new heating systems connected to the University of Utah's high temperature water (HTW) distribution piping system.

2. **Construction Documents**

   a. Construction drawings and specifications are to provide sufficient detail to fully describe the extent and arrangement of the work expected.

      1) **Underground Piping**

         Drawings are to include plan and profile drawings showing existing and new pipeline elevations; existing piping along the route; existing and new boxes, manholes, anchors, expansion guides, etc.; and, manhole identification numbers, details and elevations of manholes, connections, and pipe routing.

      2) **Mechanical Room Piping**

         Provide lay-out drawings, elevations, and details showing all necessary dimensions.
required to arrange the pipe, specialties, and equipment within the building.

3) Tanks

Include specifications and drawings for all tanks designed for HTW primary and secondary heating systems.

4) Controls

Include specifications and drawings completely describing the control system to be used on the project.

(3) Design Requirements

a. HTW System Availability

The consultant must coordinate with the University Project Manager to determine if HTW is the best application for the heating system, including availability of HTW before design.

b. Steam Generation Using HTW

Steam generation requires prior approval before design. Steam generation from HTW may over burden the distribution system.

c. Consultant Experience

The campus high temperature water system requires a unique expertise. The University reserves the right to limit the selection of consultants to those experienced in high pressure/high temperature piping design with associated maintenance and safety design capabilities, and require evidence of such experience.

d. System Testing

Unless directed otherwise, specify system tests which conform to applicable sections of the codes, ordinances, and industry standards referenced in 2.0 Codes, Laws, Rules and Regulations, University of Utah Supplement.

e. Design Parameters for System Calculations

1) System Operating Pressure = 460 psig for both “upper” and “lower” zones.

2) System Operating Temperature, “Upper Zone” = 390°F.

3) System Operating Temperature, “Lower Zone” = 435°F.

4) Minimum Approach Temperature:
APPROACH TEMPERATURE = (HTW RETURN TEMP °F) - (SECONDARY SUPPLY TEMP °F)

a) HTW steam generators:
   (i) 10°F (for 45 psig to 100 psig steam operating pressures)
   (ii) 15°F (for 44 psig and lower steam operating pressures)

b) HTW water-to-water converters and water heaters, 15°F

5) Maximum Pressure Drop.
   The maximum allowable pressure drop from the HTW building entry through each mechanical room including piping, equipment, and controls shall be 20 PSI.

f. Equipment Ratings
   Pressure/temperature ratings required for equipment, valves and piping are described in (4) "Guide Specifications – High Temperature Hot Water System" below.

g. Blowdown Heat Recovery on Humidifier Steam Generators
   Steam generators used for humidification shall be designed with heat recovery on the blowdown line. The recovered heat shall temper the makeup water to the steam generator to avoid shocking the generator.

h. Piping System Design
   1) Use Fanning or other equally acceptable formulae to calculate flow, velocity, and resistance of the water piping.
   2) The maximum allowable pressure drop in branch lines from the main to building equipment and returning to the main shall be 2 PSI/100 FEET OF PIPE, with a maximum water velocity of 7 FEET/SECOND.
   3) Minimum pipe size shall be 1/2" for HTW lines above ground and 2-1/2" for underground branch lines.
   4) The minimum bury depth to the insulation wrap shall be no less than 5 feet between the top of the insulation and the ground level for plain pipe. Thermacor Process L.P. Duo Therm “505” pre-insulated pipe requires a minimum bury depth of 24”. If conditions require a shallower depth, the minimum bury can be 12” for Thermacor “505” pipe if under a concrete slab on grade. The minimum insulation depth to the top of the pipe shall be 6” (and varies to 10” - see detail).
   5) Buried pipe crossing over or under high temperature water lines:
      a) Routing of new HTW piping may require revisions to existing underground
utilities. New buried utility piping will require special considerations for crossing HTW piping.

b) To prevent damage to pipe and/or contents from the elevated temperatures expected at crossing high temperature water lines, the following requirements apply (with the exception of Thermacor Process L.P. Duo Therm “505” piping):

(i) Buried piping systems which must cross over or under HTW lines shall be metal pipe (no plastic) for at least 5 feet either side of the cross point of the HTW pipe line.

(ii) A buried water, sewer, or storm sewer pipe which crosses HTW piping shall be constructed of a 20 foot section(s) of ductile iron pipe, with the middle of the ductile pipe section centered over or under the crossing HTW pipe(s). The angle of crossing shall not be less than 60º. Any storm drain entry box, or piping joints within five feet lateral clearance of a crossing point over or under high temperature water piping must have an epoxy concrete envelope around the storm drain joints.

(iii) Buried pipe which crosses HTW piping must have adequate vertical clearance; a minimum of two feet (2') is allowed without a copper guard. If the clearance between the crossing pipes must be closer than two feet, design a 4' wide, ¼” copper plate(s) midway between the crossing piping and the HTW piping. The copper plate(s) shall extend a minimum of 3 feet either side of the HTW piping.

(iv) Buried electrical and telecommunications ductbanks which cross HTW piping must have adequate vertical clearance; a minimum of one foot (1’) is allowed without a copper guard. If the clearance between the ductbanks must be closer than one foot, design a 4’ wide, 1/4” copper plate(s) between the ductbanks and the HTW piping. See Detail HTW-18.

6) If new Thermacor Process L.P. Duo Therm “505” pipe system is to be installed, and a connection to an existing Gilsulate insulating fill system or a Z-Crete cast-in-place insulation system is required, design an engineered transition which may include a vault, foundation, or doghouse. Direct connections between the differing pipe/insulation systems shall not be permitted.

7) Minimum size for drains and vents shall be 3/4” DRAINS and 1/2” VENTS. Refer to drawing details provided herein. Gate valves shall be used on all HTW drains and vents.

8) Due to the high potential for high pressure water to flood adjacent areas, rooms shall be designed to contain water and quickly drain it away. All instrument air tubing in the HTW equipment rooms shall be copper.

9) HTW Vent Lines
Vent valves are to be installed at the highest point of the HTW system inside the building. Vent valves are also to be installed at the high point of each high temperature water converter (HTW side of each water and steam converter/generator) in both the supply and return piping.

10) Design to Minimize Shock

If the length of HTW piping between the control valve and the converter/generator exceeds 20 feet, include a bypass line near the converter/generator to allow HTW circulation which will serve to keep the idle HTW consistently hot and thereby prevent start-up shock.

11) When selecting heavy wall pipe (i.e. schedule 80), the consultant must account for the smaller inside pipe diameter in design calculations.

12) Submit detailed calculations to Facilities Management through the University Project Manager for review. The calculations used in the design of all HTW extensions shall be approved by Facilities Management prior to construction.

13) Piping insulation thickness shall be shown in table form on the drawings or in the specifications.

i. Domestic Hot Water Design Using HTW

Domestic hot water systems are to be designed with multiple storage tanks to allow maintenance on one tank while the system remains in service.

j. Avoid Pad Support Under Heat Exchangers

Do not specify a housekeeping pad under HTW heat exchangers. Hydraulic lifts are used to remove heat exchanger heads and a minimum of 3 feet clearance is required at the floor behind the heads for proper access.

k. HTW Equipment Rooms

See 3.4 Structural / B. University of Utah Requirements / (2) Design Criteria / f. High Temperature Water Equipment Rooms for special design requirements.

l. Emergency Shut-Off Control Valve at Building Supply

1) Include an emergency shut-off control valve at new buildings and new installations of a high temperature water system. Manual remote operation of the valve is to be located outside of the HTW equipment room near the door. The purpose of the emergency shut-off control valve is to protect the equipment room from destruction after a tube rupture or head gasket failure. The HTW emergency shut-off control valve shall have the following characteristics:

a) The control valve shall be installed inside the building on the HTW supply line and shall be full line size with a full port.
b) Cast steel valve body conforming to ANSI 600 LB specifications. Flange surface shall match 600 LB ANSI flanges.

c) The seat leakage shall be limited to the requirements of ANSI B16.104, Class IV. Control valve shall close against a 500 psi pressure difference and shall be suitable for 450°F.

d) The control valve shall be specified normally closed, failing to the closed position on loss of control air. The valve shall be a rotary ball design with a side mount actuator that can be right or left of the pipe. Actuator shall be air operated with spring return. The maximum air to operate the valve shall be 60 psig. The maximum allowable air to actuator to be 125 psig.

e) Control valve shall have remote control for opening and closing through the campus automation system.

m. Blowdown Heat Recovery on Steam Generators

Steam generators shall be designed with heat recovery on the blowdown line. The recovered heat shall temper the makeup water to the steam generator to avoid shocking the generator.

n. System Review by Facilities Management

In all cases, piping design, equipment selections, and controls are to be reviewed with Facilities Management through the University Project Manager at each stage of design development.

(4) Guide Specifications – High Temperature Hot Water System

**General Design Requirements**

a. The information provided in this section should be used in coordination with other related sections of the University of Utah supplement. Information regarding pipe identification, insulation, seismic supports, etc., found in other sections of the University supplement may pertain to the work being designed.

b. This section is not intended to encompass all the needs of a complete project. The consultant will be expected to provide appropriate additional information for the contract specifications to adequately cover the requirements of the work.

c. Contract Documents are to include EQUIPMENT SCHEDULES for all HTW generators and converters. Include sufficient design data to allow manufacturers to calculate their own selection routines for their equipment. Such design data should include, as a minimum, OPERATING TEMPERATURES and PRESSURES, FLOW REQUIREMENTS for both primary and secondary systems, TUBE SIDE SURFACE AREA, MAXIMUM PRESSURE DROP for each system, FOULING FACTOR limits, and confirming BTU/HR REQUIREMENTS.

d. Contract Documents are to include CONTROL SCHEMATIC DRAWINGS for all HTW
equipment requiring system controls. Include sufficient design data to allow manufacturers to calculate their own selection requirements for valves, operators, and system logic.

e. **Installation**

1) **BTU meters** will require a minimum length of straight piping to allow the manufacturer to guarantee performance. The meter installation shall be designed for 20 pipe diameters upstream and 10 pipe diameters downstream of straight piping only. If these conditions cannot be met, some reduction allowance will be approved, but no less than 10 pipe diameters upstream and 5 diameters downstream of the meter. Contract documents shall clearly indicate the required length of unobstructed flow to the piping contractor.

2) **High Temperature Water Meters**

   a. Building meters shall meter high temperature hot water consumption in British Thermal Units (BTUs) delivered to the building by Campus central plant facilities.

   b. Meters shall provide instantaneous information via on-screen local displays as well as integrate into the University’s Energy Information System.

   c. Meters shall have the ability to provide instantaneous energy consumption in Btu/h.

   d. If piping arrangements prohibit this installation protocol, HHW BTU meters may be installed on the building side of the converters. All converters shall be metered for complete hot water usage monitoring.

   e. All HTHW meters shall guarantee the following performance levels at all operating (pressure and temperature) scenarios:

      1) **Accuracy:** ±1 percent

      2) **Repeatability:** ±0.5 percent.

      3) **Pressure drop:** As indicated on project drawings

      4) **Flow sensor turndown:** No less than 10 to 1.

   f. **Flow rate** shall be measured in gallons per minutes (gpm).

   g. **Metering components and BTU computers** shall be capable of operating in ambient temperatures of at least 150 °F.
h. All data sheets and informational literature shall be submitted for review prior to implementation

1) Transmitters
2) Sensors
3) Flow elements
4) Totalizers

i. Calibration for all flow metering distribution meters and transmitters shall be provided.

j. Meter and BTU computer shall be capable of communicating with the University’s building automation system and Energy Information System. The following data shall be provided:

1) Fluid temperatures
2) BTU
3) Btu/h
4) Flow (GPM)

k. Flow element shall be a variable-area, differential pressure flow element.

l. RTDs shall be provided to measure supply and return temperature at building interface piping or at building heat exchangers. 1) RTDs shall be 316 stainless steel.

m. Flow sensor size shall match installed pipe size.

n. Temperature Sensors and Transmitters

1) Spring-loaded dual element 100 ohm platinum resistance temperature detector (RTD) temperature sensor.

2) RTD accuracy: ±0.5 percent at 32 °F.
   a) Temperature range: 20 °F to 800 °F.

3) Install RTDs with 316 stainless steel thermo-well.

4) Straight-run distance shall not be less than 4 times the diameter (4xD).
f. Specifications shall mandate all new materials.

g. For a planned shut-down of the high temperature water system, direct the Contractor to add additional lead time to that shown in the Supplemental General Conditions for University of Utah Projects; and, coordinate the request well in advance of the needed shut down date to allow preparation time for the affected University services.

h. Before the Contractor begins any work which will affect the University’s high temperature water system, direct the Contractor to prepare a ‘hazard control plan’ in accordance with OSHA; and, require the Contractor to submit the plan in advance of the work to the A/E for initial review and comment. The A/E shall forward the plan with comments to the University Project Manager who will review the plan with Facilities Management. Work on the University’s HTW system shall not commence without an approved hazard control plan.

15060 Pipe and Pipe Fittings

15061 HTW Piping - General

a. All HTW piping installed in building mechanical rooms shall be exposed and not concealed within the structure.

b. Design the anchors and supports for all HTW piping with allowance for free expansion and movement without damage to piping, valves, structures or connected equipment.

c. Piping expansion shall be provided by expansion loops only. No mechanical expansion joints will be allowed on the HTW System.

d. Eccentric reducers shall be used on horizontal piping. Specify / detail the reducers with the straight side on top of the piping.

e. Do not allow the Contractor to hang pipe from other piping.

f. Isolate each branch line and each equipment item with valves and flanged unions. Provide flanged or welded connections only. Refer to drawing details provided herein.

g. Threaded unions are not allowed on HTW connections.

h. Specify only long radius elbows for piping turns.

i. Neither bushings, short nipples, cast iron fittings, nor flanges shall be allowed in HTW Piping. The entire assembly shall be all welded construction.

j. Require the Contractor to identify pipe and fittings at the work site with labels. See paint and label requirements in 3.8 HVAC. The University reserves the right to reject items not readily identified as meeting the requirements of this supplement.
k. Vents and drains - high points of piping must be properly vented. Careful consideration must be given to pipe routes and elevations, especially for underground piping. Costly manholes must be provided for vents if a means cannot be found to avoid high points. Drains at low points in underground piping are usually impractical, so low points should be avoided.

l. Tie-ins between Thermacor Process L.P. Duo Therm “505” pipe and pipe by other manufacturers are not recommended. Design shall include a vault, doghouse, or foundation as solution for transition.

15062 Piping and Fittings Below Grade

a. Unless otherwise approved, all new below ground direct bury HTW piping shall be Thermacor Process, L.P. Duo Therm “505” or prior approved equal pre-insulated pipe, including extra strong schedule 80 carrier pipe. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Follow ALL of the manufacturer’s installation details and processes.

1) When approved for direct bury, specify extra strong schedule 80 piping, ASTM A106 Grade B, plain end seamless black steel pipe.

   a) Insulate all plain (non-pre-insulated) direct buried HTW piping with insulation specified in section 15256.

b. All service piping, supply and return, shall meet the above specifications, including piping installed in service boxes, underground conduit, and appurtenance piping connected thereto including sensing, vent, drain, etc. piping. Piping shall be all welded construction for all sizes.

c. Fittings 2” and smaller shall be socket weld forged black steel, conforming to ASTM A105, Grade II, and ANSI B16.11, 3000 pounds. Specify only United States (domestic) manufactured pipe and fittings. Acceptable manufacturers are Grinnell, Ladish, and Vogt.

d. Fittings 2-1/2" and larger shall be butt weld seamless black steel, long radius, conforming to ASTM A234, ANSI B16.9, ASA B10, Grade B Extra Strong Schedule 80, and physically/chemically equal to the piping to which connected. Specify only United States (domestic) manufactured pipe and fittings. Acceptable manufacturers are Grinnell, Ladish, Tube-Turn, and Tube Forgings.

15063 Piping and Fittings in Mechanical Rooms and Tunnels

a. All exposed insulated piping in mechanical rooms and tunnels shall be Extra Strong Schedule 80 for 4” and smaller, ASTM A106 Grade B, plain end seamless black steel pipe. Specify only United States (domestic) manufactured pipe and fittings.

b. Piping 5” and larger shall be Schedule 40 ASTM A106 Grade B, plain end seamless black steel pipe.
c. Fittings 2" and smaller shall be socket weld forged black steel, conforming to ASTM A105, Grade II, and ANSI B16.11, 3000 pounds. Specify only United States (domestic) manufactured pipe and fittings. Acceptable manufacturers are Grinnell, Ladish, and Vogt.

d. Fittings 2-1/2" and larger shall be butt weld seamless black steel, long radius, conforming to ASTM A234, ANSI B16.9, ASA B10, Grade B Schedule 40, and physically/chemically equal to the piping to which connected. Specify only United States (domestic) manufactured pipe and fittings.

15064 Joints

a. Pipe joints 2" and smaller shall be socket weld as specified above.

b. Pipe joints 2-1/2" and larger shall be butt-weld as specified above.

c. Adapter fittings between Schedule 40 and Schedule 80 pipe shall be prepared according to the latest edition of ASME B31.3.

15065 Flanges and Accessories

a. Flanges 2" and smaller shall be forged black steel, conforming to ASTM A105, Grade II, and ASA 16.5, Class 600 LB, with serrated raised face and socket weld connections.

b. Flanges 2-1/2" and larger shall be forged black steel, conforming to ASTM A234 and ASA B16.5, Class 600 LB, with serrated raised face, welding neck, or slip-on welding flanges.

c. Gaskets shall be Flexitallic. No other gasket will be approved.

d. Bolts are not to be used in HTW pipe assembly.

e. Studs and nuts shall conform to the following ANSI and ASTM Standards: ANSI Class 300 LB, 400 LB and 600 LB standards; and, ASTM A193 Grade B7 and ASTM A194 Grade 2H requirements.

f. Nuts shall not exceed 2" in size.

g. Provide flanged connections where shown on plans for convenient dismantling and reassembling piping, for branch line and equipment connections, and for convenient dismantling and reassembling of bypass assemblies.

15066 Welding Certification

a. Each welder shall have passed a qualification test within the past 6 months.

b. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.
c. The test report shall certify that the welder is qualified to weld the material to be used at the job site.

d. The Contractor shall submit three copies of each welder's qualification test report to the A/E / University Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified and approved by the University Project Manager.

15067  Welding

a. Electric metallic arc process shall be specified for all welding. End preparations shall conform to ANSI and ASTM Standards.

b. Specify only one welder for each joint.

c. Weld slip-on flanges on both front and back sides.

d. Thermometer wells and test wells shall be back welded.

e. Require the Contractor to maintain a log and map of all pipe welds showing a weld number, location, and welder information. The log is to be turned over to the University Project Manager at the completion of the work.

15068  Piping Tests

a. Prior notification of at least 10 days will be required for an intent to perform hydrostatic testing. The Contractor's notice shall be reviewed and approved by the University Project Manager and Facility Operations prior to commencement of the required testing.

b. Specify piping tests performed in accordance with the applicable ANSI Code for Pressure Piping. Insert the applicable code reference for use by the Contractor.

c. Piping tests shall be completed prior to painting, insulating, or covering the pipe.

d. The University will retain the services of an ASME Authorized Inspector. The inspector’s duties will include on-site verification of all piping tests from commencement to test completion. The inspector will provide written certification of completed tests. Three copies of the certification report for each test will be submitted to the University Project Manager for approval.

e. Each test shall comply with the requirements of industry standards and prior notification as specified above. Piping shall be hydrostatically tested. 100% of all welds will be visually and x-ray inspected by the University’s ASME inspector whether above or below grade. If a socket weld fitting needs to be tested, then specify hydro testing.

15069  Internal Cleaning

a. All HTW piping shall be internally cleaned prior to system start-up and after
successful testing. The cleaning of the piping system shall be accomplished by the approved water treatment supplier, W.E.S.T., Water and Energy Systems Technology. Other suppliers must be prior approved with University field tests before bidding.

b. Specify prior notification of the time for boil-out to the University Project Manager, who shall witness the process.

c. Require the Contractor to furnish a boiler (or other suitable heat source), circulating pump(s), valves, etc. and all required materials and labor to complete the internal cleaning.

d. Specify that all internal surfaces shall be cleaned using a "boil-out" process with solutions specified. Repetitive flushing shall remove all traces of grease, oil, dirt, loose scale, metal particles, welding slag, etc. Include the following in the specifications:

1) Step One - Flush

Flush piping with clean water to remove loose material, then discharge the water in a location away from service boxes, where no damage will occur.

2) Step Two - Boil Out

Thoroughly dissolve West B 802 Caustic High pH Boil-Out Cleaner using 25 pounds for each 1000 gallons of system water in the piping and equipment. Fill the system piping/equipment with clean water and the cleaning solution. Circulate the system water at a minimum velocity of 0.5 FT/SEC, and heat until the solution in the entire system is between 160 and 180 degrees F. Maintain the temperature level between these limits and continue circulation at no less than 0.5 FT/SEC for a minimum of 24 hours.

3) Step Three – Drain

Thoroughly drain the system including all equipment.

4) Step Four – Flush

Fill the system piping and equipment with clean water and flush, then thoroughly drain, and repeat until the pH of drained flush water is below eight.

5) Step Five - Final Fill

Completely fill the system with clean, zeolite softened water in cooperation with the University Project Manager and HTW Plant Personnel. The Contractor shall furnish interconnections and the services of an approved water supplier for filling. Water hardness measured at the University wells is approximately 27 GPG total hardness as CaCO₃.
15070  **System Start-Up**

a. No valve between existing and new HTW piping shall be opened until after all tests are approved, and internal cleaning operations are complete; then, system valves may be opened only with authorization and on-site-assistance from Campus Utility Services, the HTW Plant, and the University Project Manager.

b. Require the Contractor to assist University personnel in system start-up. The HTW Plant personnel will provide on-site management of the start-up process and direct the Contractor in valve positioning. The Contractor shall not activate any valve during start-up until directed to do so by the University.

c. Require the Contractor to check all parts of the system for leaks, and repack valve stem glands that indicate a need for additional packing.

15083  **Strainers**

a. Show strainers on the inlet side of all control valves on contract drawings. Strainers are to be full pipe size, and where pipe size reductions occur, the strainer shall be the same size as the large end of the reducer.

   1) Strainers 2-1/2" and Smaller: Strainers shall be Y-type with socket weld ends and drain conforming to ANSI Class 600 LB, with body material of carbon steel, type 1030 WCB. They are to have a bolted retainer plate; a socket welded drain connection; studs conforming to ASTM A193, Grade B7; nuts conforming to ASTM A194, grade 7H; and, stainless steel screens. The blow down line shall be welded (only). No threads are allowed on the blow down line until after two valves.

   2) Strainers 3" and Larger: Strainers shall be Y-type with butt weld ends and drain conforming to ANSI Class 600 LB, with body material of carbon steel, type 1030 WCB. They are to have a bolted retainer plate; a socket welded drain connection; studs conforming to ASTM A193, Grade B7; nuts conforming to ASTM A194, grade 7H; and, stainless steel screens. The blow down line shall be welded (only). No threads are allowed on the blow down line until after two valves.

15090  **Pipe Hangers, Supports and Anchors**

a. Pipe hangers, supports and anchors are to be designed as a complete support system for HTW piping. Approved manufacturers are Blaw Knox, Fee & Mason, and Grinnell.

b. The shop drawing submittal shall include system calculations for zero reaction on all equipment, and shall include necessary seismic restraints.

c. Require the Contractor to install all connections, supports, hangers, anchors, guides, and accessories necessary to provide pipe support, restraint, and allowance for predicted movement.
d. Require the Contractor to provide and install auxiliary structural steel supports as necessary to support, anchor, and/or restrain the pipe and accessories.

e. Within Manholes

Design structural steel anchors, hangers, and pipe supports in manholes. Require the Contractor to cut anchor steel to accurately fit the pipe, and bend the support to allow a continuous weld to the pipe. Prepare for the weld so as not to reduce pipe wall thickness or impair strength. Specify gusset or filler plates between structural members and pipe as required. Change the slope of pipe only at anchors. See the detail drawings included in these supplement.

f. Wall Entry

Specify and show packed gland seals and end seals at service box walls and building walls as shown on the detail drawings.

g. Cathodic Protection at Wall Entry

Pipe anchors which will be set in concrete shall have an epoxy coating to act as a dielectric for the anchor and adjoining pipe. The area to be coated shall be cleaned to remove mill scale, grease, dirt, etc. Brush apply a full coverage prime coat of O’Brien Mira-Plate, or Westglas 920 with hardener added. Follow with a brushed coat of O’Brien Mira-Plate Hi Luster or Westglas No. 930. Finish using necessary catalysts or hardeners, and repair damaged areas prior to pouring concrete around the anchor. The finish must be continuous without blemish at the time of pour. Wall rebar must not contact the anchor or pipe.

15100 Valves

a. Secondary Side, Low Pressure Valves

Valves installed on the low pressure side of converter systems shall be as specified in 3.8 HVAC.

b. Acceptable Manufacturers for HTW valves are Crane, Velan, Vogt, RP&C.

1) Require the Contractor to identify valves at the work site with labels. The University reserves the right to reject items not readily identified as meeting the requirements of this University of Utah supplement.

c. High Temperature Water - Gate and Globe Valves, 2“ and Smaller

Valves shall be specified forged steel, outside screw and yoke rising stem (OS&Y), conforming to ANSI Class 800 LB, with the valve body conforming to ASTM 105 Grade 2, and ANSI B16.11. Provide socket weld ends, a bolted bonnet, full bore, stud bolts conforming to ASTM A193 Grade B7, and nuts conforming to ASTM A194 Grade H. Provide stainless steel internals and trim (ASTM A182, Grade F-6-1961T) with hard-faced seats.
1) Gate valves shall have a solid wedge and shall be full ported.

2) Globe valves shall have a solid disc.

d. High Temperature Water - Gate and Globe Valves, 2-1/2" and Larger

Valves shall be specified "full flow", cast steel body, OS&Y, conforming to ANSI Class 600 LB standards. The valve body shall conform to ASTM A216 Grade WCB, stud bolts shall meet ASTM A193 Grade B7 requirements, and nuts shall conform to ASTM A194 Grade 2H. The internals and trim shall be alloy steel with hard faced seats.

e. Valves shall be rated for 800 degrees F (transient) and 445 degrees F continuous operating temperature, both at 500 PSIG.

f. Specify butt-weld ends.

g. Specify a bolted, flanged yoke-bonnet with a tight shut-off back seat arrangement inside the bonnet to allow packing the valve while in operation.

h. Each valve shall be factory tested to ANSI B16.34 or API 598 standards for hydrostatic shell and seat testing, and shall be certified for tight shut-off prior to shipping. Factory test results and certification shall be submitted (three copies) to the University Project Manager prior to installation.

i. Each valve shall have a nameplate to match the requirements of 3.8 HVAC. Additionally include the manufacturer, the size, and the ANSI pressure-temperature service rating.

j. Specify that the machined end bore of each valve shall match the bore of the connecting pipe.

k. By-Pass

Valves 5" and larger shall be furnished with a single valued by-pass (3/4" for valves 5", 6", and 8") (1" for valves 10" and larger). The by-pass shall have welded joints and a welded globe valve meeting the specifications listed above.

l. Special Operators

Valves 8" and larger shall be furnished with concealed bevel gear type operators. Approved manufacturer is Crane Converto-Gear Type N, and P.

m. Optional Factory Service Requirement

Some projects may require a follow-up check-out of the valves. The following sample specification may apply:

"THE VALVE SUPPLIER SHALL INCLUDE IN HIS BID THE COSTS FOR A POST-START-UP ADJUSTMENT SERVICE TO BE PERFORMED BY A FACTORY AUTHORIZED SERVICE"
n. Strainer Drain Valves

1) All strainers are to have two valves welded in the drain piping.

2) Show one globe valve in the drain line near the strainer, full line size, ANSI Class 800 LB as specified above.

3) Downstream of the first valve, specify a second valve rated for 1500 PSIG at 1050 degrees F. The second valve shall be a self-aligning disc type valve, straightway pattern, with a forged steel body and socket weld ends. The valve shall have a stellite faced seat, a non-distorting thermal compensated seat groove, and a 321 SS stem. All working parts must be removable through yoke.

o. Blowoff Valves at HTW Steam Generators:

Show two valves in tandem (in series). Each shall be seatless lubricated type valves rated for 250 PSIG. The valves shall have iron body construction with flange connections.

**15130 Manholes**

a. General

Branch line connections to the underground high temperature water mains shall be in underground concrete manholes. Connections to the mains shall include gate valves in the manholes. Vents and drains shall be double valved with a 6" long threaded nipple outlet. Vent and drain lines are to be as short as possible and not tied together, nor routed to a wall. A 90 degree elbow between the first and second valve will be acceptable if required for clearance.

b. HTW manholes (vaults) shall be poured-in-place reinforced concrete, constructed in accordance with 3.2 Civil, with University specified protected rebar. The manholes shall be square or rectangular in shape with reinforced concrete footings, walls, and top. The bottom shall be open for drainage and shall have a four foot deep gravel sump.
c. Two entry lids shall be provided in the top of each manhole. The entry lids shall be located at opposite corners of the manhole. Install the entry lids and manhole rings at ground level, with round reinforced concrete extensions down to the manhole ceiling.

d. Grade the ground surface/concrete surrounding the manhole lids to provide sloped drainage away from the lids with a gradual grading which will not interfere with snow removal blade operation. Note: Manhole rings, extensions, and connections to the vault shall be waterproofed to prevent ground water and surface water from entering the vault.

e. Specify / show a stainless steel ladder extending from 12” above the floor to entry point. The ladder shall be 14”W, with 3/4” knurled risers at 12” on center, and shall have 1-1/2” x ½” runners. The ladder shall be bolted to the structure at the top and bottom of the ladder and with 4’ minimum vertical spacing. Arrange piping to provide a clear landing below each ladder, and a clear egress path for emergency escape.

f. The manhole lids will be used for regular maintenance and shall have a minimum diameter of 24” and a maximum diameter of 30” with exceptions noted below.

1) For valve removal one of the manhole lids must be large enough to remove the largest valve.

2) If the 30” diameter entry is too small for valve removal, specify / show a dual manhole lid instead. A dual lid shall be a 36” diameter or a 42” diameter lid (sized determined by valve removal needs) with a 24” diameter lid in the center of the larger lid. The 24” lid will be used for regular maintenance and the 36” or 42” lid will be used to removed and replace a large valve.

g. Specify that high temperature water manhole lids shall be provided with vent holes.

h. High temperature water manhole entry lids shall be specified cast iron or steel with "HTW" stamped or welded on the lid.

15250 Insulation

15254 Pipe Insulation - Above Ground

a. General

1) Require the Contractor to Insulate all HTW piping and equipment. The term "piping" as used herein includes piping, fittings, valves, controls, specialties, accessories, etc.

2) "Above ground" includes HTW piping in buildings, tunnels, crawl spaces, etc. "Above ground" refers to every location except direct bury pipe.

3) Insulation shall be delivered to the job site in original, unopened manufacturer's containers.
b. Installation

1) Approved manufacturers for "above ground" HTW insulation are Johns-Manville, Carey, Eagle-Pitcher, Owens-Corning, Pabco, and Pittsburgh-Corning.

2) Installation shall be neat and professionally trim.

3) Insulating cement shall have temperature-resisting qualities equivalent to those of the insulation used.

4) Finishing cement shall provide a smooth hard finish over pipe, fittings, and block insulation.

5) Glass fabric shall be heavy duty "GLAS-FAB."

6) Adhesives shall be either Arabol, Sealfas, or Swifts.

7) Provide an aluminum or white PVC jacket with color code stripe in accordance with the section describing color code identifiers in 3.8 HVAC. If yellow PVC jacket is used it will not be necessary to have color code stripe. PVC jackets shall not be used for lines which run in supply air or return air plenums.

8) Where a waterproof vapor barrier is required, install a short fibrous "cut-back" material equal to "Insulseal".

c. Piping Insulation

1) Insulation for HTW piping "above ground" shall be heavy density one-piece or sectional pipe insulation suitable for temperatures up to 1200 degrees F. The jacket may be either "all-purpose" pre-manufactured, or field prepared. Approved manufacturer is Johns-Manville, or prior approved equal. No plastic, nor aluminum will allowed.

2) Calcium silicate precision molded pipe covering will be used, provided the installed thickness produces specified insulating value. Refer to required insulation thickness specifications herein or on the drawings.

3) Foamglass expanded glass may be specified, provided the installed thickness produces specified insulating value. Refer to required insulation thickness specifications herein or on the drawings.

4) Fiberglass insulation may be specified, provided the installed thickness produces specified insulating value. Refer to required insulation thickness specifications herein or on the drawings.

d. Equipment Insulation

HTW equipment (tanks, heat exchangers, etc.) shall be insulated with calcium silicate
precision molded block, consisting of expanded silica combined with a binder and inorganic fiber. The completed system shall be water-resistant and suitable for temperatures of at least 1200 degrees F.

e. Required Thickness

Piping insulation "above ground" shall conform to the following:

<table>
<thead>
<tr>
<th>NOMINAL PIPE SIZE</th>
<th>MINIMUM THICKNESS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; and Under</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 2&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; to 4&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>5&quot; to 6&quot;</td>
<td>3-1/2&quot;</td>
</tr>
<tr>
<td>8&quot; and Larger</td>
<td>3-1/2&quot;</td>
</tr>
</tbody>
</table>

* Calcium silicate insulation only (thickness of cement, cover, etc. not included)

f. Application of Materials (HTW EQUIPMENT) "Above Ground"

1) Require the Contractor to install insulation over steam generators and converters to completely cover all surfaces, except heads and flanges.

2) Require the application of calcium silicate block and monolithic type insulation, 2-1/2" (minimum, not including thickness of insulating cement and canvas cover) over all surfaces of equipment.

3) Secure the block insulation to the surface of the equipment with 10 gauge black annealed iron wire (or clips, nuts, etc.) welded to the metal surface.

4) Fill depressions or cavities in the surface of the equipment with block and insulating cement to provide a smooth base for the application of the block insulation. Finish curved surfaces with close fitting curved blocks.

5) Reinforce the insulation at openings and corners with metal beading securely wired in place.

6) Require the Contractor to cover the entire area of block insulation with 1" poultry netting, then apply a 1/4" coat of insulating cement and a fabric cover.

7) Allow adequate maintenance space for accessibility to all fittings and name plates. Taper the insulation to these items for such access.

g. Application of Materials (HTW EQUIPMENT HEADS and FLANGES)
1) A special insulation is required for HTW HEAT EXCHANGER HEAD SECTIONS, CONNECTING FLANGES, and ORIFICE FLANGES.

2) Removal blankets shall be installed. These shall consist of felt mineral insulation, glass fabric, and "velcro" or buckle type enclosures. Wire type closures will not be approved. The density and thickness of the felt shall be uniform to assure full insulating value.

3) The blankets shall be rated for 850 degrees F.

4) Approved manufacturer is Johns-Manville Turbine Blanket.

h. Application of Materials (PIPING) "Above Ground"

1) All required piping tests shall be completed before insulation is applied to the pipe.

2) Flanged joints shall not be insulated until after start-up when the piping system is at final operating temperature, and the flange bolts have been fully tightened.

3) Require the Contractor to insulate valve bodies and accessories with coverings equal in temperature resistance and thickness to that of the connecting piping.

4) Require the Contractor to install a short piece of pipe covering next to flanges on both sides of the joint. This will allow removal of a short piece of pipe insulation, providing access to bolts in the flange.

5) All flanges shall have blanket covers as specified above.

6) Require the Contractor to apply pipe insulation in sectional form. Fit all segments to conform to the curved surfaces to which applied. Carefully point all joints with cement and apply a thin finishing coat of insulation cement to present a smooth, even surface.

7) Fasten calcium silicate insulation securely with annealed iron wire* 6” on centers. Use the following wire gauges for the appropriate pipe size:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>WIRE GAUGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” and Smaller</td>
<td>No. 18</td>
</tr>
<tr>
<td>5” and Larger</td>
<td>No. 16</td>
</tr>
</tbody>
</table>

* Fasten each layer of insulation independently of other layers. Secure the wires and allow no projections to be visible through the canvas jacket. Fill all indentations with insulating cement for an even surface.
8) Provide expansion joints per the manufacturer’s instructions for expansion control of the finished insulation system.

9) Vertical Piping

Tack weld studs or clips to vertical sections of pipe when the rise is more than 5'-0" vertically to support the insulation and prevent displacement by slipping or contraction. Welds must conform to the welding specifications above.

10) Insulation on fittings shall be standard pipe insulation or blocks molded into sections to form a smooth exterior. Coat the exterior of the insulation with insulating cement to form neatly rounded curves. Finish in the same manner as the adjoining pipe.

11) Apply calcium silicate block insulation on valve bodies, leaving the packing nuts exposed, then securely tie the insulation with wire.

12) Where exposed metal surfaces will exceed 200 degrees F (i.e. at the edge of the insulation) rather than use a canvas covering on the insulation, apply a 6" wide strip of glass cloth over the insulation at the edge of the exposed surface. Paste the glass cloth over the affected area with suitable adhesive.

13) All piping in mechanical rooms, chases, and manholes must be labeled in accordance with the specifications provided in 3.8 HVAC.

i. Work Site Operations

1) Require the Contractor to clean the worksite at the end of each work period. Protect the equipment and building with drop cloths and procedures which minimize the migration of work materials into adjacent spaces.

2) Store materials in locations which will not interfere with the work of others.

3) Remove spatters and other defacements from structures, equipment and the work of others.

4) Leave the premises clean and free from insulation debris.

15256 Piping Insulation - Below Ground Direct Bury

a. Unless otherwise approved, all new below ground direct bury HTW piping shall be Thermacor Process, L.P. Duo Therm “505” or prior approved equal pre-insulated pipe, including extra strong schedule 80 carrier pipe. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid. Follow ALL of the manufacturer’s installation details and processes.

b. When approved for direct bury, specify the insulation of all plain (non-pre-insulated) pipe with inorganic granular insulation as follows:
1) Provide engineered inorganic non-toxic, non-flammable, sodium potassium aluminum silicate insulation with calcium carbonate filler.

2) Insulation shall be chemically treated to render it hydrophobic.

3) Insulation shall be free of asbestos.

4) Provide insulation with the following properties for below grade installations on piping systems with operating temperatures at or above 400 Degrees F:
   a) Density: 40 to 42 lb/cu ft consolidated use density.
   b) Load Bearing: 12,000 psf at consolidated density.
   c) Thermal Conductivity: $K = 0.60 \text{ BTU/hr/sq ft/degrees F/inch}$ at consolidated density and at mean temperature of 176 degrees F.
   d) $K = 0.65 \text{ BTU/hr/sq ft/degrees F/inch}$ at 300 degrees F.
   e) Temperature Range: 35 degrees F to 800 degrees F.
   f) Electrical Resistivity: Greater than $10^{-12}$ Ohm-cm.
   g) Approved Product: GILSULATE 500 or prior approved equal. All other manufacturers / products must be reviewed and approved by University Facilities Management prior to bid.

5) Provide insulation with the following properties for below grade installations on piping systems with operating temperatures below 400 degrees F.
   a) Thermal Conductivity: (ASTM C 177) $K = 0.58$ to $0.68 \text{ btu/hr/ft}^2 \text{ °F}$.
   b) Minimum Temperature Range of 0°F to 400°F (250°C).
   c) Bulk Density: 40 to 62 lbs per cubic feet (CF) installed.
   d) Load Bearing: Up to 12,000 lbs per square feet.
   e) Electrical Resistivity Range: From $R = 10$ to the 12th to $R = 10$ to the 14th OHMS-CM.
   f) Dielectric Constant: 2.7
   g) Friction Coefficient: $0.35 \pm 0.04$
   h) Water /Moisture Resistance: Withstands 10 ft hydrostatic head of water for a minimum of 14 days with moisture gain less than 0.02%.
6) Completely Non-Toxic and Environmentally Safe.

7) Approved Products: Gilsulate or Dri Therm or prior approved equal. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

8) Installation of granular insulation as required by the granular insulation manufacturer/supplier:

   a) Installation of expansion cushions as required by the manufacturer/supplier:
      
      (i) Wrap mineral fiber cushions around pipe elbows on expansion elbows and expansion loops as indicated on manufacturer’s drawings and as specified herein.
      
      (ii) Ensure there is sufficient space or flexibility between cushions to allow insulation to pour and be consolidated under piping.
      
      (iii) Secure cushion to pipe with strapping.

   b) Installation of Forms
      
      (i) Provide gypsum board forms with support posts as indicated in manufacturer’s design and installation manual.
      
      (ii) Posts must be located on the outside of the forms and spaced to prevent bowing of the gypsum board.
      
      (iii) After forms are in place, partially backfill outside of form to height of pipe.

   c) Testing of Pipe
      
      (i) Prior to installing insulation, x-ray test, number and log all pipe welds as required by other sections of the specifications.
      
      (ii) Clean pipe of dirt, scale and foreign materials.

  d) Insulation Coverage for Piping Systems
      
      Provide insulation coverage for piping systems in accordance with granular insulation manufacturer’s/supplier’s instructions.

  e) Pouring of Insulation
      
      (i) Pour insulation in short sections along the pipe axis.
(ii) Apply bitumastic to structural steel surfaces and fill trench to center line of pipe as required by the manufacturer/supplier.

(iii) Consolidate insulation using a rod-type concrete vibrator pulled along the sides and between the pipes if required by the manufacturer/supplier.

(iv) Pour and consolidate additional layers of insulation until the design coverage has been achieved.

(v) Backfill first 6 inches of soil (no stones) by hand.

(vi) Complete backfilling and mechanically compact in layers to grade levels as required by the manufacturer/supplier.

c. Interfacing New Granular Insulation to Existing Z-CRETE

1) Contractors must be made aware that most existing insulation used for the HTW system is Z-CRETE. This product was installed with a bubble wrap, surrounded by an insulating mud compound, and then wrapped inside a rubber membrane. This was then covered by sand and then back-filled with regular soil.

2) The University Project Manager shall be notified prior to any work on HTW lines.

3) Tar shall be placed at each connection point to the existing Z-CRETE membrane envelope. Tar coverage shall be 100%, extending at least 12” beyond the cut (or damaged) Z-CRETE membrane.

4) A sheetrock form shall be built and new insulation properly installed surrounding the pipe.

5) Stored insulation must be protected from moisture.

6) Under no circumstance shall any of this work be buried without notification and approval of the High Temperature Water Plant Supervisor (following inspection).

d. Repairs to Existing Z-CRETE. (See c. Interfacing New Granular Insulation to…)

1) Require the Contractor to notify the University Project Manager immediately if the Z-Crete membrane is ruptured.

2) The HTW Plant Supervisor shall determine who will make the repair and what type of repair to make. No work on this damage, nor covering of this damage shall occur without authorization.

3) Before insulation repair can be made, the membrane must be exposed by
removing dirt to a point at least 12" beyond any part of the fractured membrane.

4) If severe damage occurs, the membrane and insulation shall be removed completely from the pipe. It shall then be treated as an interface (see e. above).

5) Under no circumstance shall any of this work be buried without notification and approval of the High Temperature Water Plant Supervisor (following inspection).

e. Guarantee

The Contractor shall guarantee the installation of the insulating system for a period of one (1) year from date of acceptance by the University against deterioration of insulating value, compaction, or water leakage under normal operating conditions.

15732 HTW Steam Generators and Hot Water Heat Exchangers

a. General

HTW generators and heat exchangers shall be manufactured by Howard’s Engineering of Pico Rivera, California. The terms “converter” and “heat exchanger” are interchangeable when used in this supplement. Approval for other manufacturers will be considered after suitable field testing by the University. Prior to fabrication, submit shop drawings detailing the material, coatings, connections, appurtenances, dimensions, and arrangement of the heat exchanger.

b. All HTW heat exchangers shall operate with HTW in the tubes and secondary water or steam in the shell.

c. Show an overhead rail over each heat exchanger, complete with block and tackle, to allow head and tube removal and tube/shell cleaning. Design the heat exchanger with adequate tube removal space.

d. Locate each heat exchanger with adequate clearance for emergency egress. Valves and controls are to be located near the head, fully accessible from a standing position (without ladder and without kneeling), and maintainable from a clear access zone which will not trap a maintenance man if any part of the system fails to hold the hot media.

e. Each unit shall be factory tested prior to shipment. The factory hydrostatic test pressure for heat exchanger shall be 1.5 times the design pressure, correcting for temperature. This test shall be provided for both tube and shell sides of each unit. Provide ASME Code and National Board inspection and stamping for both the tube side and the shell side; and, furnish shop inspection certificates.

f. Design all appurtenances with allowance for expansion and contraction of all parts. Arrange the pipe and fittings to prevent rubbing and abrasion as the system parts move during temperature changes.
g. Each heat exchanger shall have factory installed supporting steel saddles (cradles) with drilled holes for anchors.

h. Prior to shipping, require the manufacturer to thoroughly clean all surfaces and apply an exterior coating suitable for the expected operating temperature specified. The coating shall include saddles and supports.

i. See the HTW equipment drawing details in this supplement for head construction and additional requirements.

j. General Construction

Provide for convenient removal and replacement of tube bundles through flanged shell openings. All connections shall be tight and free of leaks at test and operating pressures. Provide a minimum of 1/8" corrosion allowance for all carbon steel pressure parts.

k. Tube bundles shall be U-tube type, 5/8" or 3/4" O.D. seamless 18 BWG Cupro-Nickel.
   
   1) Provide double wall U-tube bundles with passive tube leak detection for domestic water converters. Provide single wall U-tube bundles and not double wall U-tube bundles on industrial water converters.
   
   2) Tube bends shall be stress relieved after bending.
   
   3) The bundle shall be designed to allow free expansion and contraction.
   
   4) The tubes shall be designed for a minimum operating pressure of 535 PSIG at 450 degrees F. They shall pass a factory hydrostatic test of 800 PSIG prior to shipment.
   
   5) The maximum pressure drop through the tubes shall be 8 FT W.C.. The maximum water velocity shall be 7 feet per second.
   
   6) Fouling factors for the shell shall be 0.001 for steam generators, 0.0005 for space heating heat exchangers, 0.003 for domestic water heating, and 0.003 for industrial water heating heat exchangers.
   
   7) Tube arrangement shall be square pitch with not less than 3/16" cleaning space between tubes.
   
   8) Tube sheets for steam generators and space heating heat exchangers shall be constructed of carbon steel plate. Tube sheets for domestic water heating and industrial water heating heat exchangers shall be constructed of 304 stainless steel plate. The surface of each sheet shall be machined for bolt clearance to allow male and female gasket seating of the flange and multiple pass partitions. See the drawing details provided in this supplement.
9) In addition to flange bolts, attach the tube sheet to the shell flange with four recessed shoulder bolts allowing the HTW head bonnet to be removed and replaced without disturbing the gasket between tube the sheet and shell flange.

10) Do not exceed 2" nut size for flange studs.

11) The tube sheet shall have two "slip-through" holes in its face for insertion of pulling eyes. Holes which are not threaded shall be protected by removable plugs.

12) Tube supports, sheets, and baffles shall be Teflon coated steel plate, adequately braced and spaced to prevent tube rattle or sag during operation.

13) Supports, sheets, and baffles shall be fabricated and arranged to prevent abrasion and wear on the tubes during expansion, contraction, or service.

The unit construction shall allow convenient removal and replacement of the tube bundle from shell.

1. HTW heads shall be constructed of flange steel ASTM A285, grade C, rated for 600 PSIG design pressure and 900 PSIG test pressure at 450 degrees F.

1) HTW heads shall be stationary bonnet type with bonnet flange rated at 600 LB TEMA class "C", with a confined gasket joint.

2) Provide radial flange side inlets and outlets as shown on the details provided herein.

3) High and low points on tube side not vented or drained by nozzles are to be provided with 1/2" (minimum) connections for venting and 3/4" (minimum) connections for draining the tube bundle. All fittings must be socket weld; no screwed fittings are allowed on the primary HTW system.

4) Heads are to be provided with lifting eyes or lugs.

5) Air Vent.

Provide 2 welded valves as shown in details with threaded nipple, 3" long, open to atmosphere.

6) HTW connection piping shall conform to ANSI Class 600 LB with the bonnet head flange rated at 600 LB TEMA Class C.

m. All heat exchanger shells shall be constructed to operate at a design pressure of 150 PSIG and a test pressure of 225 PSIG. The shells shall be factory tested prior to shipment.

1) HTW/steam generator shells and hot water heating converter shells shall be weldment fabricated using flange steel plate ASTM A285 Grade C.
HTW/domestic water converter and industrial water shells shall be fabricated with 304 stainless steel.

2) Each shell shall be x-rayed and stress relieved during fabrication at the factory.

3) High and low points of shell shall be provided with 3/4" vent (minimum) and 1-1/2" (minimum) drain connections.

4) Each shell shall be provide with an adequately sized relief valve, drip pan ell, and threaded fitting to allow the attachment of relief piping to the outside. Each safety relief valve shall be sized in accordance with ASME Code requirements.

5) Provide an aluminum or white PVC jacket with color code stripe in accordance with the section describing color code identifiers in 3.8 HVAC. If yellow PVC jacket is used, it will not be necessary to have color code stripe.

n. Steam generator shells shall be sized to provide a steam space of 55% (minimum) of the total shell volume. See the drawing details included in this supplement.

1) Steam generators shall include a steam separator and a baffle arrangement at the top of the shell to limit the passage of solids to 5 PPM with a design loading of 2500 PPM total solids in the water located in the shell, while the steam generator operates between 10% and 110% of the rated capacity.

2) The unit shall be fabricated with attachment ports for blowdown piping, feedwater piping, and chemical feed piping per the details included herein.

3) The interior of the shell shall be sandblasted to bare metal, then two coat of "Apexior No. 1" shall be applied.

4) The shell shall have an automatic surface blow down and conductivity meter factory installed and tested.

o. HTW space heating heat exchanger shells shall be sized to limit the overall shell length (including the thickness of the shell flange) to a maximum of 5 times the shell diameter. See the drawing details contained in this supplement.

1) The interior of the shell shall be sandblasted to bare metal, and at least two applications of a corrosion resistant material (suitable for the service intended) shall be applied to the internal surfaces.

2) The shell shall be inspected prior to assembly and any damage to the interior coating shall be repaired and cured prior to shipment.

p. Shell connections for all heat exchangers shall be factory installed as detailed herein. Shell connections shall be internally and externally welded to the shell. Reinforcing steel plates shall be installed where required by code.
1) All flanges shall conform to ANSI B16.5 and ASTM A181-11. They shall have a serrated raised face and can be butt welded or slip-on. Slip-on flanges shall be welded inside and outside.

2) Couplings and half couplings shall be socket weld type to conform to ASTM A105 Grade 2 for 3,000 LB.

3) Piping butt weld connections shall conform to ASTM A106 or A53 Grade B pipe. Pipe 3” and smaller shall be Schedule 80, and 4” and larger shall be Schedule 40.

4) The secondary (shell side) piping shall conform to ANSI Class 150 LB.

5) All openings shall be securely covered prior to shipping.

q. Make-up water to steam generators and space heating heat exchangers shall be soft water.

15900 Controls and Instrumentation

15901 General

a. Controls and instruments shall be provided for all HTW heat exchangers. All controls shall be wired through the emergency power system. Control power shall be 120 volts or 240 volts, field selectable.

b. Mechanical rooms where HTW equipment will operate shall be provided with:

1) Temperature gauges and metering

2) Pressure gauges and metering

3) HTW flow recorder/meter

4) HTW temperature difference recorder/meter

5) BTU meter

6) BTU totalizer meter

7) Connections to the campus central control system (as described in 3.8 HVAC, Section 15900)

15902 Control Panel Cabinet

a. Specify the installation of a control panel cabinet to house the meters, recorders, and all controllers for HTW heat exchangers. The controls, instruments, meters, etc., shall be flush mounted on the panel door. Submit shop drawings to the University prior to fabrication for approval of the panel arrangement. The minimum mounting height is
3'-0" from the floor to the cabinet bottom.

b. The panel cabinet shall be free standing or wall mounted, totally enclosed with a hinged access door(s) allowing access to the entire back of the panel. Panel doors shall close tightly.

c. Specify the panel fabricated with cold rolled steel plate and a supporting frame of sufficient for the mounting of the controls, meters, recorders, and accessory equipment.

d. Show the cabinet mounted with bolts and secured to a 4" concrete housekeeping base. Seismically brace the cabinet to withstand a 1 G horizontal impact.

e. Coat the cabinet with an undercoat rust-resistant primer, then three coats of filler, two coats of a sanding surface coat sanded smooth, and finally, two coats of sprayed lacquer.

f. Require the Contractor to provide name plates for all items mounted on the panel. These shall be black Norplex-Micarta or Bakelite with white engraved block style lettering 3/16" high.

g. Install all controls, relays, accessories, etc. inside the panel, except those items that must be remote mounted. Panel wiring and piping shall be the work of the instrument contractor.

h. The cabinet shall include a mounted wiring diagram, fuse blocks, terminal blocks for outgoing leads, and labeled wires and tubes.

i. Water piping and tubing within the cabinet shall have isolation valves between the controls and instruments and the system. Terminate outgoing piping and tubing connections at bulkhead unions.

j. Air piping and tubing shall be installed with one control air supply connection to a manifold. Provide a shut-off valve at each pipe inlet and outlet to/from the header.

15903 Heat Exchanger and Generator Controls

a. HTW heat exchanger and steam generator control valves shall be specified as manufactured by Fisher. Other proposed valves must be reviewed and approved by the University prior to bid. Downstream steam or hot water valves are specified in 3.8 HVAC. The HTW heat exchanger control valves shall have the following characteristics:

1) Normally closed, failing to the closed position on control failure, and must close against a 500 PSI “delta-P”.

2) Single seat with equal percentage flow-to-travel operation. Seat leakage shall be limited to the requirements of ANSI B16.104, Class V.
3) Cast steel valve body conforming to ANSI 600 LB specifications.

4) Fast operating pneumatic operator with repeatable accuracy.

5) Pneumatic valve positioner, factory installed (“I” to “P”), including an actual "$%" position indicator.

b. HTW heat exchanger controls serving the HTW valves shall be Powers 535 or prior approved equal by the University. Other proposed controls must be reviewed and approved by the University prior to bid. Label Each Controller by specific function (SHC - SPACE HEATING HEAT EXCHANGER, DHWC - DOMESTIC HOT WATER HEAT EXCHANGER, ABSC - ABSORBER HEAT EXCHANGER, SG - STEAM GENERATOR). The heat exchanger controls shall have the following characteristics:

1) Controls shall be reverse acting, PID, with a consistent, repeatable accuracy of plus or minus 0.5% of full scale (including hysteresis). The controls shall use a 100 OHM RTD, 3 wire DIN curve; or, a 4-20 MA signal. The controls shall have two alarm function input signals.

2) Provide "auto/manual" control with bumpless transfer.

3) The control shall provide a direct reading indication of SETPOINT, PERCENT OUTPUT, VALVE POSITION (% open), and include an IDENTIFIER SIGN describing the controlled process.

4) A loss of control air, power, or loss of a control signal shall cause a loss of control to the HTW valve, allowing the valve to fail to the closed position. Such a condition shall allow the use of the local manual override using a security pass code.

   a) Include optional 3rd and 4th outputs for additional relays to provide an out-put signal to the central control system informing the HTW Plant that the controller has failed (refer to the "manufacturer’s order option" for the Powers 535 Controller).

5) The controller shall have a slow ramp to setpoint (adjustable), for all conditions including start-up and set-point change.

6) The controller shall accept a remote set-point adjustment from the campus central computer, and shall have the ability to toggle between remote and local operation. For initial programming, unless specifically required by the HTW Plant, program the controller to operate without the remote setpoint function.

c. Make-up water controls for HTW steam generators shall include:

1) Controls to regulate the supply make-up water from the water softener to the make-up/condensate receiver tank, including all necessary operators and valves.
2) Provide feedwater controls including a float activated electric switch mounted on the HTW generator shell. The device shall be Mc Donnell Miller Number 150S, or approved equal by Mercoid or Magnetrol. The unit shall have 1" pipe tappings on the float cage and shall be fabricated with packless construction. The controller shall cycle the feedwater pumps to maintain a safe water level in the shell.

3) Provide a low water cut-out and alarm and high water level cut-out and alarm to stop the feedwater pumps, close the HTW control valve, and activate a central control alarm indicating a low water or high water level in tank. Separate indications are required at the central control monitor. This device is to be separate from the feedwater controller. Provide a McDonnell Miller Number 150 or approved equal by Mercoid or Magnetrol. The controller shall operate an electric-pneumatic relay to close the HTW control valve at either the high or low level condition in the shell. Note that the low water cut-out must be manually reset.

d. Blowdown Tank Controls for HTW Steam Generators shall include:

1) Temperature Controls to limit the temperature of the water leaving the blowdown tank to a 120 degrees F. (maximum) by mixing blowdown water in the tank with cold soft water.

2) Control valves shall be self-operated and controlled by a remote temperature bulb. Construction shall include a double seated bronze body, screwed ends, and stainless steel seats and disc. Provide with separable socket, removable liquid filled bronze bulb, bronze welds, and copper tubing with spiral weld metal cover over the capillary tubing. Each valve shall have a fully adjustable temperature setting with the temperature scale and indicator in the valve frame. Approved manufacturers are American Temperature Regulator and Trerice.

15904 Gauges and Level Indicators

a. Temperature gauges and sockets serving the HTW system shall conform to the following:

1) Sockets and wells shall be 3/4" stainless steel Type 316, socket welding type, rated for a design pressure of 1,000 PSIG at 1,000 degrees F, and tapered or machined to provide maximum contact with the stem or bulb. The stem length shall allow for the required insulation (2-1/2" extension length). Approved manufacturers are Trerice and Palmer.

2) Socket connections shall be separable union type.

3) Thermometers shall be glass tube, red reading mercury type, straight or angle as required for convenient reading from ground level. Thermometers shall be industrial grade. Approved manufacturers are Trerice, Palmer, and Weksler.

4) Thermometer case shall be 9", black finish, cast aluminum or extruded brass,
with magnifying lens, stainless steel bulb chamber, and separable socket (union type).

5) The thermometer scale shall be black on white or silvered background. The scale range shall be 100 degrees to 550 degrees F with 5 degree graduations.

b. Pressure Gauges serving the HTW system shall be wall mounted on a panel or bracket. Approved manufacturers are Helicoid, Crosby, and Trerice. The gauges shall conform to the following:

1) Pressure gauges shall be industrial quality bourdon tube type (stress relieved) constructed of stainless steel movement with welded joints, socket, and tip.

2) The case shall be flush or surface panel mounting type constructed of cast aluminum with a black finish. Mount rigidly on brackets securely fastened to the building.

3) Flanges shall be cast aluminum or iron with a black finish. Provide a screwed bezel ring to retain the glass cover. The required range for HTW service is 0 to 800 PSI.

4) The dial face shall be black figures set in a laminated plastic surface, with micrometer adjustable points. Provide a 6” dial.

5) Accessories shall include a stainless steel pressure snubber and needle valve. The needle valve shall be constructed of forged or bar stock stainless steel with stainless steel trim and a pressure rating 600 PSIG at 750 degrees F.

c. ISE-Magtech water column level indicators shall be installed on HTW steam generators, condensate receivers, and make-up tanks. The units shall be rated for 250 PSIG and shall include water gauge valves. The units shall use a magnetized indicator or series of metallic flags with the indicator magnetically coupled to the float.

1) Indicators shall provide full visibility of the water level from 2” below the low water cut-off to 2” from the top of the tank or shell. In all cases, the high level alarm position shall be visible.

2) Gauge valve holders shall be Reliance Number 403 RS with a 250 PSIG rated blowdown cock.

15905 High Temperature Water BTU Meters

a. The University requires metering of high temperature water service to its buildings. Review the proposed HTW system and estimate the total building load and capacity, then install a Fluxus ADM 7407 Liquid Ultrasonic Digital Flowmeter or preapproved equal. When system is designed for high temp and chilled water, a dual channel meter shall be selected. Provide load calculations and product specifications to the University Project Manager for each project. Copies of computer programming, wiring diagrams, manuals, and certifications will be physically provided to the HTW Plant and the University Utility Analyst.
b. High temp water BTU meters shall be a wall mounted fixed installation consisting of a BTU computer, BTU totalizer, and display device capable of measuring and reporting.

1) The BTU computer shall be a microprocessor unit and shall calculate, store and display the following properties:

a) HTW flow rate

b) Supply and return temperatures and the difference between.

c) Instantaneous MBH

d) Password protected MBtu totalizer that uses an even multiplier of 10,000 Btu, 100,000 Btu or 1,000,000 Btu.

2) The meter must be capable of transmitting calculated flow rate, energy flow rate, supply and return temperatures and an energy totalizer to the campus central computer using Modbus Rtu protocol.

3) Loss of main power or battery back-up must not erase Btu total.

4) Locate meter display in adjacent mechanical room and not in HTW mechanical room because of high ambient temperature and humidity.

5) Capable of water temperature range 0-500° Fahrenheit.

c. Specify that Contractor is responsible for parts not specified but required for installation and wire terminations.

d. The HTW flow sensor element shall be installed in the return line in a location approved by flow meter manufacturer to guarantee performance. The flow sensor should be clamped on rather than welded. Sensors requiring silicone grease resulting in scheduled maintenance are not acceptable. Piping contractor must provide upstream/downstream straight piping distances as specified by piping specifications. unless specifically stated accuracy of flow transmitter should be +/- 0.8% of reading with +/- 0.2% repeatability of flow rate. Pilot tube or orifice plate technology is not acceptable.

e. A minimum of 2 temperature sensors shall be furnished and installed in heavy duty stainless steel wells which are back welded in locations approved by the meter manufacturer.

1) Temperature sensors shall be resistance type, 100 ohm RTD. Signals should be transmitted to Btu computer via separate wiring with system accuracy of +/- 0.1%. Temperature measurements using gas or mercury filled bulbs are not allowed for Btu Calculations.
2) Supply and return RTD’s shall be matched pair and connected directly to flow computer following the meter manufacturers specifications in reference to the number of wires transmitting the signal from the RTD to the calculator.

f. Specify a requirement for a trained instrument service engineer and special documentation. Trained service engineer shall determine flow meter and temperature element location in field prior to installation of piping; and, shall calibrate all instruments and certify accuracy of installation. Record this information along with a copy of the Btu computer’s programming, wiring diagrams, manuals and certifications and include in O&M manual with any web-based information provided by having the address clearly marked. Specify 2 extra copies of this information should be bound separately and routed to the HTW Plant, the University of Utah’s Utility Analyst, and placed in the O&M manual with the building number designated on the covers. Wire termination at the field instrument location and panel location and system start-up shall be done by instrument supplier/contractor.

End of 3.8 HVAC
DESIGN REQUIREMENTS

5.0 HIGH PERFORMANCE BUILDING SYSTEM

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:
The purpose of this supplement is to acquaint the A/E with functions and standards of the University of Utah. A basic knowledge in these areas is essential before an A/E can successfully carry out its contract responsibilities.

This supplement describes University requirements which pertain to the construction of new and remodeled facilities.

ADDED:
REVISIONS SUMMARY for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>5.0</td>
<td>Whole Standard re write</td>
</tr>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>5.4 / C. / (6) / (c)</td>
<td>University of Utah Energy Standards added requirement</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 have been reformatted and re-issued as the University of Utah Supplement to the DFCM Design Manual. Most of Chapter 1 is included in the “Design Process” supplement while other chapters have become supplemental text in the “Design Requirements” volume. The University of Utah Energy Standard was removed from the former Chapter 1 and placed in this section 5.0.</td>
</tr>
</tbody>
</table>
5.0  HIGH PERFORMANCE BUILDING RATING SYSTEM (2009)

5.5  Energy

ADDED:

A.  All University of Utah projects exceeding $5 million of design and construction costs must meet the following additional minimum standards, unless the Associate Vice President for Facilities of the University of Utah approves an exception:

1)  The project must achieve a minimum of LEED v4 Silver certification.

2)  The project must specifically achieve the LEED credits as outlined in Table 2.A. Table 2.A is not inclusive of all credits allowed under LEED v4 but shows the required credits in the University of Utah’s design standards as found in Column 3, University of Utah LEED Conditions. Column 4, HPBS Requirements, shows the State of Utah’s High Performance Building Standard items that must be followed in addition to the University’s requirements; HPBS requirements not listed are either not as strict as University of Utah design requirements or not as strict as LEED requirements. LEED credits that are not listed but would be required to achieve LEED v4 Silver can be pursued at the design firms’ discretion as long as the outcome is a minimum of LEED v4 Silver certification. Table 2.A is a quick reference guide of how LEED v4 Silver, the University Design Standards and HPBS relate to each other in order for projects to meet LEED and HPBS design requirements.

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED v4</td>
<td>LEED Credit Name</td>
<td>University of Utah LEED Conditions</td>
<td>HPBS Requirements</td>
</tr>
<tr>
<td>Category</td>
<td></td>
<td></td>
<td>Projects must follow HPBS 5.15 (Owner’s Project Requirements)</td>
</tr>
<tr>
<td>or Prereq</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit</td>
<td>Integrative Process</td>
<td>Highly suggested</td>
<td>Project must follow HPBS Section 5.1 (Integrated Design Process)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location and Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LtC5</td>
<td>Access to Quality Transit</td>
<td>Required; project must earn a minimum of 1 point</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Category</td>
<td>Requirements</td>
<td>Details</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>LTC6</td>
<td>Bicycle Facilities</td>
<td>Required</td>
<td>Project must follow HPBS 5.3 E (Transportation Management--parking stalls)</td>
</tr>
<tr>
<td>LTc8</td>
<td>Green Vehicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Sustainable Sites</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSc4</td>
<td>Rainwater Management</td>
<td>Required; following campus design standards will meet the credit requirements of Path 2</td>
<td></td>
</tr>
<tr>
<td>SSc5</td>
<td>Heat Island Reduction</td>
<td></td>
<td>Project must follow HPBS 5.4 D (Heat-Island Effect)</td>
</tr>
<tr>
<td>SSc6</td>
<td>Light Pollution Reduction</td>
<td></td>
<td>Project must follow HPBS 5.4 E (Light Pollution Reduction)</td>
</tr>
<tr>
<td></td>
<td><strong>Water Efficiency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEc1</td>
<td>Outdoor Water Use Reduction</td>
<td>Required; project must earn a minimum of 1 point</td>
<td>Project must follow HPBS 5.14 (Incentives and Rebates) Please also see Materials and Resources HPBS 5.5 B requirement (Appliances and Equipment)</td>
</tr>
<tr>
<td>WEc2</td>
<td>Indoor Water Use Reduction</td>
<td>Required; project must earn a minimum of 2 points</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Energy and Atmosphere</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAp1</td>
<td>Fundamental Commissioning and Verification</td>
<td>Following the HPBS will likely meet LEED requirements AND project must follow HPBS 5.10 (Metering)</td>
<td></td>
</tr>
<tr>
<td>EAp3</td>
<td>Building-Level Energy Metering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAc1</td>
<td>Enhanced Commission</td>
<td>Required; project must earn 4 points under Option 1.</td>
<td></td>
</tr>
<tr>
<td>EAc2</td>
<td>Optimize Energy Performance</td>
<td>Required; project must earn a minimum of 13 points exclusive of consideration of cogeneration at the U. Cogeneration may be used in the LEED submittal, however.</td>
<td>Project may not go below threshold set in HPBS 5.5A(1) without DFCM review and approval</td>
</tr>
<tr>
<td></td>
<td><strong>Materials and Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRc2</td>
<td>Building Product Disclosure and Optimization--Environmental Product</td>
<td>If this credit is achieved along with Building Product Disclosure and Optimization--</td>
<td>Project must follow HPBS 5.5 B (Appliances and Equipment) Project must follow HPBS 5.7 B (Water bottle filling stations) Project must follow HPBS 5.7 D (Sustainable Material Sourcing)</td>
</tr>
<tr>
<td>MRc3</td>
<td>Building Product Disclosure and Optimization--Sourcing of Raw Materials</td>
<td>Please see above note regarding Building Product Disclosure and Optimization--Environmental Product Declarations.</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>MRc9</td>
<td>Construction and Demolition Waste Management</td>
<td>Required; project must earn a minimum of 1 point</td>
<td></td>
</tr>
<tr>
<td>IEQc2</td>
<td>Low-Emitting Materials</td>
<td>If the LEED credit is not pursued, projects must follow HPBS 5.8 (Indoor Environmental Quality) Sections C, D and E</td>
<td></td>
</tr>
<tr>
<td>IEQc3</td>
<td>Construction Indoor Air Quality Management Plan</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>IEQc4</td>
<td>Indoor Air Quality Assessment</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>IEQc6</td>
<td>Interior Lighting</td>
<td>Option 2 of this credit is required; individual spaces that require specialty finishes based on functionality may be exempted from this requirement as identified in programming documents</td>
<td></td>
</tr>
<tr>
<td>IEQc7</td>
<td>Daylight</td>
<td>If the LEED credit is not pursued, project must follow HPBS 5.8 I (Access to daylights and views)</td>
<td></td>
</tr>
<tr>
<td>IEQc8</td>
<td>Quality Views</td>
<td>If the LEED credit is not pursued, project must follow HPBS 5.8 I (Access to daylights and views)</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td></td>
<td>Required; project must earn 1</td>
<td></td>
</tr>
</tbody>
</table>
1) The project must comply with the University’s Measurement and Verification Plan. The Plan is available on the University’s Facilities Management web site: [http://facilities.utah.edu/project-resources/documents-standards/MV-4-30-14.pdf](http://facilities.utah.edu/project-resources/documents-standards/MV-4-30-14.pdf)

*End of 5.0 High Performance Building Rating System*
DFCM REQUIREMENTS

6.0 SUMMARY of PRODUCTS and VENDORS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016

The University of Utah
FACILITIES MANAGEMENT
V. Randall Turpin University Services Building
1795 E. South Campus Drive, Room 201
Salt Lake City, Utah 84112-9403
Phone (801) 581-4707
FAX (801) 581-6081
ADDED SECTION:

1. The intent of this Section 6.0 is to provide a central repository for the manufacturers, vendors and products that are found in the University supplement, and are therefore specifically needed by the University. This supplement lists items with approved products, manufacturers, vendors, etc., (one product or a small group of products) which represent the required quality standard for each item. Some of these items are “sole source” and will be specified without the opportunity for substitution.

2. During the bidding process and prior to the bid due date, the A/E will assist the University in the evaluation of substitution requests (prior approval requests) submitted by vendors / suppliers.
   a. These requests for prior approval will generally be submitted to the A/E no later than a deadline established by Facilities Business Services and placed in the bidding documents.
   b. Each substitution request will be evaluated by the A/E who will forward a summary of its recommendations to the University in a proposed addendum format for University review. The A/E will submit the proposed addendum to both the University Project Manager and to Facilities Business Services/Contracts. The University Project Manager will distribute the proposed substitutions to Facilities Management for shop review.
   c. Upon approval of the A/E’s recommendation by Facilities Management, Facilities Business Services will post the A/E’s addendum in the University’s web based bid system.
   d. The A/E shall not distribute addenda to bidding contractors / vendors.

2. Product changes or special design circumstances may suggest a deviation from these standards. For all University projects, any anticipated change to, or variance from any portion of the supplement will require a review by the Design Standards Committee. Each request for change or variance must be submitted through the University Project Manager to the committee on the appropriate form found in Design Process, University of Utah Supplement or on the Facilities web site.
## 6.0 SUMMARY OF PRODUCTS AND VENDORS

**ADDED New Section for University of Utah Projects:**

### 6.1 General (DESIGN REQUIREMENTS 1.0)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- - -</td>
<td>No vendors or products are identified in 1.0 General.</td>
<td>- - -</td>
<td>- - -</td>
</tr>
</tbody>
</table>

### 6.2 Codes, Laws, Rules and Regulatory Requirements (DESIGN REQUIREMENTS 2.0)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- - -</td>
<td>No vendors or products are identified in 2.0 Codes, etc.</td>
<td>- - -</td>
<td>- - -</td>
</tr>
</tbody>
</table>

### 6.3 General (DESIGN REQUIREMENTS 3.1)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 / J. / (6)</td>
<td>Sediment Control at Open Utilities</td>
<td>• Royal Environmental Systems, Inc. InfraSafe Sediment Control Barrier</td>
<td>• Similar To (No Prior Approval Required)</td>
</tr>
</tbody>
</table>

### 6.4 Civil (DESIGN REQUIREMENTS 3.2)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 / D. / (7) / d.</td>
<td>Surveyor’s Submittals</td>
<td>• AutoCAD Civil 3D</td>
<td>• Sole Source, No Other Products Approved (Compatibility Requirements)</td>
</tr>
</tbody>
</table>
### 6.4 Civil Page 2 of 2 (concluded)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 / L. / (6) / h. / 4</td>
<td>Ball Valves</td>
<td>● Apollo</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.2 / L. / (6) / h. / 5</td>
<td>Valves, Air and Vacuum</td>
<td>● DeZurik/APCO ● Crispen-Multiplex ● G-A Industries</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
</tbody>
</table>

### 6.5 Architectural (Design Requirements 3.3)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 / C. / (11) and (14) / b.</td>
<td>Roof Boards (High Traffic)</td>
<td>● Georgia-Pacific “DensDeck”</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / C. / (12) / a.</td>
<td>Roof Under Overburden</td>
<td>● Hydrotech “Garden Roof”</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / C. / (18) / a. / 1</td>
<td>Roof Conduit and Pipe Supports</td>
<td>● PipePier Support Systems</td>
<td>● Similar To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.3 / C. / (19)</td>
<td>Roof Membrane Termination Sealant</td>
<td>● Dow 795 / 790</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / C. / (21) / a.</td>
<td>Roof Penetration Sealant</td>
<td>● Dow 890</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / C. / (22) / a.</td>
<td>Roof Drain Domes</td>
<td>● Josam ● Smith ● Wade ● Zurn</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / C. / (22) / c. / 1</td>
<td>Roof Curb</td>
<td>● Unistrut</td>
<td>● Similar To (No Prior Approval Required)</td>
</tr>
</tbody>
</table>
### 6.5 Architectural Page 2 of 5 (continued)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 / I. / (8)</td>
<td>ADA Curb Ramps</td>
<td>● Cast In Tact</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.3 / M. / 04210 / a.</td>
<td>Face Brick</td>
<td>● Interstate Brick Company (SLC) Baja Brown, Matte</td>
<td>● No Other Products / Manufacturers Allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Interpace Industries, Inc. Desert Brown, Wirecut</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Robinson Brick Company Colorado Rose</td>
<td></td>
</tr>
<tr>
<td>3.3 / M. / 07120 / a. / 3 / a)</td>
<td>Waterproofing, Fluid Applied</td>
<td>● American Hydrotech, Inc. Monolithic Membrane #6125</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Grace Construction Products Procor 20, and/or 75</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Barrett Company Ram-Tough 250 DM</td>
<td></td>
</tr>
<tr>
<td>3.3 / M. / 07910</td>
<td>Joint Sealants</td>
<td>● Dow Corning #780</td>
<td>● Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Thiokol Base Federal Specification TT-S-00227</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Hornflex</td>
<td></td>
</tr>
<tr>
<td>3.3 / M. / 08710 / b.</td>
<td>Electronic Locks</td>
<td>● CCure</td>
<td>● Sole Source, No Other Products Approved (Standardized Security Requirements)</td>
</tr>
<tr>
<td>3.3 / M. / 08710 / b. / 5)</td>
<td>Electronic Locks, Interior, for Buildings without CCure</td>
<td>● Essex</td>
<td>● Sole Source, No Other Products Approved (Standardized Security Requirements)</td>
</tr>
<tr>
<td>3.3 / M. / 08710 / b. / 6)</td>
<td>Electronic Locks, Interior, for Doors without Power</td>
<td>● Locknetics</td>
<td>● Sole Source, No Other Products Approved (Standardized Security Requirements)</td>
</tr>
<tr>
<td>LOCATION</td>
<td>PRODUCT DESCRIPTION</td>
<td>UNIVERSITY APPROVED VENDOR / MGFR</td>
<td>PROCUREMENT REQUIREMENT</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>3.3 / M. / 08710 / c.</td>
<td>Cylinder Locks</td>
<td>● <strong>Schlage</strong> “Standard 6 Pin Format” / L Series / ND Series</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / M. / 08710 / c. / 1) / b)</td>
<td>Panic Bars</td>
<td>● <strong>Von Duprin</strong> 99 Series or 33 Series</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / M. / 08720 / b.</td>
<td>Door Closers</td>
<td>● <strong>LCN</strong> #4041 Series (domestic mfgr)</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.3 / M. / 08730 / f.</td>
<td>Door Openers, Automatic</td>
<td>● <strong>LCN</strong> #4611 or #4622</td>
<td>● For Other Products, Prior Approval is Required</td>
</tr>
</tbody>
</table>
| 3.3 / M. / 09680 / i. / 1) | Rubber Base        | ● **Johnsonite**  
● **Burke**  
● **Roppe**  
● **VPI** | ● Similar / Equal To (No Prior Approval Required) |
| 3.3 / M. / 09900 / c. / 1) | Paints, Interior   | ● **Pratt and Lambert**  
ProHide or Cellu-tone or Vitralite  
● **Sherwin Williams**  
ProMar 200  
● **Dupont** 76  
● **Kwal-Howells** Accu-Pro Satin 1910 | ● No Other Products Allowed |
| 3.3 / M. / 09900 / c. / 2) | Paints, Exterior   | ● **Pratt and Lambert**  
● **Ameritone**  
● **Glidden**  
● **Sherwin Williams**  
● **Kwal-Howells** | ● No Other Manufacturers Allowed |
| 3.3 / M. / 09950 / a. / 2) | Wall Coverings     | ● **Vicretex**  
● **Essex** | ● Similar / Equal To (No Prior Approval Required) |
<p>| 3.3 / M. / 10110 / a. | Chalkboards and Markerboards | ● <strong>ADP Lemco</strong> | ● Similar / Equal To (No Prior Approval Required) |</p>
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 / M. / 10520 / a. / 1)</td>
<td>Portable Fire Extinguishers, Electronically Monitored</td>
<td>● Mija, Inc.</td>
<td>● For Other Products, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / M. / 10800 / a. / 1) / a)</td>
<td>Towel Dispenser <em>(Owner Furnished, Contractor Installed)</em></td>
<td>● Steiner SST</td>
<td>● Sole Source, No Other Products Approved <em>(Standardized Maintenance Requirements)</em></td>
</tr>
<tr>
<td>3.3 / M. / 10800 / a. / 1) / b)</td>
<td>Soap Dispenser <em>(Owner Furnished, Contractor Installed)</em></td>
<td>● Ullitmatic L-3</td>
<td>● Sole Source, No Other Products Approved <em>(Standardized Maintenance Requirements)</em></td>
</tr>
<tr>
<td>3.3 / M. / 10800 / a. / 1) / c)</td>
<td>Toilet Paper Dispenser <em>(Owner Furnished, Contractor Installed)</em></td>
<td>● Ullitmatic S-44C</td>
<td>● Sole Source, No Other Products Approved <em>(Standardized Maintenance Requirements)</em></td>
</tr>
</tbody>
</table>
| 3.3 / M. / 10800 / b. | Toilet Accessories | ● American Specialties, Inc.  
● Bobrick Washroom Equipment, Inc.  
● Bradley Corporation | ● No Other Manufacturers Allowed |
| 3.3 / M. / 11600 / a. / 1) | Laboratory Casework | ● Sheldon  
● Hamilton  
● Kewaunee  
● Granite Mill Graniteline | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.3 / M. / 11600 / b. and 1) | Laboratory Tops | ● Prime Industries  
● Laboratory Tops, Inc.  
● Durcon  
● Epoxyn Products | ● No Other Manufacturers Allowed |
| 3.3 / M. / 11600 / d. | Laboratory Waste and Drain Piping, Substitute for Pyrex | ● Durcon  
● Duriron | ● No Other Manufacturers Allowed |
### 6.5 Architectural Page 5 of 5 (concluded)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 / M. / 11600 / f.</td>
<td>Paper Towel Dispenser, Laboratory Casework</td>
<td>● Scott 995</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / M. / 12505 / a.</td>
<td>Louver Blinds, Horizontal</td>
<td>● Bali Classic Blind Series 3000</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.3 / M. / 13170 / b.</td>
<td>Floor, Waterproof, Washable</td>
<td>● Crossfield Products Dex-O-Tex</td>
<td>● Similar / Equal To (No Prior Approval Required)</td>
</tr>
</tbody>
</table>

### 6.6 Structural (Design Requirements 3.4)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- - -</td>
<td>No vendors or products are identified in 3.4 Structural</td>
<td>- - -</td>
<td>- - -</td>
</tr>
</tbody>
</table>

### 6.7 Mechanical Part 1 General HVAC, Plumbing, Fire Protection (Design Requirements 3.5)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 / C. / (19) / 4</td>
<td>Covers, Heated, for Reduced Pressure Backflow Prevention Devices</td>
<td>● Hot-Box</td>
<td>● Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.5 / C. / (26)</td>
<td>Pipe Restraints, Mechanical</td>
<td>● Megalug</td>
<td>● Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.5 / G. / (2) / a. / 2</td>
<td>Lighting, Emergency</td>
<td>● Active Safety Corporation Model PSL 11000</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / G. / (2) / a. / 2</td>
<td>Adhesive, Emergency Lighting</td>
<td>● Durabond 3001</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
</tbody>
</table>
### 6.7 Mechanical Part 1 Page 2 of 14: General HVAC, Plumbing, Fire Protection (continued)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
</table>
| 3.5 / G. / (6) / m. | Door, Pressure Relief | ● Ruskin Model PRD18 (basis for U of U specifications)  
● Greenheck Fan Corporation  
● AJ Manufacturing | ● For Other Product / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15051 / h. / 2) | Paint, Identification | ● DeVoe Mirrolac  
● Pratt and Lambert  
● Glidden  
● Rust-Oleum  
● Sherwin Williams | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / f. / 4) and o / 5) | Couplings, Mechanical Grooved Pipe | ● Victaulic  
● Gruvlok  
● Grinnell | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / o. / 2) | Pipe, Fire Protection, 2” & Under | ● Allied Tube-Sprinkler Dyna-Thread | ● Or Schedule 40 Black Steel Pipe |
| 3.5 / EE. / 15061 / o. / 3) | Pipe, Fire Protection, CPVC | ● Lubrizol BlazeMaster | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / q. / 5) / a) | Waste & Vent, Acid Resistant, Borosilicate Glass | ● Kimax  
● CHEM Flowtronics  
● H.S. Martin, Inc. | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / q. / 5) / b) | Waste & Vent, Polypropylene Acid Resistant | ● GSR Fuseal  
● Enfield  
● Orion | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / q. / 5) / c) | Waste & Vent, Acid Resistant, CPVC, Above Ground | ● Spears LabWaste | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15061 / u. / 2) / a) | Pipe, Distilled, DI, Demineralized, RO | ● GSR/Sloan (basis for U of U specifications)  
● Harvel  
● PureTech | ● For Other Products / Manufacturers, Prior Approval is Required |
### Mechanical Part 1 Page 3 of 14: General HVAC, Plumbing, Fire Protection (continued)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 / EE. / 15061 / v.</td>
<td>Pipe, Ultra Pure</td>
<td>● Spears Manufacturing Company (basis for U of U specifications) ● Harvel ● PureTech</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15062 / b.</td>
<td>Seals, Resilient, Bell &amp; Spigot</td>
<td>● Ty-Seal</td>
<td>Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.5 / EE. / 15062 / b. / 5)</td>
<td>Waste &amp; Vent, Acid Resistant, Below Ground</td>
<td>● GSR Fuseal ● Enfield ● Orion ● Spears LabWaste</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15065 / b.</td>
<td>Pipe Hangers and Supports</td>
<td>● ITT Grinnell ● B-Line ● Anvil International</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15066 / a. / 1)</td>
<td>Pipe Cleaning See also 3.5 / EE. / 15435 / d. / 5) and 3.5 / GG. / 15069 / a.</td>
<td>● Water and Energy Systems Technology (W.E.S.T.)</td>
<td>No Other Products / Manufacturers Allowed (W.E.S.T. is a University contract vendor selected by advertised procurement)</td>
</tr>
<tr>
<td>3.5 / EE. / 15066 / f.</td>
<td>HVAC Pipe Glycol Systems</td>
<td>● JEFFCOOL P150 ● Dow Dowfrost</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15100 / a. / 8)</td>
<td>Control Valves</td>
<td>● Johnson Controls, Inc. Metasys ● Trane US, Inc. Trane ● Wasatch Controls Honeywell</td>
<td>No Other Products / Manufacturers Allowed (These Contractors were selected by advertised procurement)</td>
</tr>
<tr>
<td>3.5 / EE. / 15100 / c. / 1)</td>
<td>Gate Valves, 2” and Smaller, Low Pressure Steam / Condensate</td>
<td>● Nibco T-111, T-113 (basis for U of U specifications) ● Crane ● Stockham ● Powell</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15100 / c. / 2)</td>
<td>Gate Valves, 2 ½” and Larger, Low Pressure Steam / Condensate</td>
<td>● Nibco F-617-O, F619 (basis for U of U specifications) ● Crane ● Stockham ● Powell</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
</tbody>
</table>
### 6.7 Mechanical Part 1 Page 4 of 14: General HVAC, Plumbing, Fire Protection (continued)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
</table>
| 3.5 / EE. / 15100 / c. / 3) | Globe Valves, 2” and Smaller, Low Pressure Steam / Condensate | • Nibco T-235-Y (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / c. / 4) | Globe Valves, 2 ½” and Larger, Low Pressure Steam / Condensate | • Nibco F-718-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / c. / 5) | Check Valves, 2” and Smaller, Low Pressure Steam / Condensate | • Nibco T-413-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / c. / 6) | Check Valves, 2 ½” and Larger, Low Pressure Steam / Condensate | • Nibco F-918-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / c. / 7) | Strainers, 2” and Smaller, Low Pressure Steam / Condensate | • Watts 77S (basis for U of U specifications)  
• Conbraco  
• Armstrong | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / c. / 8) | Strainers, 2 ½” and Larger, Low Pressure Steam / Condensate | • Watts 77F-125 (basis for U of U specifications)  
• Conbraco  
• Armstrong | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 1) | Gate Valves, 2” and Smaller, High Pressure Steam | • Nibco T-154-SS, T-176-SS (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 2) | Gate Valves, 2 ½” and Larger, High Pressure Steam | • Nibco F-667-O, F-669 (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | • For Other Products / Manufacturers, Prior Approval is Required |
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
</table>
| 3.5 / EE. / 15100 / d. / 3) | Globe Valves, 2” and Smaller, High Pressure Steam | • Nibco T-256-AP (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 4) | Globe Valves, 2 ½” and Larger, High Pressure Steam | • Nibco F-768-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 5) | Check Valves, 2” and Smaller, High Pressure Steam | • Nibco T-453-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 6) | Check Valves, 2 ½” and Larger, High Pressure Steam | • Nibco F-968-B (basis for U of U specifications)  
• Crane  
• Stockham  
• Powell | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 7) | Strainers, 2” and Smaller, High Pressure Steam | • Watts 77S (basis for U of U specifications)  
• Conbraco  
• Armstrong | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / d. / 8) | Strainers, 2 ½” and Larger, High Pressure Steam | • Watts 77F-250 (basis for U of U specifications)  
• Conbraco  
• Armstrong | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / f. / 1) | Ball Valves, Domestic Water | • Watts B-6080 (basis for U of U specifications)  
• Nibco  
• Apollo | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / f. / 2) | Gate Valves, Domestic Water (Limited) | • Nibco T-111, T-113  
• Crane 428, 438 | No Other Products Allowed |
| 3.5 / EE. / 15100 / f. / 3) | Globe Valves, Domestic Water | • Nibco S-235  
• Crane 7TF | No Other Products Allowed |
| 3.5 / EE. / 15100 / f. / 5) | Check Valves, Domestic Water | • Nibco S-480-B  
• Crane 37 | No Other Products Allowed |
| 3.5 / EE. / 15100 / f. / 6) | Strainers, Domestic Water | • Watts 777 | Sole Source, No Other Products Approved (Standardized Maintenance Requirements) |
| 3.5 / EE. / 15100 / g. / 2 | Butterfly Valves, Compressed Air | ● Crane “Monarch” 21 (basis for U of U specifications)  
● Nibco (WD2100 or LS 2100) | ● For Other Product / Manufacturers, Prior Approval is Required |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 / EE. / 15100 / g. / 3 / a</td>
<td>Lift Check Valves, 1 ½” and Smaller, Compressed Air</td>
<td>● Crane 117 ATJ</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15100 / g. / 3 / b</td>
<td>Swing Check Valves, 2” and Smaller, Compressed Air</td>
<td>● Crane No. 41TF</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
</tbody>
</table>
| 3.5 / EE. / 15100 / g. / 3 / c | Swing Check Valves, 2 ½” and Larger, Compressed Air | ● Nibco F-918-B  
● Crane 373 | ● No Other Products Allowed |
| 3.5 / EE. / 15100 / i. / 1 | Natural Gas Valves, 2” and Smaller | ● Apollo G-B-10 (basis for U of U specifications)  
● Nibco GB1A or GB2A (size restricted) | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / i. / 3 | Valves, Earthquake Actuated | ● PSP California KOSO | ● For Other Products, University Field Testing for Approval is Required |
| 3.5 / EE. / 15100 / j. / 1 | Valves, Expansion, Refrigeration | ● Alco (basis for U of U specifications)  
● Parker Hannifin (including Sporlan)  
● Henry Technologies  
● Mueller Refrigeration | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / j. / 2 | Filter-Driers, 5/8” and Smaller, Refrigeration | ● Alco (basis for U of U specifications)  
● Parker Hannifin (including Sporlan)  
● Mueller Refrigeration | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / j. / 3 | Filter-Driers, ¾” and Larger, Refrigeration | ● Alco (basis for U of U specifications)  
● Parker Hannifin (including Sporlan)  
● Mueller Refrigeration | ● For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / j. / 4 | Sight Glasses, Refrigeration | ● Alco (basis for U of U specifications)  
● Parker Hannifin (including Sporlan)  
● Mueller Refrigeration | ● For Other Products / Manufacturers, Prior Approval is Required |
<p>| 3.5 / EE. / 15100 / j. / 5 | Solenoid Valves, Refrigeration | ● Alco (basis for U of U specifications) | ● For Other Products / Manufacturers, Prior Approval is Required |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Vendors</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 3.5 / EE. / 15100 / j. / 6) | Valves, Manual Refrigerant Shut-Off | ● Asco  
● Parker Hannifin (including Sporlan) | Prior Approval is Required                                                                  |
| 3.5 / EE. / 15100 / j. / 7) | Flexible Connectors, Refrigeration | ● Apollo Conbraco (basis for U of U specifications)  
● Superior Refrigeration Products  
● Mueller Refrigeration  
● Henry Technologies  
● Virginia | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / k. | Valves, Distilled, DI, Demineralized, RO | ● Chicago 869A | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15100 / l. | Ball Valves, Medical Gas | ● Chemtron  
● Ohio Medical | No Other Manufacturers Allowed |
| 3.5 / EE. / 15106 / a. / 2) | Flow Meters, Venturi | ● Armstrong AVP  
● Rinco  
● Barco | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15106 / b. / 3) | Thermometers, Glass | ● Ametek  
● Marsh  
● Marshalltown  
● Trerice  
● Weiss | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15106 / c. / 2) | Pressure Gage Cocks | ● Apollo 77-100 | Similar / Equal To (No Prior Approval Required) |
| 3.5 / EE. / 15106 / c. / 4) | Pressure Gauges | ● Ametek  
● Marsh  
● Marshalltown  
● Trerice  
● Weiss | For Other Products / Manufacturers, Prior Approval is Required |
<p>| 3.5 / EE. / 15106 / d. / 5) | P/T Connector Plugs | ● Flow Design, Inc. Super Seal | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15106 / e. / 5) | BTU Meters | ● Fluxus ADM 7407 | For Other Products / Manufacturers, Prior Approval is Required |</p>
<table>
<thead>
<tr>
<th>Requirement Code</th>
<th>Product Description</th>
<th>Manufacturer(s)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 / EE. / 15251 / c.</td>
<td>Insulation, Refrigerant Suction Piping</td>
<td>● Amaflex</td>
<td>Prior Approval is Required. Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.5 / EE. / 15251 / d.</td>
<td>Insulation Covers, Fittings and Valves</td>
<td>● Zeston</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15251 / g.</td>
<td>Insulation Protection Inserts and Shields</td>
<td>● Grinnell Fig. 167</td>
<td>Similar / Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.5 / EE. / 15258 / a.</td>
<td>Insulation Facing</td>
<td>● Kraft FRK-25</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15258 / c. and d.</td>
<td>Tape, Duct Insulation</td>
<td>● Kraft Tape</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15258 / e.</td>
<td>Acoustical Insulation, Duct Lining</td>
<td>● Schuller Permacote Linacoustic, ● CertainTeed Ultralite with Certa*Edge Coat, ● Owens Corning QuietR</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15351 / c.</td>
<td>Air Compressors</td>
<td>● Quincy Compressor, ● FS-Curtis Air Compressors, ● Ingersoll-Rand Company</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15353 / a. / 7)</td>
<td>Vacuum Pumps</td>
<td>● Quincy Compressor, ● FS-Curtis Air Compressors, ● Ingersoll-Rand Company</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15400 / a. / 4) / d)</td>
<td>Backflow Preventer / Vacuum Breaker, Reduced Pressure Type</td>
<td>● Febco 825Y, ● Watts 909</td>
<td>No Other Products Allowed</td>
</tr>
<tr>
<td>3.5 / EE. / 15400 / a. / 4) / d)</td>
<td>Backflow Preventer / Vacuum Breaker, Pressure Type</td>
<td>● Febco 765, ● Watts 800</td>
<td>No Other Products Allowed</td>
</tr>
<tr>
<td>3.5 / EE. / 15400 / a. / 4) / d)</td>
<td>Backflow Preventer / Vacuum Breaker, Atmospheric Type</td>
<td>● Febco 710, 715, ● Watts 288A</td>
<td>For Other Products / Manufacturers,</td>
</tr>
<tr>
<td>Section</td>
<td>Item</td>
<td>Description</td>
<td>Approved Vendors</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td>3.5 / EE. / 15400 / a. / d</td>
<td>Backflow Preventer / Vacuum Breaker, Double Check Type</td>
<td>- Febco 805Y  - Watts 700</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15401 / a. / 2</td>
<td>Water Pressure Regulator</td>
<td>- Watts U5B (size restricted)  - CLA-VAL 790 (size restricted)</td>
<td>● No Other Products Allowed</td>
</tr>
<tr>
<td>3.5 / EE. / 15405 / c.</td>
<td>Manhole Drop Connection / Flow Diversion</td>
<td>- Royal Environmental Systems IntraFlow</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / c. / 1</td>
<td>Water Softening or Conditioning Equipment</td>
<td>- GE Osmonics  - Pacific Water Inc  - Water Specialties  - McCook Sales</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / d. and 1</td>
<td>Conductivity Controller</td>
<td>- Lakewood 250</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / d. / 1</td>
<td>Motorized Ball Valve</td>
<td>- Worcester</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / d. / 2</td>
<td>Chemical Feed System</td>
<td>- Neptune 500, 500A</td>
<td>● Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / d. / 5</td>
<td>Water Treatment  See also 3.5 / EE. / 15066 / a. / 1 and 3.5 / GG. / 15069 / a.</td>
<td>- Water and Energy Systems Technology (W.E.S.T.)</td>
<td>● Sole Source, No Other Vendors Approved (W.E.S.T. is a University contract vendor selected by advertised procurement)</td>
</tr>
<tr>
<td>3.5 / EE. / 15435 / e.</td>
<td>Controller, Chiller Condenser Water Treatment</td>
<td>- Pulsafeeder PULSAtrol MCT210-B-C-F-L1-M3-WE</td>
<td>● For Other Products, University Field Tests for Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15450 / j. / 1</td>
<td>Emergency Eye Wash / Emergency Showers</td>
<td>- Haws  - Bradley  - Guardian</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / EE. / 15450 / j. / 2</td>
<td>Plumbing Fixtures</td>
<td>- American Standard (including Eljer)</td>
<td>● For Other Products / Manufacturers,</td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Approved Vendors</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-----------------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| 3.5 / EE. / 15450 / j. / 3 | Floor & Roof Drains, Carriers, Etc. | - Kohler  
- Zurn  
- Elkay | Prior Approval is Required

- Zurn  
- J. R. Smith  
- Josam  
- Wade | For Other Products / Manufacturers, Prior Approval is Required

- Chicago Faucets  
- Elkay  
- T & S Brass | For Other Products / Manufacturers, Prior Approval is Required

- Sloan  
- Zurn (Z6000 Series only) | No Other Products / Manufacturers Allowed

- Global Vision, Inc. Zonecheck Automatic Flow Switch Tester | For Other Products / Manufacturers, Prior Approval is Required

- Comfort-Aire  
- Amana | No Other Manufacturers Allowed

- Fujitsu  
- Mitsubishi | No Other Manufacturers Allowed

- Carrier  
- Trane  
- York | For Other Products / Manufacturers, Prior Approval is Required

- Carrier  
- Trane  
- York | For Other Products / Manufacturers, Prior Approval is Required

- Tower Engineering, Inc.  
- Marley Cooling Technologies  
- Composite Cooling Solutions, L.P. | For Other Products / Manufacturers, Prior Approval is Required

- Tower Engineering, Inc.  
- Marley Cooling Technologies  
- Composite Cooling Solutions, L.P. | For Other Products / Manufacturers, Prior Approval is Required

- Evapco  
- BAC  
- Marley Cooling Technologies | For Other Products / Manufacturers, Prior Approval is Required

- Fulton  
- KN | For Other Products / Manufacturers,
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Vendors</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 3.5 / EE. / 15700 / f. | Boilers, Over 1,000,000 BTUh Input | ● Lochinvar  
● Cleaver Brooks  
● Burnham  
● Rite Boilers  
● Hurst | Prior Approval is Required  
For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15710 / g. | Pumps                                      | ● Bell and Gossett  
● Taco  
● Paco  
● Armstrong | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15730 / c. / 4) | Plate and Frame Heat Exchangers | ● Tranter  
● Bell and Gossett  
● Armstrong  
● Alfa-Laval | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15740 / g. | Terminal Units, VAV | ● Anemostat  
● Krueger  
● Titus | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15770 / s. | Packaged Air Handling / Rooftop Units | ● Carrier  
● Trane  
● York | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15775 | Computer Room Units | ● Liebert | For Other Vendors, University Field Tests for Approval is Required |
| 3.5 / EE. / 15821 / a. | Centrifugal Fans | ● New York Blower  
● Aladdin  
● Barry Blower  
● Pace | For Other Products / Manufacturers, Prior Approval is Required |
| 3.5 / EE. / 15821 / b. | Vane-Axial Fans | ● Strobic-Air  
● Joy | Similar Manufacturers Allowed  
For Use of this Fan System, Prior Approval is Required |
| 3.5 / EE. / 15821 / e. | Enclosures | ● Industrial Acoustics Company | Similar / Equal To  
(No Prior Approval Required) |
| 3.5 / EE. / 15860 / c. | Pressure Gauge | ● Dwyer 605 Series | Similar / Equal To  
(No Prior Approval Required) |
| 3.5 / EE. / 15900 / a. / 1) | Automatic Temperature Control Systems | ● Johnson Controls, Inc. MSEA  
● Trane US, Inc. Trane  
● Wasatch Controls Honeywell | No Other Products / Manufacturers Allowed  
(These Contractors were selected by advertised procurement) |
### Design Requirements

#### 6.0 Summary of Products and Vendors

**University of Utah Supplement**

| 3.5 / EE. / 15900 / a. / 2) | Building Automation Systems | **Johnson Controls, Inc.** Metasys  
**Trane US, Inc.** Trane  
**Wasatch Controls** Honeywell | **No Other Products / Manufacturers Allowed** (These Contractors were selected by advertised procurement) |
|-----------------------------|-----------------------------|---------------------------------|--------------------------------------------------------------------------------|
| 3.5 / EE. / 15902 / a.      | Controllers                 | **Johnson Controls, Inc.** Metasys  
**Trane US, Inc.** Trane  
**Wasatch Controls** Honeywell | **No Other Products / Manufacturers Allowed** (These Contractors were selected by advertised procurement) |
| 3.5 / EE. / 15904 / c.      | Wave Tracking Filter        | **EFI**                          | **For Other Products / Manufacturers, Prior Approval is Required** |
| 3.5 / EE. / 15908 / a.      | ATC Control Panels          | **Corbin CAT-38 or CAT-102**     | **Sole Source, No Other Products Approved** (Standardized Maintenance Requirements) |
| 3.5 / EE. / 15910 / a.      | ATC Controller (ATCC) Software | **MicroSoft Windows**            | **Similar Manufacturers Allowed**  
**Must be Compatible, Prior Approval is Required** |

---

### Mechanical Part 2 Laboratory Ventilation (Design Requirements 3.5)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
</table>
| 3.5 / FF. / 3.2.7 | Hood Manufacturers | **Thermo Scientific Hamilton**  
**Kewaunee Scientific Corporation**  
**Labconco Corporation**  
**ALC-Collegedale**  
**Mott Manufacturing, Ltd.** | **For Other Products / Manufacturers, Prior Approval is Required** |
| 3.5 / FF. / 3.3.3.1 | Flow Measuring Device | **Phoenix Controls**  
**TSI Incorporated** | **For Other Products / Manufacturers, Prior Approval is Required** |
| 3.5 / FF. / 5.3.3.1 | Coatings, Exhaust Fan | **Eisenheiss**  
**Heresite** | **For Other Products / Manufacturers, Prior Approval is Required** |
### Mechanical Part 3 High Temperature Hot Water System (Design Requirements 3.5)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 / GG. / (4) / 15062 / a.</td>
<td>Pre-insulated HTW Pipe, Below Grade</td>
<td>● Thermacor Process, L.P. Duo Therm “505”</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15062 / c.</td>
<td>Fittings, 2” &amp; Smaller, Below Grade</td>
<td>● Grinnell</td>
<td>● No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15062 / d.</td>
<td>Fittings, 2 ½” &amp; Larger, Below Grade</td>
<td>● Grinnell, Ladish</td>
<td>● No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15063 / c.</td>
<td>Fittings, 2” &amp; Smaller, Mechanical Rooms &amp; Tunnels</td>
<td>● Grinnell, Ladish</td>
<td>● No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15065 / c.</td>
<td>Gaskets</td>
<td>● Flexitallic</td>
<td>● Sole Source, No Other Products Approved, No Other Vendors Approved</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15069 / a.</td>
<td>Pipe Cleaning, HTW Piping, Internal</td>
<td>● Water and Energy Systems Technology (W.E.S.T.)</td>
<td>● Sole Source, No Other Vendors Approved, W.E.S.T. is a University contract vendor selected by advertised procurement</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15069 / d. / 2</td>
<td>Boil-Out Cleaner</td>
<td>● Water and Energy Systems Technology (W.E.S.T.) B 802 Caustic High pH Boil-Out Cleaner</td>
<td>● Sole Source, No Other Vendors Approved, W.E.S.T. is a University contract vendor selected by advertised procurement</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15090 / a.</td>
<td>Pipe Hangers, Supports &amp; Anchors</td>
<td>● Blaw Knox, Fee &amp; Mason, Grinnell</td>
<td>● No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15090 / g.</td>
<td>Cathodic Protection at Wall Entry</td>
<td>● O’Brien Mira-Plate Primer, Hi Luster, Westglas 920, 930</td>
<td>● No Other Products Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15100 / b.</td>
<td>HTW Valves</td>
<td>● Crane, Velan, Vogt, RP&amp;C</td>
<td>● No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15100 / 1.</td>
<td>Special Valve Operators</td>
<td>• Crane Converto-Gear Type N and P</td>
<td>• Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15100 / n. / 3</td>
<td>Seat Hardfacing, Strainer Drain Valves</td>
<td>• Deloro Stellite</td>
<td>• Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / b. / 1</td>
<td>Insulation, HTW, Above Ground</td>
<td>• Johns-Manville</td>
<td>• No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / b. / 5</td>
<td>Insulation, Glass Fabric</td>
<td>• GLAS-FAB</td>
<td>• Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / b. / 6</td>
<td>Insulation, Adhesives</td>
<td>• Arabol • Sealfas • Swifts</td>
<td>• No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / b. / 8</td>
<td>Waterproof Vapor Barrier</td>
<td>• Insulseal</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / c. / 1</td>
<td>Insulation, Piping, Above Ground</td>
<td>• Johns-Manville</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15254 / g. / 4</td>
<td>Insulation, Removal Blankets</td>
<td>• Johns-Manville Turbine Blanket</td>
<td>• Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15256 / a.</td>
<td>Pre-insulated HTW Pipe, Below Grade</td>
<td>• Thermacor Process, L.P. Duo Therm “505”</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15256 / b. / 4 / g</td>
<td>Insulation, Inorganic Granular, Below Grade, at or above 400°</td>
<td>• Gilsulate International, Inc. 500</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15256 / b. / 7</td>
<td>Insulation, Inorganic Granular, Below Grade, below 400°</td>
<td>• Gilsulate International, Inc.</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Vendor Information</td>
<td>Approval Information</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15732 / a.</td>
<td>HTW Generators &amp; Hot Water Heat Exchangers</td>
<td>● DriTherm International, Inc.</td>
<td>Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15732 / k. / 12</td>
<td>Coating, Interior Supports, Tube Sheets, Baffles</td>
<td>● Howard’s Engineering</td>
<td>For Other Products, University Field Tests for Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15732 / n. / 3</td>
<td>Coating, Interior Shell</td>
<td>● Dupont Teflon</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15902 / f.</td>
<td>Name Plates, Control Panel</td>
<td>● Norplex-Micarta ● Bakelite</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15903 / a.</td>
<td>Control Valves, HTW Heat Exchangers &amp; Steam Generators</td>
<td>● Fisher</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15903 / b.</td>
<td>Controls, HTW Heat Exchanger</td>
<td>● Powers 535 Controller</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15903 / c. / 2</td>
<td>Feedwater Controls</td>
<td>● McDonnell Miller 150S ● Mercoid ● Magnetrol</td>
<td>No Other Product / Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15903 / c. / 3</td>
<td>Low Water Cut-Out Alarm / High Water Level Cut-Out Alarm</td>
<td>● McDonnell Miller 150 ● Mercoid ● Magnetrol</td>
<td>No Other Product / Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15903 / d. / 2</td>
<td>Remote Temp Bulb Operator</td>
<td>● American Temperature Regulator ● Trerice</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15904 / a. / 1</td>
<td>Sockets &amp; Wells</td>
<td>● Trerice ● Palmer</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15904 / a. / 3</td>
<td>Thermometers</td>
<td>● Trerice ● Palmer ● Weksler</td>
<td>No Other Product / Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15904 / b.</td>
<td>Pressure Gauges</td>
<td>● Trerice ● Heicoid ● Crosby</td>
<td>No Other Product / Manufacturers Allowed</td>
</tr>
<tr>
<td>3.5 / GG. / (4) / 15904 / c.</td>
<td>Level Indicators, Water Column</td>
<td>● ISE-Magtech</td>
<td>Sole Source, No Other Manufacturers Approved</td>
</tr>
</tbody>
</table>
### 6.10 Electrical Part 1 Electrical Engineering (Design Requirements 3.6)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 / C. / (7) / e. / 3</td>
<td>Fuses for Pole Lights</td>
<td>● CooperPower Systems Bussmann KTK-6 with HEB-JJ In-Line Fuse Holder</td>
<td>● Sole Source, No Other Manufacturers Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.6 / C. / (7) / e. / 5 / a</td>
<td>Pole Light Base Concrete Forms</td>
<td>● Sonoco Sonotube</td>
<td>● Similar To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.6 / C. / (7) / e. / 6</td>
<td>Light Poles, 10’ &amp; 20’</td>
<td>● Sterner Lighting by Hubbell Lighting, Inc.</td>
<td>● No Other Manufacturers Allowed (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.6 / C. / (7) / e. / 7</td>
<td>Walkway Lighting, 10’ Pole Light Fixtures</td>
<td>● LSI Industries, Inc., Enterprise Round Area Light, Model # SPL – ENS – PT – H – 2 – 100MH – F – MT – BLK – TE – 0450SFTR</td>
<td>● Sole Source, No Other Manufacturers Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.6 / C. / (7) / e. / 7</td>
<td>Walkway Lighting, 10’ Pole Light Fixtures</td>
<td>● Beta Lighting, Inc. by Ruud/Cree, Edge Model # ARE–EDR–3M–R5–08–D–UL–BK–350–43K</td>
<td>● Sole Source, No Other Manufacturers Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.6 / C. / (7) / e. / 8</td>
<td>Parking Lot Lighting, 20’ Pole Light Fixtures</td>
<td>● Lithonia Lighting, Round Area Light, Model # KVR2 – 250S – SYMFL – 277 – PT4.5 – DBL – LPI</td>
<td>● Sole Source, No Other Manufacturers Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>3.6 / G. / (1) / a. / 3</td>
<td>Cable Mounting in Manhole</td>
<td>● Unistrut</td>
<td>● Similar To (No Prior Approval Required)</td>
</tr>
<tr>
<td>3.6 / G. / (3) / b. / 4 &amp; 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.6 / G. / (1) / a. / 3)</td>
<td>Cable Mounting Clamps</td>
<td>• ZSI, Inc. Cush-A-Grip</td>
<td>• For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 3.6 / G. / (1) / a. / 11) | Cable | • Okonite  
• Kerite Company  
• General Cable Corporation  
**Superior Essex** | • No Other Product / Manufacturers Allowed |
| 3.6 / G. / (1) / a. / 11) | Splices | • Raychem TE  
• 3M | • No Other Manufacturers Allowed |
| 3.6 / G. / (1) / a. / 11) | Terminations | • Thomas & Betts Corporation  
• Cooper Power Systems  
• 3M  
**Richards Manufacturing** | • No Other Product / Manufacturers Allowed |
| 3.6 / G. / (1) / b. / 3) / e | Padlock for Switch / Transformer Enclosure Gate | • ASSA, Inc. #65190B | • Sole Source, No Other Manufacturers Approved  
*(Standardized Maintenance Requirements)* |
| 3.6 / G. / (1) / b. / 3) | Medium Voltage Solid Dielectric Switches | • Thomas & Betts Corporation  
• G&W Electric Company | • No Other Manufacturers Allowed |
| 3.6 / G. / (1) / b. / 4) | Padlock for Switch Cabinet Door | • ASSA, Inc. #65190B | • Sole Source, No Other Manufacturers Approved  
*(Standardized Maintenance Requirements)* |
| 3.6 / G. / (5) / d. / 1) / f | Grade Ring Sealing System | • Sika Corporation  
“Sikadur Combiﬂex” | • For Other Products / Manufacturers, Prior Approval is Required |
| 3.6 / H. / (++) / a. / 2) | Combination Starters | • Eaton Corporation  
Cutler-Hammer  
• GE Energy  
• Siemens AG | • No Other Manufacturers Allowed |
| 3.6 / H. / (++) / b. / 2) | Electronic Solid State Starters | • Schneider Electric Square D  
• GE Energy  
• Eaton Corporation  
Cutler-Hammer  
• Siemens AG | • No Other Manufacturers Allowed |
| 3.6 / H. / (c) / 4 | Motor Control Centers | • Schneider Electric
• Square D
• GE Energy
• Eaton Corporation
• Cutler-Hammer
• Siemens AG | • No Other Manufacturers Allowed |
| 3.6 / H. / (2) / j | Variable Frequency Drives | • Danfoss
• GE Energy
• Mitsubishi Electric
• Automation
• Rockwell Automation
• Allen Bradley
• Yaskawa Electric
• America | • No Other Manufacturers Allowed |
| 3.6 / I. / (3) / a. / 1 / f | Padlock for Transformer Cabinets | • ASSA, Inc. #65190B | • Sole Source, No Other Manufacturers Approved
(Standardized Maintenance Requirements) |
| 3.6 / I. / (3) / a. / 5 | Distribution Transformers | • Cooper Power Systems
• GE Energy
• Eaton Corporation
• Cutler-Hammer
• Schneider Electric
• Square D
• MGM Transformer
• Company | • No Other Manufacturers Allowed |
| 3.6 / I. / (3) / b. / 4 | Step Down Transformers | • Eaton Corporation
• Cutler-Hammer
• GE Energy
• Schneider Electric
• Square D
• Siemens AG
• Synergy Energy, Inc | • No Other Manufacturers Allowed |
| 3.6 / I. / (5) / d. | Digital Power Meters | • Electro
• Industries/Gauge Tech
• (EIG) “Shark”
• GE Energy
• Schneider Electric
• Square D “Power Logic” | • No Other Manufacturers Allowed |
| 3.6 / I. / (6) / e. | Switchboards / Distribution Boards | • Schneider Electric
• Square D
• GE Energy | • No Other Manufacturers Allowed |
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 / I. / (7)/e.</td>
<td>Panel Boards</td>
<td>Eaton Corporation Cutler Hammer</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cutler Hammer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Siemens AG</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Schneider Electric Square D</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GE Energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eaton Corporation Cutler Hammer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Siemens AG</td>
<td></td>
</tr>
<tr>
<td>3.6 / I. / (11)/f.</td>
<td>Engine Generator Sets</td>
<td>Caterpillar</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generac Power Systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kohler Power Systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cummins Onan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detroit Diesel</td>
<td></td>
</tr>
<tr>
<td>3.6 / I. / (12)/b. / 7)</td>
<td>Large UPS Systems</td>
<td>Emerson Network Power Liebert</td>
<td>No Other Manufacturers Allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MGE UPS Systems, Inc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitsubishi Electric Automation, Inc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toshiba Corporation</td>
<td></td>
</tr>
<tr>
<td>3.6 / K. / (6)/a. / 1)/ b)</td>
<td>Clock System</td>
<td>SimplexGrinnell</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primex Wireless</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sapling, Inc.</td>
<td></td>
</tr>
<tr>
<td>3.6 / M. / (1)/c.</td>
<td>Fire Alarm Systems</td>
<td>FCI (Honeywell Gamewell Fire Control Instruments)</td>
<td>Sole Source, No Other Manufacturer or Vendor will be Approved (Standardized Maintenance/Fire Security Requirement)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>furnished and installed by Nelson Fire Systems</td>
<td></td>
</tr>
<tr>
<td>3.6 / M. / (1)/c.</td>
<td>Electronic Notifying Pressure Switch (Fire Extinguishers)</td>
<td>MIJA, Inc. “en.Gauge”</td>
<td>Sole Source, No Other Manufacturer or Vendor will be Approved (Standardized Maintenance/Fire Security Requirement)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.11 Electrical Part 2 Communications / Security Wiring Systems (Design Requirements 3.6)

- **Cable Seals at Manholes**
  - Virginia KMP Presstite Permagum
  - Sole Source, No Other Manufacturers Approved (Standardized Maintenance Requirements)

- **Conduit Entrances**
  - Emerson O.Z. Gedney Bell End Entrances Type TNS
  - Equal To
| 3.6 / P. / (7) / kk. / 1) and COM-1 | Communication Device, Elevator Phone Panel | **Ramtel Corporation**  
RR833 | • Sole Source, No Other Products Approved  
*(Standardized Maintenance Requirements)* | (No Prior Approval Required) |

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 / P. / (8) / e.</td>
<td>Security Alarm &amp; Access System</td>
<td>● Software House C-Cure</td>
<td>No Other Products / Manufacturers Allowed (This manufacturer was selected by advertised procurement)</td>
</tr>
<tr>
<td>COM-3</td>
<td>Duct Spacer</td>
<td>● Underground Devices, Inc.</td>
<td>Equal To (No Prior Approval Required)</td>
</tr>
<tr>
<td>COM-4</td>
<td>Manhole Ring &amp; Cover</td>
<td>● Conco Foundry, Inc. Catalog # C-1380</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
</tbody>
</table>

6.12 Landscape and Irrigation Standards (DESIGN REQUIREMENTS 4.0)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5 / J. / (2) / a. / 2</td>
<td>Exterior Benches and Tables</td>
<td>● Landscape Forms, Inc. Plexus Benches, Carousel Tables</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>4.5 / J. / (4) / a.</td>
<td>Waste Receptacles</td>
<td>● Wausau Tile Company Number TF 1040</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>4.5 / J. / (4) / b.</td>
<td>Waste Receptacles, Light Weight (use of light weight unit by prior approval only)</td>
<td>● Plexus</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>4.5 / J. / (5)</td>
<td>Urns</td>
<td>● Wausau Tile Company Number UR 10201NS or UR11201NSPL</td>
<td>Sole Source, No Other Products Approved (Standardized Maintenance Requirements)</td>
</tr>
<tr>
<td>4.5 / J. / (6)</td>
<td>Tree Grates</td>
<td>● D&amp;L Supply Company #R-8740 180 deg. Square</td>
<td>For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
</tbody>
</table>
### 6.12 Landscape and Irrigation Standards (continued)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
</table>
| 4.6 / O. / (3) | Threaded Connection Seal | ● Teflon  
● RectorSeal Corporation  
Number Five | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / O. / (4) | Flex Swing Pipe | ● Rain Bird SPX FLEX  
● Toro Super Funny Pipe  
● Irritrol Super Blue Flex | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / Q. / (4) | Fittings on Flex Swing Pipe | ● Toro Super Funny Pipe Fittings  
● Rain Bird SB Series  
Spiral Barb Fittings  
● Lasco Blue Twister | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / R. / (4) / b. | Quick Coupler Valve | ● Rain Bird 44NP  
● Buckner QBRB5NP10  
● Hunter Industries HQ-44LRC-NP | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / S. / (2) / a. / 1 | Electric Remote Control Valves 1” | ● Rain Bird 100-PEB  
● Hunter Industries ICV-101G  
● Toro 220-P | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / S. / (2) / a. / 2 | Electric Remote Control Valves Larger than 1” | ● Toro 220 Series  
● Rain Bird GB  
● Hunter Industries IBV | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / U. / (1) | Electric Controller | ● Rain Bird ESP | Sole Source, No Other Products Approved |
| 4.6 / X. / (1) / a. | Spray Heads | ● Rain Bird RD-XX-S-P30  
● Hunter Industries PROS-XX-PR530-CV | For Other Products / Manufacturers, Prior Approval is Required |
| 4.6 / X. / (2) / a. | Small Size Rotors | ● Rain Bird Models 5000 Plus Series  
● Hunter Industries I-20-XX-CV | For Other Products / Manufacturers, Prior Approval is Required |
6.12 Landscape and Irrigation Standards Page 3 of 3 (concluded)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6 / X. / (4) / a.</td>
<td>Large Rotors</td>
<td>● Rain Bird Models 8005 Series</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Hunter Industries I-25 Series</td>
<td></td>
</tr>
<tr>
<td>4.6 / AA. / (1)</td>
<td>Valve Box</td>
<td>● Carson &amp; Brooks</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td>4.6 / CC. / (6) / a.</td>
<td>Inline Drip Tubing</td>
<td>● Netafim Techline CV</td>
<td>● For Other Products / Manufacturers, Prior Approval is Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Rain Bird XFCV</td>
<td></td>
</tr>
</tbody>
</table>

6.13 High Performance Building Rating System (2009) (Design Requirements 5.0)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PRODUCT DESCRIPTION</th>
<th>UNIVERSITY APPROVED VENDOR / MGFR</th>
<th>PROCUREMENT REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- - -</td>
<td>No vendors or products are identified in 5.0 High Performance Building Rating System (2009)</td>
<td>- - -</td>
<td>- - -</td>
</tr>
</tbody>
</table>

End of 6.0 Summary of Products and Vendors
Measurement and Verification Plan

UNIVERSITY OF UTAH
DESIGN STANDARDS SUPPLEMENT

January 15, 2016

The University of Utah
FACILITIES MANAGEMENT
V. Randall Turpin University Services Building
1795 E. South Campus Drive, Room 201
Salt Lake City, Utah 84112-9403
Phone (801) 581-4707
FAX (801) 581-6081
Measurement and Verification Plan

1. Introduction

In order to encourage better project design, enable better building operation and account for increased energy savings and reduced emissions, the University developed this Measurement and Verification (M&V) Plan. The purpose of this M&V Plan is to establish a consistent method for quantifying the performance of energy conservation measures by comparing actual energy consumed by a building, its systems and subsystems to the predicted energy consumption developed during project design.

The basis of this M&V Plan is the Efficiency Valuation Organization’s International Performance Measurement and Verification Protocol (IPMVP). *IPMVP Volume 1: Concepts and Options for Determining Energy and Water Savings* (available at [www.evo-world.org](http://www.evo-world.org)) outlines four options (Options A through D) for measuring and reporting a project’s savings. Option B: Retrofit Isolation: All Parameter Measurement is the only option allowed under this M&V Plan.

Compliance with this M&V Plan will provide a path for projects registered under LEED v3 to earn EA Credit 5: Measurement and Verification and for projects registered under LEED v4 to earn the Advanced Energy Metering credit. Additionally, compliance with this Plan will assist the University as it works to meet its commitments to sustainability and energy efficiency including the American College and University President's Climate Commitment (climate neutrality by 2050) the Better Buildings Challenge (20% reduction in energy intensity by 2020).

2. Project Specific Measurement and Verification Plan Requirements

A project specific Measurement and Verification Plan must be developed by the design team along with the development and design of energy conservation measures. All design strategies and devices needed to fulfil the M&V Plan must be budgeted in the project and included in project documents. Details of the Plan must be coordinated with Facility Operations/Energy Management. The following outline represents the minimum requirement for a project specific M&V Plan and is designed to meet the needs of LEED v3 EA Credit 5.

1) Table or listing of project’s energy end uses
2) Indication of which of the energy end uses are monitored and if the monitoring is permanent or temporary
3) Indication of the location of all monitoring devices
4) Specific information regarding the baseline conditions established for the project
5) Specific information regarding the method/frequency for data collection and analysis against the documented baseline conditions
6) Specific information regarding the corrective action strategy if measured data deviates from the anticipated performance
7) Confirmation that the M&V period covers a minimum of one year post-construction occupancy

3. Metering Requirements

Energy and water meters are fundamental to meeting the requirements of this M&V Plan. Utility grade meters must be installed at the building level for each utility feeding each building or major subunit of a complex. Submetering must be installed on each subsystem as required by the project specific M&V Plan. Submetering must also be installed to isolate any functional and/or billable subdivision within a building. In addition to metering devices, data acquisition devices must be installed in each building to enable communication between each metering device and the University’s Energy Information System (EIS) and/or Building Automation System (BAS). Details of the required metering and meter communications must be coordinated with Facility Operations/Campus Utility Services and Energy Management.

Following is an outline of basic metering and data requirements. This is a general list; exact metering must be based on specific building requirements as outlined in the project specific M&V Plan. (See Design Standard for specific meter requirements.)

- Primary metering (utility grade meters)
  - Building level. This also applies to separate programmatic spaces (spaces requiring individual energy accounting or billing)
    - Electricity
    - Gas
    - Chilled Water
    - High Temperature / Hot Water
    - Water
- Submetering (utility grade meters not required if alternative means are available)
  - Electricity
    - Lighting
      - Interior Lighting
      - Exterior Lighting (walkways, parking lots, etc.)
      - Special use lighting (athletic fields, etc.)
    - Plug loads
    - High Intensity/Process Loads (data centers, specific equipment)
    - HVAC System Equipment (fans, pumps, etc.)
  - Thermal Energy
    - Primary Heating (boilers (gas), heat exchangers (btu))
    - Domestic Hot Water (water heaters (gas), heat exchangers (btu))
    - Primary Cooling (chillers (electrical), heat exchangers (btu))
- Pressure/temperature ports on hydronic equipment, such as cooling and heat coils.
  - Water
    - Irrigation
    - Domestic
    - Mechanical water usage (makeup/feed water)
- Data Requirements
  - Meters to provide instantaneous data to BAS for operational monitoring of HVAC system
  - Meters to provide 15 minute interval data to EIS for trending and analysis
  - Electrical meters to report volts, amps, power (kW), energy (kWh), etc.
  - Gas meters to report pressure and temperature compensated volume in hundred cubic feet (CCF) or thousand cubic feet (MCF)
  - Chilled and High Temp/Hot Water meters to report flow in gallons per minute (gpm), supply and return temperature, energy (kBtu or MMBtu)
  - Water meters to report volume in cubic feet (CF) or gallons

4. Responsibility and Accountability

It is the responsibility of the design team to develop the project specific M&V Plan. The design team must ensure all required metering devices are budgeted and included in the design documents. It is the responsibility of the project team (design team, contractors, commissioning agent) to verify that all metering devices are reporting, recording, and communicating prior to project substantial completion.

It is the responsibility of the University (Facilities Management/Facility Operations) to provide coordination and information to the design team in support of developing the project specific M&V Plan. Upon substantial completion, the University will take ownership of Measurement and Verification Plan and the process of collecting and reporting data.
DFCM REQUIREMENTS

4.0 LANDSCAPE and IRRIGATION STANDARDS

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
PREFACE
University of Utah Supplement

GENERAL INTRODUCTION TO THE UNIVERSITY OF UTAH SUPPLEMENT:

The DFCM Design Manual “Design Requirements” (State of Utah, Department of Administrative Services, Division of Facilities Construction and Management, referred to herein as “DFCM Manual” or “Manual”) dated June 11, 2009 including highlighted updates is the basis for A/E design services provided for all University of Utah projects.

This document accepts the DFCM Manual as the University of Utah standard, and supplements the Manual with requirements which are needed to satisfy University organization and mission objectives.

The reader is directed first to the DFCM Manual, then to this supplement where added requirements are preceded by “ADDED” and paragraph alterations required to accommodate University processes are preceded by “REVISED.”

To remain consistent with the DFCM Manual, this supplement is organized in a format matching that of the parent Manual. Only portions of the parent Manual are reproduced in this supplement, either as navigation guides or as altered paragraphs. DFCM text is presented in a gray font. University additions and insertions are presented in normal font.

ADDED:

1. The University of Utah is situated on a 1,500 acre site, encompassing 600 developable acres. The site supports over 300 buildings. Since moving to its current location in 1900, the University campus has evolved into a ‘look’ and ‘feel’ identifiable as “The U of U.” A mission objective of the University Department of Landscape Maintenance is to insure that the University’s identity and setting is applied consistently in the design of campus green space.

2. Over years of campus evolvement, the Landscape Maintenance Department has evaluated, and continues to evaluate products, materials, and methods of irrigation and plantings in support of a cost effective, low maintenance landscape infrastructure which maintains the traditional U of U identity. Products, materials, plants, and system assemblies described herein and in the detail drawings have been selected to standardize campus landscape and irrigation systems; minimize the stocking of parts from multiple manufacturers; and, efficiently conserve University energy, water, and maintenance resources.

3. The purpose of this supplement, including 4.0 LANDSCAPE AND IRRIGATION STANDARDS DETAIL DRAWINGS, is to acquaint the design consultant (Landscape Architect, herein referred to as “A/E”) with these University specific landscape and irrigation requirements, as established by the University Department of Landscape Maintenance and approved for publication by the Design Standards Committee.

4. All landscape designs prepared for University of Utah projects shall include the general and specific requirements described in this supplement, and include applicable graphics located in the section containing the detail drawings.
**ADDED:**

**REVISIONS SUMMARY**  
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 May 2015</td>
<td>- - -</td>
<td>DFCM quoted text and numbering revised to correspond with DFCM Changes. University standards unchanged.</td>
</tr>
<tr>
<td>1 November 2014</td>
<td>4.0 / 4.5/ K.</td>
<td>Roof Top Gardens Added requirement</td>
</tr>
<tr>
<td>1 May 2014</td>
<td>4.1</td>
<td>Landscape and Irrigation General updates to standard</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>Preface</td>
<td>The Preface was simplified – specific design requirements previously located in the Preface were moved to appropriate locations in the body of the supplement (e.g., drought resistant plants, 2 for 1 tree replacement, selection and location of tree species)</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6)</td>
<td>University Requirements. Moved “University of Utah General Requirements” from 4.1 / D. to 4.1 / A. / (6) and renamed the title to “University of Utah Design Requirements”</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / a.</td>
<td>A/E Site Examination. Added “tree inventory” to records of existing conditions at the project site</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / b.</td>
<td>Joint Site Meeting. Added “joint site meeting” to assess the impact of construction on site vegetation and trees</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / c.</td>
<td>Value of Campus Trees. Added a section regarding the value trees both on campus and at the construction site</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / d.</td>
<td>Tree Replacement on Campus. Added requirements regarding tree replacement when campus trees are removed</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / e.</td>
<td>Trees Damaged During Construction. Added requirements regarding the damage of trees during construction</td>
</tr>
<tr>
<td>21 September 2012</td>
<td>4.1 / A. / (6) / f.</td>
<td>Protect Tree Trunk and Root Zone. Revised and added new requirements for “Tree Protection Zone”</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>University Design Standards. The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Campus Design &amp; Construction. CD&amp;C has changed to Construction Project Delivery (in this document CD&amp;C was replaced by Facilities Management)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td>Plant Operations. Plant Operations has changed to Facility Operations</td>
</tr>
</tbody>
</table>
Revisions Summary *(concluded)*

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 January 2012</td>
<td>4.11 / A. / (2)</td>
<td>Plant List General Requirements. Removed “DFCM” in the “INFORMATION GATHERED FROM...” column</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>4.11 / A. / (3)</td>
<td>Plant List Deciduous Trees. Added three Ulmus tree varieties, and added ‘Schmi\ldtlow’ to Zelkova serrata</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>4.11 / A. / (5)</td>
<td>Plant List Shrubs. Removed “Caryopteris X clandonensis” (Blue Mist Spirea)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>4.11 / A. / (11)</td>
<td>Plant List Turf Grass. Added Xerilawn, Bella Blue, and BioMeadow; and, removed Dura turf</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>4.11 / A. / (11)</td>
<td>Plant List Turf Grass. Changed “parking lots” to “areas between hard surfaces”</td>
</tr>
<tr>
<td>02 July 2011</td>
<td>4.5 / J. / (2)</td>
<td>Benches. Added tables and revised spec. requirements</td>
</tr>
<tr>
<td>17 May 2011</td>
<td>4.6 / R. / (4)</td>
<td>Non-Electric Valves. Added “Quick Coupler Valve” manufacturer</td>
</tr>
<tr>
<td>17 May 2011</td>
<td>4.6 / U. / (1)</td>
<td>Electric Controller. Added prior approval requirements for electric controllers</td>
</tr>
<tr>
<td>17 May 2011</td>
<td>4.6 / X.</td>
<td>Irrigation Heads. Added rotor requirements</td>
</tr>
<tr>
<td>25 January 2011</td>
<td>4.5 / J. / (3)</td>
<td>Bike Racks. Replaced ribbon racks with inverted “U” racks</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>- - -</td>
<td>Chapter Update. Several portions of this chapter have been updated</td>
</tr>
</tbody>
</table>
4.0 LANDSCAPE AND IRRIGATION STANDARDS

4.1 General

REVISED:
C. Purpose. A purpose of this section is to designate site landscape standards for the design of attractive, water efficient landscapes that are sensitive to the geological and historical context of the site. The DFCM and the University envision landscapes that will endure because they are sensitive to the cultural, social, and aesthetic values of a community; the climate, water resources, and other environmental aspects of a location; and the financial investment of installation and maintenance over the life of the landscape. It is recognized that DFCM and University projects cover a wide range of community sizes, locations, and climates.

REVISED:
A. Submittals

(1) Submit all described documentation in sections 4.3 and 4.4 to the Landscape Architect and the University Project Manager (for distribution to the Landscape Maintenance Department) for review and approval prior to construction or substantial completion as indicated. For University managed projects, the Landscape Development Package shall be submitted to the University Project Manager for distribution to the Landscape Maintenance Department.

(2) Contractor to submit all product literature and customer service information for products used/installed on project to Landscape Architect for review and approval prior to installation.

(3) For University projects, include a statement defining and outlining the scope of the work for the project. Assist the University in developing a budget cost for the intended work and include the budget cost in the Development Package.

ADDED:
I. University of Utah Design Requirements

The landscape design for University of Utah projects shall include the following:

(1) A/E Pre-Design Site Evaluation

   a. The A/E shall request records regarding the conditions at the project site (i.e., utility maps, site plans of existing buildings, tree inventory, etc.).
b. The A/E shall visit the site to identify all existing conditions which will affect the proposed design.

(2) Joint A/E / Facilities Management Site Meeting

a. When the building footprint is known, and prior to submission of the design development drawings, coordinate with the University Project Manager to arrange a site meeting with the University Project Manager and the University Landscape Maintenance Department.

1) Existing site conditions and A/E’s proposed improvements will be evaluated at the meeting.

2) Trees and other site vegetation, both within the intended construction site limits and adjacent to the construction site, will be evaluated. Roots from adjacent trees and vegetation which could be damaged by construction activities (i.e., vehicular traffic, lack of water, excavation, etc.) will be addressed.

a) Analyze access routes for equipment, staging locations, and temporary storage areas likely to affect the site.

b) Inventory the trees within the contract limit lines. Record the location, size, and health of each tree to be saved. Identify trees which will require pruning to allow for future structure.

c) Photograph each tree to establish a base line health status and condition of the tree before construction.

d) Estimate the size of the protection zone for each tree and determine the feasibility of fencing the affected trees at the protection zone line. Show the protected zone areas on the project drawings.

3) Information gathered at the site meeting will be used to establish the following:

a) The environmental value of special vegetation and trees in and around the project site will be considered.

b) The Department of Landscape Maintenance will provide the specific terms to be included in the project documents regarding tree replacement (both for intended replacement and for unintended loss). See paragraph d. TREE REPLACEMENT ON CAMPUS below.

c) The Department of Landscape Maintenance will identify the current dollar value for each tree remaining on site. The A/E shall insert tree value(s) in the drawings /
specifications. See paragraph c. VALUE OF CAMPUS TREES below.

d) The Landscape Maintenance Department will provide special care instructions for existing vegetation to remain. These shall be included in the project documents. See paragraph e) herein. Examples of tree protections methods are provided in paragraph f. TREE PROTECTION AT UNIVERSITY CONSTRUCTION SITES below.

e) The A/E shall prepare minutes of the meeting to record specifics for each tree. The A/E shall distribute the minutes to the University Project Manager and Landscape Maintenance Department.

(3) Value of Campus Trees

a. The University of Utah campus is Utah’s State Arboretum. Each tree on campus has a significant value to the University, each is cataloged, and the condition of each tree is monitored.

b. The current monetary value for each tree will be established by the Landscape Maintenance Department for each project where trees may be affected by construction.

1) A/E drawings and specifications shall include the dollar value of each tree which is intended to remain on, and/or adjacent to the project site.

2) The cost shown for each tree will establish the basis for the Contractor’s liability if any tree is damaged due to construction activities or the Contractor’s lack of care.

(4) Tree Replacement on Campus

a. Include the following statement in the Construction Documents:

“Written permission by the Landscape Maintenance Department (through the A/E and University Project Manager) is required prior to the removal of any tree on campus.”

b. When a project includes the planned removal of trees, or when trees are removed by the Contractor for any reason, either the project or the party responsible for the removal shall replace each lost tree with at least two new trees.

1) The Landscape Maintenance Department reserves the right to require replacement by more than two-for-one, or by a larger caliper specimen size, when tree removal will cause significant loss of value to the University (i.e., prominent landmark, tree
function / value to the site, historical value, pairing loss to other trees, significant loss to the State Arboretum, etc.).

2) The Landscape Maintenance Department will consider A/E suggestions for the species proposed for the replacement; however, the Landscape Maintenance Department is the jurisdiction having authority and will make the final determination of the selection of the tree species, and determine exact location(s) for replacement tree plantings.

3) When trees are planned to be removed for new construction, the A/E’s drawings / specifications shall identify the species and location of replacement trees as directed by the Landscape Maintenance Department.

(5) Tree Damage During Construction

a. The A/E shall observe the status of the trees during regular inspection site visits. Tree damage at the project site, including overstressed, dying or dead trees, shall be reported to the Contractor and University Project Manager as soon as it is observed. Photograph the damage. The University Project Manager will coordinate with the Landscape Maintenance Department to determine the cause of the damage, assess the value of loss based on the tree’s cost shown in the project documents, and direct any remedial action required to restore the tree.

b. The A/E shall include damage penalties in the specifications if trees are to be saved on site. Base the penalties on the value of each tree as determined by the University Landscape Maintenance Department.

c. For trees which are damaged beyond recovery due to Construction or lack of care, the Contractor shall be responsible for replacement in accordance with paragraph d. TREE REPLACEMENT ON CAMPUS above.

(6) Tree Protection at University Construction Sites

a. In the drawings and specifications, the A/E shall establish the Contractor’s responsibility to care for and protect each tree which will remain on site, or face penalties for damage, or replace each lost tree in accordance with the terms established by the Landscape Maintenance Department.
b. General Requirements for Tree Protection

1) Trees can be damaged or killed by a wide variety of construction activities. Above ground injuries such as broken branches or torn bark are open wounds which can deplete a tree’s energy resources and provide entry points for insects or diseases.

2) Root damage can be a significant danger to a tree. Critical roots generally exist in the top one to three feet of soil extending out to the drip line of the tree canopy, and beyond to a distance of two times the height of the tree.

c. Protected Root Zone (TPZ – Tree Protection Zone)

1) Determine the area needed for the tree protection zone (“TPZ”) for each tree, including trees which could be affected adjacent to the construction site. The TPZ is the approximate distance from the tree trunk in which a critical amount of the tree’s roots may be found. This is the area which should be isolated from construction activity, and is determined as follows:

   a) Estimate the height of the tree.
   b) Multiply the tree height by 0.40.
   c) Measure and mark this distance from the tree trunk. If this distance is less than the extent of the tree’s canopy drip line, extend the mark to the outside drip line.

d. Specify that nothing inside the TPZ is to be raked, cut, stored, or otherwise disturbed.

e. Specify regular watering during construction.

f. TPZ Fence

1) Direct the Contractor to install protective fencing around each tree at the marked TPZ perimeter. Specified fencing shall be sturdy and highly visible to discourage entrance and disturbance of the area within the TPZ.

   a) Specify either chain-link, or sturdy wire mesh, or wood fencing. Require the Contractor to solidly anchor the fencing into the ground.
b) Require the Contractor to attach weather protected warning signs every 50 linear feet along the fence (for a smaller TPZ, require a minimum of two signs at appropriate locations on the perimeter fence). Each sign shall be at least two feet wide, with red lettering on white background, with the following message prominently displayed:

```
TREE PROTECTION AREA
DO NOT ENTER
ZONA DE PROTECCION
PARA ARBOLES – NO ENTRE
```

c) Specify fencing height of 4 to 6 feet or higher depending on the needs of the site and anticipated construction activities.

g. If the A/E’s design cannot guarantee that construction traffic will remain outside of a tree’s TPZ for the entire duration of construction, require trunk protection as described herein, and additionally specify one or more of the root protection measures described below.

1) Trunk Protection

a) Instruct the Contractor to install a closed cell foam pad around the trunk and buttress roots, overlaid with 2 inch thick wood planks (2” x 4” or 2” x 6” as appropriate) arranged vertically and approximately 1” apart.

(i) Specify straps or wire to bind the planks in place.

(ii) Do not allow the Contractor to drive fasteners into the tree.

(iii) As determined by the length of the construction schedule, require the Contractor to adjust the strap or wire binding during periods of trunk diameter growth.
2) Root Protection Measures

a) Options available to the A/E for root protection measures within the TPZ are:

(i) 6 to 12 inches of wood chip mulch evenly distributed within the protection zone.

(ii) A ¾ inch plywood deck, or a matt of 4 x 4 wood beams laid over 4+ inches of wood chip mulch evenly distributed within the protection zone.

(iii) 4 to 6 inches of gravel laid evenly over a taut, staked geotextile fabric.

(iv) Commercial logging or road mats assembled over support rails, laid over a 4” to 6” mulch layer.

3) Maintaining Trunk and Root Protective Measures

Root protection measures specified by the A/E must be inspected daily by the Contractor and refreshed as conditions warrant (i.e., weather, time, traffic wear, etc.).

4) Removal of Trunk and Root Protective Measures

Trunk and vehicle load protective methods described above must be removed from the TPZ when the threat of damage has ended, or at Substantial Completion, whichever occurs first.

5) TPZ Fence Management When Accessed for Construction

a) The TPZ perimeter fence shall remain in place until immediately before the required construction activity within the TPZ.

b) The TPZ perimeter fence shall be replaced as soon as possible when the required construction activity in the TPZ is done.
(7) U of U Landscape Reference Standards

Use plant names in the specifications obtained from "Standard Plant Names" or "Bailey's Encyclopedia of Horticulture." When a name is not found in either reference, consult local resources from the nursery trade for a name which will not confuse local landscape contractors.

(8) Tree and Planting Specifications

Tree and planting guidelines are to be specified in accordance with ISA (International Society of Arboriculture), Utah State University Extension Service (Extension Forester), and the U.S. Department of Agriculture, except where the requirements herein are more restrictive.

(9) Plant Tagging Requirements

Require all plants to be tagged by the supplier nursery with the identification labels consistent with the specified plant names and project drawing identifiers if drawing symbol identifiers are used.

(10) Drawings / Specifications for University Projects

a. Drawings shall be prepared at 1” = 20’ scale or greater showing the layout of the landscaping. All parts of the landscaping shall be completely specified either on the drawings or in the specifications.

b. Require at least one registered CIC, with a current certification from the Irrigation Association (Irrigation Association Certified Irrigation Contractor, or “CIC”) to be included in the Contractor’s work crew as a direct employee of the Contractor. The CIC will be required to meet weekly with the Irrigation Foreman of the University Landscape Maintenance Department to walk the work site and review the progress of the Work.

c. The landscape irrigation system will be specified and graphically represented on drawings using sprinklers, valves, piping, fittings, controllers, wiring, etc., of quality and capacity described herein.

d. Once approved by the University, locations of sprinkler heads, valves, piping, wiring, etc., will be changed only with the permission of the Landscape Maintenance Department.

e. The University expects an irrigation design which will result in a complete water distribution system efficient in operation, fully automated, low maintenance, and fully compatible with current industry standards, the University’s maintenance plan, and the existing irrigation system structure.

f. Include in the specifications the Contractor's responsibility to report to the A/E, in writing, any contradictions between the
drawings, specifications, and site prior to submitting the bid in sufficient time to allow the issuance of an addendum to the bid documents. Failure to do so will require the Contractor, at its own expense, to include any replacements and / or relocations necessary to complete a fully functional installation in full compliance with the contract documents, when such contradictions were identifiable before the bid.

(11) Pre-Bid Contractor Site Examination on University Projects

a. The specifications will require that each Contractor visit the site and study all portions of the contract documents before submitting the bid. Consider a pre-bid, on-site conference for prospective bidders.

b. Prior to beginning landscape operations at the site, direct the Contractor to visit the site and become familiar with all existing conditions and the extent of work being performed by other contractors on the site.

(12) Changes to Bid Documents or Contractor Questions

If changes or product approvals or clarifications to the bidding documents become necessary, the A/E prepares an addendum for issuance by the University prior to the bid due date.

(13) Substitution of Materials

a. Provide opportunity for bidders to seek prior approval for the substitution of equal materials to be used in their bids.

b. The A/E is responsible to specify products approved by the Landscape Maintenance Department and described herein, then evaluate substitution requests, and submit the results of the evaluation with recommended product approvals or rejections to the University (both the University Project Manager and the Landscape Maintenance Department).

c. After review by the University, approvals for substitute materials shall be inserted into an addendum which will be issued prior to the bid.

(14) Supervision

The specifications will require the Contractor to provide competent supervision for the work to be accomplished; and, require the Contractor to keep the same foreman on the job unless a change is authorized by the A/E and the University Project Manager.
(15) **Coordination Between Contractors**

The specifications will require cooperation and coordination between the landscape contractor and other contractors working on the project, if applicable.

(16) **Workmanship**

The specifications will require first class workmanship from competent workmen. Defective materials or workmanship will not be allowed on the project.

(17) **Digging / Shutdown Permits for Campus Projects**

Direct the Contractor to obtain a “Digging Permit” from the University before beginning any trenching, excavation, or digging. Also require the Contractor to initiate a “Request for Shutdown” any time a utility must be shut off to allow work to progress. Requirements are described in the Supplemental General Conditions for University of Utah Projects. This process will allow the University to research the work site for hidden utilities, or research downstream users to notify others of a pending shutdown. When digging on campus is required, a representative of the University will identify the approximate location of all known underground utilities or structures. The Contractor will be required to obtain the services of “Blue Stake in addition to the University’s assistance. Direct the Contractor to conduct the work in such a manner to protect all existing utilities and structures from damage. Although identified, underground utilities and structures will be assumed to be in approximate locations with due care exercised in their exposure. Direct the Contractor to repair or replace any damaged utility or structure using identical materials to match existing at no expense to the University.

(18) **Protection of Existing Improvements**

The specifications will require the landscape contractor to repair any damage done to buildings, grounds, or utilities at no additional cost to the University. Contractor’s staging shall be confined to within the contract limit lines.

(19) **Site / Material Protection**

a. The specifications will require locked storage facilities for materials used on the project. Lost or damaged materials will be replaced at no additional cost to the University.

b. Instruct the Contractor that landscaping work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without permission of the A/E and University Project Manager.
(20) Inspections

a. Require the Contractor to notify the A/E when irrigation piping will be tested. The University requires the presence of the A/E for pipe testing and inspection prior to backfilling. See Trenches hereinafter in Landscape Irrigation.

b. The specifications shall state that before any planting operation begins all plants must be inspected and approved by the A/E’s Landscape Architect. All rejected plants will be removed from the site and replaced with approved plants. This inspection does not waive any guarantee to be furnished by the Contractor.

c. The specifications shall state that all plants will be inspected at the time of final inspection for conformance to specified planting procedures, and for general appearance and vitality. Any plant not approved by the A/E will be rejected and replaced immediately.

(21) Housecleaning and Clean-Up

The specifications will require reasonable clean-up be conducted both during the execution and at the conclusion of the project.

(22) Maintenance of Plant Materials

a. The specifications will require the Contractor to be responsible to maintain all planted materials in a healthy and growing condition for a period of any four (4) consecutive growing months (growing months to be defined as April, May, June, July, August and September).

1) Specify this maintenance to include weeding, cultivating, fertilizing, monitoring water schedules, controlling insects and diseases, re-guying and staking, and all other operations of care necessary for the promotion of root growth and plant life so that all plants are in a condition satisfactory to the University at the end of the guarantee period.

b. The specifications shall state that the Contractor shall be held responsible for failure to monitor watering operations and shall replace any and all plant material that is lost due to the improper application of water.

(23) Instructions for the University

The specifications shall require the Contractor to instruct and inform the University as to the watering and feeding requirements for each portion of the project.
(24) Substantial Completion for Entire Project Only

a. A Substantial Completion Certificate will only be issued by the University for landscape and irrigation projects in their entirety.

b. Substantial Completion will not be portioned to designated areas of a project.

c. The A/E shall clearly indicate this information in the Contract Documents.

(25) Guarantee

a. The specifications shall state that the Contractor shall be required to guarantee all work for a minimum of one year after the date of substantial completion.

b. The contractor will be required to accompany the University Project Manager on an onsite inspection just prior to the conclusion of the guarantee period.

c. Any plant not alive, in poor health, or in poor condition at the end of the guarantee period will be replaced immediately.

d. All replaced plants shall be guaranteed and maintained according to the specifications for another four growing months.

**REVISED:**

4.3 Landscape Design Standards

A. Create a Landscape Plan with the following Design Guidelines:

(2) Topsoil Guidelines for Existing and Imported Topsoil

a. See specific University of Utah requirements for soil preparation and soil mixes in 4.3 E. below Imported topsoil installed on site to replace or augment existing soil on site shall be obtained from naturally drained areas and shall be fertile, friable loam suitable for plant growth. The imported topsoil shall be of uniform quality, free from subsoil stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots, seeds, and any other materials that would be toxic or harmful to plant growth. Topsoil borrow shall contain no noxious weeds or noxious weed seeds.

c. Mechanical Analysis shall be performed and shall conform to ANSI/ASTM D 422.

(2) Plant Selection. Choose site appropriate plant material. In most cases, this is water-efficient plant material. Refer to 4.1 C. to review the vision of DFCM landscapes. For University of Utah
projects, the A/E is to specify drought resistant plants per the University of Utah Plant List herein, and as directed by the Landscape Maintenance Department. The A/E is to meet with the Landscape Maintenance Department to review all plants intended for the site prior to bid. As part of the review, any proposed plant which is not on the University Plant List must be specifically presented to the Supervisor of the Landscape Maintenance Department. If approved, a written notice of approval must be forwarded to the University Project Manager (and DFCM Representative if applicable) prior to bid. Specified plants shall be sound, healthy, vigorous, and free from pests and diseases. They shall be well branched, be in full leaf, and have a healthy root system. All plants specified shall be nursery grown. Require the Contractor to obtain plants which conform to species and size specified. For University projects, the intended use of any plant not shown on the University of Utah Plant List must be approved in writing by the University Landscape Maintenance Department.

(6) Mulching. Use bark or rock mulches in tree, shrub and perennial beds to conserve soil moisture and increase soil nutrients. Mulch applied at the right depth will reduce weed growth and slow erosion. Organic mulches such as bark improve soil over time. Specific requirements for mulching in University of Utah projects are provided in D. 3. And E. 7. below.

(7) Appropriate Maintenance. Water-wise landscaping will reduce maintenance; however, it will not eliminate it. Low water-use landscapes are simply maintained differently than the average lawn. Maintain the landscape by pruning, fertilizing, watering, weeding mowing and proper deadheading of perennials and flowering plant material. Specific requirements for plant maintenance in University of Utah projects are provided in 4.1/ H /v. MAINTENANCE of PLANT MATERIALS above.

ADDED:

(8). Plant Availability

a. For University of Utah projects, the name and address of the source(s) or supplier(s) for all plant materials shall be furnished to the University Project Manager and A/E prior to the delivery of any plant materials.

b. All plant materials are to be inspected by the A/E at the time of delivery on site. This inspection does not constitute final acceptance of any plant material. All plant material will be inspected again at time of final inspection and once again at the end of the warranty period. Include in project specifications that any plant...
found to be unacceptable at any of these inspections shall be immediately removed and replaced.

\(c\). The A/E shall monitor the project and confirm that no unauthorized substitutions are present. If such are found, the A/E is to reject the material and require immediate replacement. If proof is submitted that specific plants or plant sizes are unobtainable, consider written substitution requests for the nearest equivalent plant or size. All substitution requests must be made in writing and preferably before the bid due date. Review any substitution request with the Landscape Maintenance Department before taking action.

(9). Tree Wrap

Tree wrap is not used on campus.

**ADDED:**

D. Planting Operations at the University of Utah

(1) General Planting Requirements

a. When trees are planned for removal in the A/E design, or otherwise removed by the Contractor for any reason, the project or parties responsible for the removal shall replace trees on at least a two-for-one basis. The Landscape Maintenance Department reserves the right to require replacement by more than two-for-one when tree removal will cause significant loss of value to the University. The Landscape Maintenance Department will consider A/E suggestions for the species proposed for the replacement; however, the Landscape Maintenance Department is the jurisdiction having authority and will make the final determination of the selection of the tree species, and determine exact location(s) for replacement tree plantings.

b. Require the Contractor to review the exact locations of all trees and shrubs with the A/E for approval prior to the digging of any holes. Refer the Contractor to the drawings for the sizes and preparation of tree and shrub holes.

c. To avoid a soil water interface problem, excavated soil material from planting holes are to be inspected by the A/E to determine if such soil should be used as backfill material. If the excavated material is not of good quality, then require modification to an acceptable texture, organic content, and pH.

d. Prior to the installing of any plant material in the prepared hole, the A/E must approve the size, width and depth of the hole.

(2) Tree Planting Operations
a. Specify the following procedure for planting trees on campus:

1) The tree planting hole should be the same depth as the root ball, and three times the diameter of the root ball. See Handout “B”, Steps for Planting a Tree in the University of Utah Landscape Maintenance Department Landscape Specifications Project Manual.

2) Trees must be placed on undisturbed soil at the bottom of the planting hole.

3) The tree hole depth shall be determined so that the tree may be set slightly high of finish grade, 1” to 2” above the base of the trunk flare, using the top of the root ball as a guide.

4) EXCEPT IN RARE CASES TREES SHOULD NOT BE STAKED.

5) Set tree on soil and remove ALL burlap, wire baskets, twine, wrappings, etc. before beginning any backfilling operations.

6) All tree holes shall be backfilled in 12 inch lifts and settled with water to minimize any settling of the tree.

7) Upon completion of backfilling operation, thoroughly water the tree to completely settle the soil and fill any voids that may have occurred. Use a watering hose, not the area irrigation system. If additional prepared topsoil mixture needs to be added, it should be a coarser mix as required to establish finish grade as indicated on drawings.

8) The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches. All cuts, scars and bruises shall be properly treated according to the direction of the A/E. Proper pruning techniques shall be used. Do NOT leave stubs and do NOT cut the leader branch. IMPROPER PRUNING SHALL BE CAUSE FOR REJECTION OF THE PLANT MATERIAL.

9) Prepare a watering circle of 2’ diameter around the trunk. For conifers, extend the watering well to the drip line of the tree canopy. Place 4” of mulch around the planted trees.

(3) Mulching

Upon completion of all planting operations, The Contractor is to remove all undesirable material from the surface of the planting beds, including all rocks over the size of 1/2 inch diameter; re-establish all watering basins and install the specified mulch.
(4) Clean-Up

Direct the Contractor to keep the site free from accumulation of waste material. At the time of completion, all areas must be swept or washed clean and all rubbish removed to the satisfaction of the A/E.

E. Soil Preparations and Soil Mixes for University of Utah Projects

(1) Topsoil for General Application

Specify topsoil consisting of natural sandy loam, of uniform quality and free from hard clods, stiff clay, debris, or any other undesirable material. Specified soil shall contain at least 4 percent organic matter. pH range shall be 5.0 to 8.2 inclusive (see Topsoil Quality Guidelines, Handout “A” in the University of Utah Landscape Maintenance Department Landscape Specifications Project Manual).

(2) Subsoil

Subsoil will not be accepted as topsoil.

(3) Instructions to the Contractor

a. Include the following instructions to the Contractor:

1) Prior to the installation of any topsoil, the Contractor shall inspect the existing subgrade for compliance to the plans and specifications. Any discrepancy shall be brought to the attention of the University Project Manager for appropriate action.

2) Spread the topsoil to the depths specified on the drawings for all planting beds. Provide a minimum of 12” of topsoil in all planting beds and a minimum of 6” of topsoil in all lawn areas.

3) Soils with less than 4 percent organic matter must be amended.

4) When contract operations have been completed to a point where the areas will not be disturbed, the Contractor shall clean the subgrade so as to be free of waste material of all kinds.

a) Direct the Contractor to scarify and pulverize the subgrade to a depth of no less than 4 inches, then mix layered soils as follows:

(i) First distribute a 2-3 inch layer of the new soil.

(ii) Mix the new soil thoroughly with the existing soil.

(iii) Distribute the remainder of the new soil on top.
b) Scarification shall be completed in all areas that are to receive plant materials whether it is to be sod, trees, ground cover, or shrubs.

5) Refer to paragraph G. (1) above for additional instructions to the Contractor in the use of prepared backfill material to be used immediately around all plants and the filling of all planting holes.

(4) Animal Fertilizer

Animal fertilizer is not used on campus.

(5) Chemical Fertilizer for General Application

Specify chemical fertilizer to be 16-16-8 with guaranteed analysis marked on the container.

(6) Compost

Compost materials include: composted weed residues, peat, leaf, and mushroom mulch. Require the Contractor to coordinate with the University Project Manager and A/E prior to using compost at the site to determine the appropriate compost for the intended area.

(7) Mulch

Specify this material to be medium coarseness. All planting beds shall receive a 4" mulch layer.

I. Sod

(1) General Requirements for Sod

a. The University will not allow hydroseeding nor any manual seeding. Seeding will not be used in place of sod.

b. Instruct the Contractor that landscaping work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without permission of the A/E and University Project Manager.

(2) Sod Specifications

a. All sod shall be 18 month old Kentucky Blue Grass that has been cut fresh the morning of installation [see 4.11 Plant List A. (11)]. Only specify sod that has been grown on a commercial sod farm. Do not allow sod from any other source.

b. Apply fertilizer prior to laying any sod.
c. Specify that all sod that has not been laid within 24 hours shall be deemed unacceptable and will be removed from the site.

d. Direct the Contractor to lay sod with seams tightly closed with no gaps between each piece of sod.

e. Instruct the Contractor to apply water directly after laying sod. Rainfall is not acceptable.

f. Require the Contractor to rope off and secure new grass areas until the sod is established or grown sufficiently to the first mowing.

(3) Fertilizer for Sod Applications

Commercial fertilizer shall be specified as a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

(4) Topsoil Specifications for Sod

a. Specified topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris, or any other undesirable material. Soil shall be free of plants, roots, or seeds that would be toxic or harmful to growth. Topsoil shall be obtained from naturally drained areas and shall contain at least 4 percent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance with current methods of the Association of Official Agricultural Chemists. pH range shall be 5.5 to 8.2 inclusive.

b. Require the Contractor to furnish a certified report of an analytical chemist approved by the A/E showing the analysis of the topsoil proposed for use. Further require the Contractor to furnish a sample of the proposed topsoil to the A/E prior to delivery of topsoil on site.

c. See paragraph 4.2 / H. / (1) TOPSOIL FOR GENERAL APPLICATION above for topsoil standards which are to be used for sod.

(5) Top Soil Installation for Sod

a. When contract operations have been completed to a point where the areas will not be disturbed, the Contractor is to clean the subgrade so as to be free of waste material of all kinds. Direct the Contractor to scarify and pulverize the subgrade to a depth of not less than 4 inches. Scarification shall be completed in all areas that are to receive plant materials whether it is to be sod, trees, ground cover, or shrubs.

b. Specify the distribution of topsoil to a depth of 6 inches over all planting areas shown in the Contract Documents. Do not allow the placement of topsoil over subgrade that is frozen or damp.
c. The surface on which the sod is to be laid is to be specified firm and free from footprints, depressions, or undulations of any kind. Specify the surface to be free of all materials larger than 1/2” in diameter.

d. The finish grade of the topsoil adjacent to all sidewalks, mow strips, etc., prior to the laying of the sod, shall be set such that the crown of the grass shall be at the same level as the adjacent concrete or hard surface. ALLOW NO EXCEPTIONS.

(6) Sod Installation

a. Include the following in specifications:

1) Prior to laying of sod, the entire surface to receive sod shall be uniformly covered with the specified fertilizer at the rate of 4 pounds per 1,000 square feet. Notify the University Landscape Maintenance Department 24 hours prior to intended fertilizer application. The A/E, University Project Manager and University Landscape Maintenance may inspect the site and fertilizer prior to application, and witness the application procedure.

2) Upon completion of the laying operation, an inspection of the area shall be made. All voids and large cracks between individual pieces of sod shall be filled with topsoil, prior to watering.

3) Watering of the sod shall be the complete responsibility of the Contractor by whatever means necessary to establish the sod in an acceptable manner prior to acceptance by the University. If an irrigation system is in place on the site, but for whatever reason, water is not available in the system, it is the full responsibility of the Contractor to water the sod by whatever means, until the sod is accepted by the A/E and University Landscape Maintenance Department.

4) Upon completion of filling all voids in the newly laid sod areas, the sod is to be completely saturated with water.

5) Protection of the newly laid sod shall be the complete responsibility of the Contractor. Instruct the Contractor to provide acceptable visual barriers, to include barricades set at appropriate distances with strings or tapes between the barriers, as an indication of new work. Specify that the Contractor is to restore any damaged areas caused by others (including vehicular traffic), erosion, etc., until such time as the lawn is accepted by the University.

(7) Sod Guarantee

Specify that the Contractor shall be responsible for the protection, watering, and replacement of any damaged sod until acceptance by the University. This
guarantee shall include filling any voids between sod pieces, repairing of any eroded areas, and maintaining the sod by watering, mowing, and controlling of insects, as well as advising the University of any maintenance or watering procedures necessary to care for and promote plant life. All sod must be in satisfactory condition at the time of the substantial completion inspection.

4.5 Landscape Design Standards

A. Creating Plant Hydra Zones or Water Zones: Hydrozones or Water Requirement Zones: When designing irrigation zones, do not combine differing plant materials or environments on the same zone (i.e., separate sod zones from shrub zones, flower zones from tree zones, sloped area zones from flat area zones, north facing shaded zones from full sun zones, etc.). Each zone should serve plants with similar water requirements. There are guidelines that should be used when creating the four water use zones that may occur in a water-wise landscape. Each zone…

G. Mulch
After completion of all planting, all irrigated non-turf areas shall be covered with a minimum layer of 3” of Mulch to retain water, inhibit weed growth and moderate soil temperature. Non-porous material shall not be placed under the mulch. Specific requirements for mulching in University of Utah projects are provided in 4.2 / G. / (3) and 4.2 / H. / (7) above.

H. Soil Preparation
Soil preparation shall be suitable to prove healthy growing conditions for the plants and to encourage water infiltration and penetration. Soil preparation shall include scarifying the soil to a minimum depth of six (6) inches and amending the soil with organic materials as per specific recommendations of the Landscape Architect based on the Soils Report. See specific University of Utah requirements for soil preparation and soil mixes in 4.2 / H. above.

J. Site Furniture (Benches, Tables, Bike Racks, Waste Receptacles, and Urns)

(1) Anchors for Site Furniture
Specify all site furniture with appropriate anchors to the concrete slab on which they are mounted, per manufacturer’s instructions.

(2) Exterior Benches and Tables
   a. Specify benches (backed or backless) and tables with coated metal grid assemblies with secure ground attachments.

   1) Colors are to be selected and approved by Facilities Management.
2) Approved manufacturer is Landscape Forms, Inc. “Plexus” benches, “Carousel” tables. All other manufacturers and products must be reviewed and approved by University Facilities Management prior to bid. If prior approval is requested, require actual furniture samples with complete specifications and the finish matching the Plexus standard.

(3) Bike Racks

Campus Planning will determine whether the proposed bicycle parking is located in an area of campus with higher or lower density parking demands.

a. The "inverted "U" bicycle rack with the galvanized finish is the campus standard for areas of campus with lower density bicycle parking demand.

1) For bike racks specified as an inverted “U” rack with no cross bar. The inverted “U” rack shall be fabricated from 2” schedule 40 galvanized tubing. The overall vertical dimension shall be 40”. The overall width of the rack measured leg to leg shall be 22”, measured from outside vertical tube to outside vertical tube.

2) The installed rack shall have a vertical dimension of 34” from top of concrete to top of the inverted “U”. Each leg’s remaining 6” shall be cored into concrete with a 3” diameter core, and filled after the rack is set with expansive anchoring cement, non-shrink grout.

3) The completed installation shall be true and plumb, square to building lines. Each core drilled hole shall be no closer
than 3” to any concrete edge or expansion joint or line. When installing a series of racks, consideration shall be taken not to place them too close to each other, a minimum of 30” shall be maintained between racks.

4) If a series of inverted “U” bike racks is specified, require the Contractor set the racks such that the clear space between individual racks is a minimum of 30”.

b. The stainless steel inverted 'U' rack is recommended for high profile areas of campus with lower density demand, i.e. campus portals.

c. For high density bicycle parking demand areas, a rack meeting the following specifications is required:

1) the rack contains the front wheel, preventing bicycles from falling over;
2) the rack itself is located on one side of the parking area, leaving more area clear when the racks are not in use than the "inverted U" rack;
3) allows two point locking for security;
4) the racks can be placed closely together and angled, allowing higher density layouts,
5) the finish is either galvanized or stainless steel.

d) If desired, a brightly colored "artsy" bicycle rack, approved by Campus Planning, may be placed in a highly visible position to draw attention to the high density rack bicycle parking area.

(4) Waste Receptacles

a. Waste receptacles shall be located at each main entry to the building (next to the entry door but out of the way for snow removal) and on each patio. Design a concrete pad extension to the entry or patio specifically for trash receptacles and urns to avoid snow plows. Direct the Contractor to bolt waste receptacles and urns to the concrete pad. The waste receptacles shall be cast concrete units manufactured by WAUSAU TILE CO., Number TF 1040. Round receptacles will not be approved. Color shall be Sand. Waste receptacles shall also be equipped with a No. TF 2094 Snuffer Attachment.

b. Where exterior site furniture weight is a limiting criterion, and design approval is received for Plexus / Landscape Forms benches, specify waste receptacles (side opening with sand pan) from the same manufacturer, with coated metal grid assemblies.
(5) Urns

Wall mount urns shall be cast concrete matching the trash receptacles in item 3 above. Specify WAUSAU TILE COMPANY Number UR 10201NS or UR11201NSPL, sand color. Selection of the specific unit style will be made by the University Project Manager and Landscape Maintenance Department. Provide a special concrete pad to avoid snow plows.

(6) Tree Grates

Tree grates should be specified for trees located in paved walkways so the inner rings can be cut as the tree grows. They should be removable grates for maintenance purposes equal to D & L Supply Co. #R-8740 180 degree square with cast iron angle frame. All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

K. Roof Top Gardens

(1) Irrigation system is required to be a two wire system controller with WiFi Module
(2) Soil moisture sensor is required for each planter bed
(3) Designer should structure zones based on light, reflection, plant type, and plant Layout
(4) In line drip emitters need to be installed at 12” spacing in a grid pattern using 0.6” gph emitters
(5) Hydrometers should include infrared registers
(6) Where rooftop access is not protected by a guard as prescribed in the IBC; and maintenance or work of any kind is performed within 10 feet of roof edges or open sides of walking surfaces, guards or approved safety harness systems shall be installed
(7) All valves must be freely accessible for maintenance from the roof, and be protected from the elements.
(8) A hose bib shall be included at every manifold off of the mainline, an isolation valve shall be included in line preceding the hose bib.
(9) Mainline isolation needs to be included inside of the building with easy access for the landscape maintenance department. It shall not be placed in areas that require safety certification and protection in order to access. Keys should be provided to the landscape department for any areas required to be locked.
(10) Where rooftop access is not required by the IBC or IFC, and rooftop gardens are installed, access to the rooftop garden shall be provided by means of permanent ladders or stair systems.
(11) A 1/4 “ test cock is to be included for a pressure gauge test for irrigation to be on the same floor as the rooftop landscape. The test cock is to be installed near the point of change from Copper to PVC. Pressure should be designed to be 90 PSI at the test port.
F. Automatic Controller
All irrigation systems shall include an electric automatic controller with multiple programs and multiple repeat cycle capabilities and a flexible calendar program. Controller shall be programmable for multiple start times for repeat and rest periods, and shall be capable of water budget adjustment. Controller shall be able to provide separate programs for turf zones, shrub zones, and drip zones. All controllers shall be capable of temporarily shutting down the system by utilizing internal/external options (such as rain, wind, and freeze devices) and the ability to adjust run times based on a percentage of maximum ET or by use of a soil sensor. Power wire and control wire shall not be contained in the same conduit. See specific University of Utah requirements below.

I. Tree Drip Emitters / Bubblers
Drip Emitters or Bubblers shall be provided for each tree where practicable. Bubblers shall not exceed 1.5 gallons per minute per device. Bubblers for trees shall be placed on a separate valve unless specifically exempted by the DFCM and the University Project Manager on all University projects.

ADDED

O. Pipe

(1) Schedule 40 PVC Pressure Rated

Specify piping (except flex swing pipe) to be schedule 40 pressure rated PVC with the ratings printed on the pipe, for sizes 1” through 3”. Specify piping to be Class 200 for sizes 4” through 10”, pipe ratings shall be clearly printed on the pipe. The pipe shall be new, free from cracks, holes, foreign material, blisters, inside bubbles, wrinkles, dents, and weathering from storage outside more than three months. No pipe will be less than 1” diameter.

(2) Main Line Piping

a. Main lines are to be sized appropriately to handle the gallons per minute (GPM) required to serve the three largest lateral systems.

b. Main lines are to be specified with solvent welded joints (gasketed pipe will be considered on a case-by-case basis, and allowed only with permission of the University Landscape Maintenance Department). Specify primer and cement (glue) for the appropriate pipe type, applied per manufacturer’s specifications. Products are to be applied per manufacturer’s specifications. All connections on main lines must be allowed to set for twenty-four hours prior to pressurization.

c. Main line pipe shall be tested for a minimum of 2 hours, at a pressure of 150 PSI. System shall be closed during test. Increase in pressure for testing shall be achieved by a powered pressure pump used for this specific purpose. Loss during testing shall not exceed 5%.

d. Thrust Block
The drawings / specifications shall require main lines to have a thrust block of poured concrete installed at each change of direction. The thrust block shall be of sufficient size for the pipe involved and rest on undisturbed ground. Thrust blocks shall be installed per Details LS-1, LS-2, and LS-3, Direct Bearing Thrust Blocks. No temporary thrust blocking shall be allowed.

(3) Lateral Line Piping

Lateral lines shall be specified as solvent weld with threaded connections at swing joints. Solvent welded lateral lines shall have the same specifications described for main lines. Threaded connections shall be sealed with Teflon type tape, and/or thread sealant, Rector Seal Number Five, or approved equal. Minimum pipe size shall be 1”, no ¾” pipe shall be allowed. Lateral pipes shall be 1”, 1-¼”, 1-½”, 2”, to a maximum of 2-1/2”. Control valves and other components shall be designed to accommodate the lateral size.

(4) Flex Swing Pipe

Flex swing pipe must be specified to be thick-walled polyethylene pipe, kink resistant, rated to at least 80 psi, and with a minimum of a two year warranty Approved manufacturers and models include: Rain Bird: SPX FLEX, Toro ‘Super Funny Pipe’, Irritrol ‘Super Blue Flex’. This pipe is to be used only between heads and lateral lines and will not exceed lengths of 2 feet. Specify for use only on heads with ¼” or smaller inlets, and sprinkler output of 6 GPM and less. Not for use with sprinklers having output over 6 GPM. For heads with 1” or larger inlets specify a prefabricated swing joint of appropriate size.

(5) Pre-Bury Pipe Inspection Form

All pipe must be inspected by the University Irrigation Shop before it can be buried. When pipe has passed inspection, the University’s representative will give the Contractor a PIPE INSPECTION FORM indicating which areas of pipe have passed. If pipe has not passed inspection, the University reserves the right to have the pipe dug up to insure it meets the standards noted herein.

P. Sleeves

Specify all sleeves to be PVC class 200 or better pipe, 2 sizes larger than the total outside diameter of the piping contained in the sleeve. Sleeves shall be a minimum of 2” in size. Specify the depth of installation for lateral and main lines. Coordinate the installation of sleeves with the location / installation of all hard surfaces. Require the Contractor to mark the location of all sleeves by attaching a locating magnet in both ends of the sleeve, and mark their location on an as-built drawing. Where sleeves are buried under hardscape, instruct the Contractor to mark the location of each sleeve by installing a magnetized masonry nail, flush with the hardscape, indicating the location of each end of the
sleeve. Insure that adequate amounts of sleeving are specified for both water lines and electrical control wires. Wires shall be in a sleeve separate from pipe, and wire sleeves shall be gray PVC S/40 electrical conduit.

Q. Fittings

(1) 3” and Above

Fittings for pipe sizes 3” and over will be specified ductile iron gasketed fittings. If gasketed pipe fittings (elbows and tees) are used, these must be thrust blocked against undisturbed soil. Refer to Details LS-1, LS-2, and LS-3, Thrust Blocking - Gasketed Piping / Sizing Procedure.

(2) Main / Laterals 2” or 2-1/2”

Fittings on main and lateral lines 2” and larger will be specified schedule 80 pressure rated PVC.

(3) Under 2”

Fittings on lateral lines smaller than 2” diameter shall be specified schedule 40 pressure rated PVC.

(4) Flex Swing Fittings

Approved manufacturers and models for fittings on flex swing pipe shall be Rain Bird SB Series spiral barb fittings, Lasco Blue Twister, Toro Super Funny Pipe fittings, or approved equal.

(5) No Galvanized Fittings

DO NOT ALLOW GALVANIZED FITTINGS of any kind on any PVC lines or fittings.

R. Non-Electric Valves

(1) Ball Valves

Specify ball valves to be domestic solid brass, meeting Federal Specification WW-V-54, CLASS A TYPE 1. Valve sizes are to be the same size as the line on which installed. Specify ball valves as isolation valves on the upstream side of automatic valve clusters and place these valves in a standard valve box.

(2) Stop and Waste Valves

Specify stop and waste valves to be solid brass meeting Federal Specification WW-V-54, CLASS A, TYPE 1. Valve sizes are to be the same as the line size on which installed. This valve must be installed below the frost line. Specify access to each valve by an appropriately sized PVC standpipe, and specify an 8” round box to cover each valve. The round box shall be stabilized on brick, and with a 12 inch gravel sump beneath the valve.
(3) Hose Bib

Specify one hose bib per group of valves. The hose bib is to be installed on a manufacturer assembled S/80, swing joint. See Detail LS-5 for additional information.

(4) Quick Coupler Valve

a. Specify one quick coupler valve to be installed downstream of, and close to, the backflow preventer. The quick coupler valve is to be installed downstream of the master valve/flow sensing device.

b. The quick coupler valve shall be a, two-piece, one inch, brass valve. Approved manufacturers and models shall be Rain Bird 44NP, Buckner QBRB5NP10, or Hunter Industries HQ-44LRC-NP.

S. Electric Remote Control Valves

(1) Installation

Specify each valve to be installed using schedule 80 piping on both the upstream and downstream sides, to extend beyond the valve box. Refer to Detail LS-4, Ball Valve Assembly and LS-7, Valve Manifold.

(2) Specification Requirements

a. Specify electric remote control valves using the following requirements:

1) One inch valves shall be plastic, approved manufacturers and models Rain Bird 100-PEB, Hunter Industries ICV-101G, or Toro 220-P:

a) Glass-filled nylon reinforced bodies.

b) Fabric-reinforced diaphragms.

c) Brass flow control stem.


e) Capability to operate low flows of .25 GPM or less

f) Optional pressure regulating device available.

g) All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.

h) 1” valves shall be designed with a minimum of 5 GPM and a maximum of 24 GPM for load.
2) Valves larger than one inch shall be brass. Approved manufacturers and models shall be Toro 220 Series valves, Rain Bird GB, Hunter IBV.

   a) Corrosion resistant brass body and bonnet.
   b) Fabric-reinforced diaphragms.
   c) Manual external bleed.
   d) Optional pressure regulating device available. The pressure regulating device shall be serviceable while the main line is under pressure. The device shall not be installed under the solenoid.
   e) All other manufacturers must be reviewed and approved by University Facilities Management prior to bid.
   f) 1-1/2” valves shall be designed with a minimum of 25 GPM and a maximum of 34 GPM for load. 2” valves shall be designed with a minimum of 35 GPM and a maximum of 75 GPM for load.
   g) Zone size shall not exceed 75 GPM

3) Specify that all valves will be tagged with University Landscape Maintenance Department approved tag indicating the appropriate controller and station number.

T. Electric Control Wire

(1) Wire Specifications

   a. Electric control wire shall be specified polyethylene (PE) UF/UL DIRECT BURIAL type. Wire which is routed from the electric remote control valve to the controller shall be #14 AWG. Polyvinyl chloride (PVC) coated UF/UL type wire shall not be used.

   b. Specify all wiring to be direct run with no splices except as noted in (3) below. Include a statement in the construction documents that wire outside of valve manifold cannot be spliced without the approval of the University Project Manager and Landscape Maintenance.

   c. The specifications shall require an extra or "spare" control wire provided to each valve group. This spare wire shall not be a single wire looped throughout the site. Five valve groups require 5 spare wires.

(2) Wire Color

   a. Wire coloring shall follow the following coding:
1) Ground wire shall be green.

2) Common wire to a valve shall be white.

3) Controller electrical power wire shall be black.

4) Master valve wire, other than the common wire, shall be orange.

5) Flow sensing wire, other than the common wire, shall be purple.

6) Each control wire extending to a valve shall have a different color wire for each valve, excluding those colors designated for other purposes i.e. green, white, black, purple and orange.

(3) Splices

Splices in electric control wire at the electric remote control valve shall be twisted together, then soldered and fitted with a direct bury UL listed wire connector. All splices shall be contained in a valve box.

U. Electric Controller

(1) Rain Bird ESP

a. All clocks shall be equal to a Rain Bird ESP-SAT-LS or LW series controller or approved equal, installed according to manufacturer’s instructions. Models within the series shall be -SITE-SAT, -SAT-LINK or -SAT-TW. Controller station counts shall be 24 or 40 only, no other count configurations allowed. Controllers shall be provided with a Rain Bird RB-SE-MET Ethernet device server. All other manufacturers / products must be reviewed and approved by University Facilities Management prior to bid. Refer to Detail LS-11, Pedestal Mounted Controller.

b. The exact location of the clock shall be approved by the Landscape Maintenance Department.

c. The controller must be located such that it can communicate clearly to the University’s central computer. A radio site survey is required to verify transmission clarity.

d. All controllers must be compatible with the University of Utah’s existing central control system. Alternate manufacturers must be prior approved before bidding. Before prior approval will be considered, proposed products will be required to undergo on-site compatibility testing under direction of the University.

e. Central control equipment including but not limited to CCU’s and controllers shall be commissioned, tested and approved by a Factory Authorized Service Technician, From a local Rain Bird authorized
Distributor, before substantial completion will be granted. This task shall be at the Contractor’s expense.

f. Cluster Control units shall be model CCU-28, with a Rain Bird RB-DS-MPX Multiplexer and a RB-SE-MET Ethernet device server.

(2) Grounding

a. Require the Contractor to ground all clocks according to manufacturer’s recommendations, using either a three rod grounding grid or a grounding plate with a rod combination. See grounding details. If a three rod grounding triangle cannot be installed, contact the University Project Manager and the Landscape Maintenance Department.

b. The grounding plate shall be manufactured for the express purpose of grounding. The plate shall measure a minimum of 4 inches by 96 inches, and no thinner than six one-hundredths of an inch.

c. Grounding rods shall be 8 foot long, 5/8 inch minimum diameter solid copper. Rods shall be placed a minimum of 8 feet apart.

d. Connect rods and/or plate using #6 AWG or larger bare, solid copper wire to interconnect all rods.

e. Wire shall be run as straight as possible, with a bend of no tighter than ninety degrees and a radius no smaller than eight inches going into the controller. The ground wire entering the controller shall be of the shortest possible length and contain no bends kinks or coils in the wire.

f. All grounding must be tested to 10 Ohms or less.

(3) Central Control Radio Signal

The controller shall include radio signal access to the University’s central controller. This shall be done by installing a 900 MHz spread spectrum radio card into the controller which is compatible with the controller. The radio card will be attached to a 900 MHz, 3db gain, antenna mounted on the controller. If the need for an antenna with a larger DB gain is determined to be needed then the antenna of appropriate size shall be attached to the radio card and controller.

(4) Controller hand-held Radio Remote Card

The controller will include a radio remote card compatible with the University’s radio remote system. This card shall be connected to a compatible radio antenna, permanently installed, and transmitting at 27 MHz. Preferred antenna shall be TRC Irrigation Remotes model 35-001-006 low profile ‘hockey puck’ antenna, or approved equal.

(5) Antenna Location
Antennas shall be installed at least forty feet away from electric motors, large power transformers, power lines, variable-frequency drives and other devices with a high level of electrical noise which could affect communication from the controller to the CCU. All antennas must be permanently mounted on the exterior of the controller cabinet, nearby building or fixture. Antennas must be positioned such that they are three feet away from all vertical surfaces and out from underneath roof awnings.

V. Master Valve / Flow Sensor

(1) Specification Requirements

The master valve and flow sensing device shall be a single, combined, unit with the capability of adding pressure regulation where needed, Netafim Reed Switch, Normally Closed models, LHMXXTG1-MEL or LHMXFG1-MEL, or approved equal. Photo Diode and normally open models shall not be specified. The valve shall be designed for high pressure, remote control applications via 14 AWG PE wire. The unit shall be double-chambered, and made of polyester coated cast iron, with a reinforced natural rubber valve diaphragm. No straight length of pipe will be required upstream or downstream of the device. Only globe configured valves will be used.

(2) Add Brass Ball Valves

When ports are available on the valve, two brass ball valves will be added to the valve, attached by two brass nipples, to allow for drainage and winterization of the valve.

W. Backflow Prevention

(1) Reduced Pressure Assembly Valves

Specify backflow preventers to be approved reduced pressure assembly valves with accessory construction, modular design, and replaceable seats. Specify this valve assembly to meet the following standards: ASSE No. 103; AWWA C506-78; CSA b65.4; and, FCCCHR of USC. This valve must be serviceable "in line" and have ball valve test cocks and valves on both sides for testing.

(2) Installation

Installation will be on the main line in an accessible location.

(3) Site Location

The exact location for the reduced pressure assembly is to be approved on site by the Landscape Maintenance Department. Specify the reduced pressure assembly to be installed above ground in a lockable metal enclosure approved by the Landscape Maintenance Department. See Detail drawing LS-17.

(4) Drains
Specify the installation of drains upstream and downstream of the reduced pressure assembly. These shall be 'American made’ brass stop and waste valves. Specify each drain to be provided with a gravel sump 12” x 12” x 12” filled with 1” minus washed gravel. Each drain is to be accessible by an appropriately sized PVC standpipe and covered with an 8” round box. The round box shall be stabilized on brick, and installed with a 12 inch deep gravel sump beneath the valve.

X. Heads

(1) Spray Heads

a. Spray heads shall be Rain Bird RD-XX-S-P30 or Hunter PROS-XX-PRS30-CV series spray heads, or approved equal, of appropriate height for the plant material it services.

b. At no time use the side inlet.

c. Heads shall have the following characteristics:

1) UV resistant plastic.

2) Stainless steel spring.

3) Retractable stem that flushes while retracting.

4) Ratcheting riser.

5) Five year warranty.

(2) Small Rotors

a. Small rotors shall be approved manufacturers and models: Rain Bird 5000-PL-XC-SAM-R series, Hunter I-20-XX-CV.

b. Small Rotors shall have the following characteristics:

1) A radius of 25 to 50 feet.

2) Durable, commercial grade body, cap and riser top.

3) A flow shut off mechanism in the rotor such that water can be cut off to the head while the lateral irrigation system is still in operation.

4) All rotor adjustments like arc, head shut-off, radius, nozzle set screw, riser access, must be readily accessible from the top of the head.

5) A twelve inch, four inch, and stainless steel riser options.

6) A ratcheting or slip clutch riser.
7) Low angle and matched precipitation rate nozzles must be available.

8) An optional built-in check valve that can hold back at least seven feet of water due to an elevation change of the pipe.

9) Five year trade warranty.

10) A matched precipitation rate nozzle package for 25, 30 and 35 foot radius of coverage.

(3) Large Rotors

a. Large rotors shall be approved manufacturers and models, Rain Bird 8005 series rotor, Hunter I-25 series rotor.

b. Large rotors shall have the following characteristics:
   1) A radius of 39 to 60 feet.
   2) Durable, commercial grade body, cap and riser top.
   3) Brass reinforced nozzle to riser connection.
   4) Vandal resistant arc adjustment that will return to a user defined arc.
   5) In-head option to change from part-circle to a continuous 360°, true full circle, head.
   6) All rotor adjustments like arc, head shut-off, radius, nozzle set screw, riser access, must be readily accessible from the top of the head.
   7) A stainless steel riser option.
   8) Built-in check valve that can hold back ten feet of water due to an elevation change of the pipe.
   9) Five year trade warranty.

Y. Nozzles

(1) No Variable Arc Nozzles

No variable arc nozzles for spray heads will be allowed.

(2) Multi-Stream Rotary Nozzles
Multi-stream rotary nozzles for spray heads are allowed, approved manufacturers and models: Hunter Industries MP Rotator nozzles, Rain Bird RVAN nozzles. The radius of arc must be adjustable from the top of the nozzle. Multi-stream nozzles must be installed on spray heads with pressure regulated stems.

Z. Head Location

(1) Drawing Requirements

a. Show all irrigation head locations on drawings diagrammatically. Although the Contractor will be required to exactly determine the location of each head for proper coverage, the A/E shall exercise all due diligence in establishing head spacing, head specifications for best coverage, and piping design for minimum pressure loss to provide peak head performance.

b. After due diligence in the design, the A/E shall include a note on the drawings indicating:

“It shall be the Contractor's responsibility to determine the exact location of each irrigation head to accommodate the conditions found on the site in order to provide COMPLETE coverage of all areas. If a deficiency is found during the installation process, contact the University Project Manager and the landscape consultant at that time.”

(2) Manufacturer’s Recommended Spacing

The A/E’s design shall locate sprinklers at 90% OR LESS, of the manufacturer’s published coverage radius. The A/E shall also use the manufacturer’s published optimum pressure recommendation for the respective sprinkler head. (i.e. using a pressure rating higher than the published recommendation in order to justify increased spacing is not acceptable) Site conditions such as wind or slope may require tighter spacing than the 90%. At no time shall the A/E match or exceed the manufacturer’s published coverage for spacing.

(3) Layout Adjustments

DO NOT allow the Contractor to make adjustments in the designed layout unless prior approved to clear existing fixed obstructions.

(4) Note Deviations on As-Buils

Direct the Contractor to note all deviations from the drawings on the as built drawings.

(5) Perpendicular & Flush to Finished Grade

Specify all irrigation heads to be set perpendicular and flush to the finished grade unless otherwise designated on the drawings and specifications.

(6) No Mixed Head Types
The design must not mix head types in a zone. All heads shall be matched precipitation rates within a sprinkler zone.

(7) The design shall not have head to head coverage extending through fencing or other barriers, or over walks or pavement. Mow curbs, paths, walks shall be border watered with part circle heads on both sides.

AA. Valve Boxes

(1) Installation Requirements

Specify each valve box to be placed on a bed of 1” minus washed gravel 6” deep below the valve box. Use the same manufacturer’s valve boxes throughout the construction site, Carson & Brooks, tee top lids. Additionally, direct the Contractor to set the box on a foundation of pressure treated wood frame or brick, which is placed on well compacted, undisturbed soil. Note that there must be 2” clearance between the base of the valve and the gravel bed. Also note that there must be 2” clearance between the top of the valve and the valve box lid. Valve boxes shall be green in color only. Specify that all valve box lids shall be ‘lipped’ or ‘T’ cover configuration, not ‘flush’ cover configuration. Specify that all valve box lids shall have labels branded into lid, using a device same as or similar to Nova Tool Co. model BI-CC-XX 2” bronze letters. Box branding shall be as follows:

<table>
<thead>
<tr>
<th>BOX LID BRANDING LABEL</th>
<th>ITEM OR EQUIPMENT IN THE BOX</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXX – YY</td>
<td>Controller #XXX – Station #YY</td>
</tr>
<tr>
<td>ISO</td>
<td>Isolation or Line Valve</td>
</tr>
<tr>
<td>WS</td>
<td>Wire Splice</td>
</tr>
<tr>
<td>S/W</td>
<td>Stop &amp; Waste Valve</td>
</tr>
<tr>
<td>QC</td>
<td>Quick Coupler</td>
</tr>
<tr>
<td>HYD</td>
<td>Hydrometer</td>
</tr>
<tr>
<td>GND</td>
<td>Grounding Equipment</td>
</tr>
</tbody>
</table>

(2) Site Location

The Contractor shall be directed to install all valve boxes no closer than three feet from sidewalks, curbs, and all hard surfaced areas. Where three feet clearance from hardscape is not possible, locate the valve box as far as practical from areas of vehicle traffic. DO NOT allow the Contractor to install valve boxes at the low point of the landscaping.

(3) Limit #Valves in Box

Limit the number valves per valve box. The maximum number allowed in each box is shown in the chart below:
### BB. Trenches

1. **Lateral Lines**

   Specify trenches for lateral lines to be dug such that a minimum of 8” and a maximum of 18” of cover on top of the pipe, and as wide as necessary to properly install piping.

2. **Main Lines**

   a. Specify trenches for main lines to be dug a minimum of 18” deep (from grade to top of pipe) and as wide as necessary to properly install piping.

   b. Direct the Contractor to route all electrical wiring in the main line trench as shown on Detail LS-12, Trench Detail. Require the Contractor to attach the electrical wires every 15 feet with tape to the underside of the main line.

3. **Multiple Pipes**

   Require trenches with more than one pipe installed to have a pipe separation distance of 4” between each pipe. NO EXCEPTIONS will be considered for this requirement.

4. **Buried Wire**

   Wire not in a main line trench shall have a minimum of 12” of cover to finish grade. Wire will be buried below and to the side of pipe with a separation from the pipe of no fewer than 3 inches.

### Table: Valve Box Size and Electric Valve Size and Quantity

<table>
<thead>
<tr>
<th>VALVE BOX SIZE</th>
<th>ELECTRIC VALVE SIZE AND QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Valve Box</td>
<td>One Valve per Box</td>
</tr>
<tr>
<td>Jumbo Valve Box</td>
<td>One 2” Valve, or Two 1-1/2” Valves, or Two 1” Valves</td>
</tr>
<tr>
<td>Little Giant</td>
<td>Two 2” Valves, or Three 1-1/2” Valves, or Three 1” Valves</td>
</tr>
<tr>
<td>Giant</td>
<td>Three 2” Valves, or Four 1-1/2” Valves, or Four 1” Valves</td>
</tr>
</tbody>
</table>
(5) Site Location

Specify that trenches shall be at least 12" away from curbs, buildings, and sidewalks; and, three feet from all roads. NO EXCEPTIONS will be considered for this requirement.

(6) Backfilling of Trenches

Instruct the Contractor to backfill around and over the pipes in accordance with Detail LS-12, Trench Detail. All material that is to come in contact with the pipes shall be less than 1/4" in diameter and shall be imported for this specific use. The existing material on site can only be used as backfill material above the piping upon the approval of the A/E; then, it may be used in accordance with Detail LS-12. Compaction requirements shall generally be 95% under walks and roadways and 85% in lawn and shrub areas, unless information shown on Detail LS-12 or elsewhere on the drawings is more restrictive.

CC. Drip and Sub-Surface Irrigation Systems

(1) Manufacturer’s Recommendations

Direct the Contractor to follow manufacturers’ recommendations for installing drip irrigation systems.

(2) No Point Source Systems

No point-source systems shall be permitted on University projects.

(3) Use End Feed / Grid Design

Design drip systems using an end feed, grid design.

(4) End Feed Piping

End feed pipes at each end of the grid (also known as footers, headers, or exhaust pipes) shall be 1” schedule 40 PVC of appropriate size, no smaller than 1”.

(5) Manifolds

a. Manifolds shall include the following devices, in this order:

1) Brass isolation ball valve.

2) Use an automatic valve. Do not exceed 14 GPM per zone.

3) Manifold union.

4) Disc filter with 140 mesh disc filter rings, of appropriate size.

5) In-line pressure regulator valve of appropriate size and flow.
6) Manifold union.

b. All of the devices in the manifold shall be spaced such that all of the devices are fully operational and accessible for maintenance purposes.

(6) Drip Tube Requirements

a. Use inline drip tubing, approved manufacturers and models Netafim Techline CV or Rain Bird XFCV.

b. Drip tubing shall be pressure compensating, have a continuously self-flushing drip emitter design, and have a 2 PSI check valve in each emitter.

c. Direct the Contractor to bury the tubing 2 – 5 inches. Do not place tubing under weed barrier fabric.

d. Require anchoring the drip tubing with stainless steel soil staples every 4 feet. Use two soil staples at each tee, elbow or cross.

e. Place manual line flushing valves at each dead end, and low point in the system. Line flush valves shall be placed in a 10 inch round box, stabilized on brick, and with a 12 inch gravel sump beneath the valve.

f. Tubing shall be 0.40, 0.60 or 0.90 GPH set @ 18” emitter spacing in tubing. Tubing row spacing shall be uniform at 18” on center.

DD. Flushing and Preliminary Testing

(1) Direct the Contractor to flush and test each zone after installation of new piping, swing pipe, and prefabricated swing joints, but before installation of irrigation heads and before trenches have been completely backfilled. The control valve shall be opened fully and a full head of water used to flush out the system. Each automatic valve shall then be disassembled, inspected for rocks, cleaned, and reassembled. Install irrigation heads and test each zone for complete coverage.

(2) Specify that testing will be performed after completion of each circuit, and again after completion of the entire system. At this time any necessary repair work will be done at the Contractor's expense and the entire system will be in good working condition prior to the Substantial Completion Inspection.

EE. Winterization

All irrigation systems at the University are winterized starting October 15th. If the Substantial Completion Certificate has not been issued before winterization, it will be the responsibility of the Contractor to coordinate with the Landscape Maintenance Department Irrigation Shop regarding winterization, and the Contractor shall be responsible to winterize the system and prevent all components from freezing. Require the Contractor to then be responsible to activate the system in the Spring, with the assistance of the Landscape Maintenance Irrigation Shop to insure there are no problems.
FF. Irrigation System Guarantee

All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of Substantial Completion. The Contractor shall correct any deficiencies when notified during the warrantee period, and additionally correct, to the satisfaction of the University, any damage to buildings or grounds caused by the deficient work, without cost to the University. All guarantees shall be in writing and approved by the A/E before submitting to the University. The written guarantee is due to the A/E for review and approval on or before the date of Substantial Completion.

4.7 Contract Documents

See 4.1 / A. / (6) / j. DRAWINGS / SPECIFICATIONS FOR UNIVERSITY PROJECTS above for specific University of Utah document requirements.

4.8 Irrigation Record Drawings and Operations and Maintenance Manuals

A. As-Builts and O&Ms

Irrigation record drawings and operations and maintenance manuals are to be turned over to the DFCM at project completion prior to final acceptance. On University of Utah projects, irrigation record drawings shall be prepared and submitted in accordance with Design Process, University of Utah Supplement, 4.4 / J. / 4. UNIVERSITY AS-BUILT DOCUMENTS REQUIREMENTS, and shall include the information described below. O&M manuals for University projects are to be prepared and submitted in accordance with the General Conditions and the Supplemental General Conditions for University of Utah Projects.

4.9 Plan Review, Construction Inspection and Post-Construction Monitoring

A. Landscape Development Package / Water Allowance Worksheet

As part of the Site Plan and Building Approval Process, a copy of the Landscape Development Package shall be submitted to the DFCM for DFCM managed projects (or to the University Project Manager for University managed projects) for review and approval before construction begins. With the Landscape Development Package, a copy of the Landscape Water Allowance Worksheet shall be completed by a Landscape Architect or another licensed professional as recognized by the State of Utah to perform Landscape Architectural services and submitted to the DFCM and to the University Project Manager for all University projects.

F. Site Inspection

During construction, site inspection of the landscaping may be performed by the DFCM, the University Project Manager, and the local institution or agency (the University of Utah Landscape Maintenance Department).

G. System Test

During construction a mainline pressure and leak test will be conducted.
(1) On University of Utah projects, prior to the Substantial Completion inspection, require the landscape irrigation contractor to coordinate with the University’s Irrigation Foreman to subcontract with a Certified Landscape Irrigation Auditor (hereinafter referred to as “CLIA”), at the Contractor’s expense. At a pre-approved time and date, the Contractor’s CLIA auditor will be directed to a location or locations specified by the University to conduct the audit. The Substantial Completion Inspection will not be authorized until the CLIA report is acceptable to the University.

H. Substantial Completion
Following construction an inspection shall be scheduled with the DFCM, University Project Manager and University Department of Landscape Maintenance to verify compliance with the approved landscape and irrigation plans. A Certificate of Substantial Completion Form shall be completed by the Contractor or Landscape Architect and submitted to the DFCM for DFCM managed projects. The Substantial Completion Form on University managed projects will be as directed by the University Project Manager.

(1) For University of Utah projects, during the Substantial Completion Inspection, the entire system, both electric and hydraulic, will be tested in the presence of the A/E, the Landscape Maintenance Department, and the University Project Manager to insure COMPLETE coverage of all areas to be watered. This test must be performed by using the irrigation controller. Any deficiencies identified at this time will require revisions by the Contractor at the Contractor's expense.

I. Water Use Efficiency Review (Audit)
Following construction a Water Use Efficiency Review (Audit) will be conducted by a certified Landscape Irrigation Auditor. The auditor shall be independent of the contractor, design firm and owner/developer of the project. The water performance audit will verify that the irrigation system complies with the minimum standards required by this ordinance. The auditor shall furnish a certificate to the DFCM (for DFCM managed projects or to the University Project Manager for University managed projects), Landscape Architect, and installer certifying compliance with the minimum distribution requirements and an irrigation schedule.

J. Right to Perform Site Inspections
The DFCM and the University reserves the right to perform site inspections at any time before, during or after the irrigation system and landscape installation, and to require corrective measures if requirements of this guideline are not satisfied.

4.10 Soils Definitions & Guidelines

H. See 4.2 H. for Additional University of Utah Guidelines

4.11 Plant List

A. University of Utah Plant List

(1) University Plant List Supersedes DFCM Plant List
On all University of Utah projects, use the University of Utah Plant List in lieu of the DFCM plant list.

(2) General Requirements

<table>
<thead>
<tr>
<th>GENERAL INFORMATION</th>
<th>INFORMATION GATHERED FROM…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use drought tolerant plants &quot;water wise plants&quot;</td>
<td></td>
</tr>
<tr>
<td>Review <em>Design Standards</em> and</td>
<td>Salt Lake City Department of Public Utilities</td>
</tr>
<tr>
<td>Review planting plans with Landscape Maintenance</td>
<td>University of Utah Department of Landscape Maintenance</td>
</tr>
</tbody>
</table>

(3) Deciduous Trees

<table>
<thead>
<tr>
<th>Acer sp</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer ginnala</td>
<td>Amur Maple</td>
</tr>
<tr>
<td>Acer grandidentatum</td>
<td>Bigtooth Maple</td>
</tr>
<tr>
<td>Acer griseum</td>
<td>Paperbark maple</td>
</tr>
<tr>
<td>Acer palmatum</td>
<td>Japanese Maple</td>
</tr>
<tr>
<td>Acer palmatum dissectum</td>
<td>Lace leaf Maple</td>
</tr>
<tr>
<td>Acer platanoides</td>
<td>Norway Maple</td>
</tr>
<tr>
<td>Acer rubrum</td>
<td>Red Maple: Brandywine, Red sunset</td>
</tr>
<tr>
<td>Acer saccharinum</td>
<td>Sugar Maple</td>
</tr>
<tr>
<td>Acer tatarica</td>
<td>Tatarian Maple</td>
</tr>
<tr>
<td>Acer truncatum</td>
<td>Shantung Maple or Purpleblow</td>
</tr>
<tr>
<td>Aesculus X carnea</td>
<td>Red Horsechestnut</td>
</tr>
<tr>
<td>Albizia julibrissin</td>
<td>Misosa, Silk Tree, Albizia</td>
</tr>
<tr>
<td>Amelanchier alnifolia</td>
<td>Saskatoon, Western Serviceberry</td>
</tr>
<tr>
<td>Amelanchier arborea</td>
<td>Downy Serviceberry</td>
</tr>
<tr>
<td>Amelanchier grandiflora</td>
<td>Autumn Brilliance</td>
</tr>
<tr>
<td>Amelanchier laevis</td>
<td>Princess Diane Serviceberry, Cole's Select Serviceberry, Laevis Serviceberry</td>
</tr>
<tr>
<td>Amerlancier utahensis</td>
<td>Utah Serviceberry</td>
</tr>
<tr>
<td>Betula nigra</td>
<td>River Birch</td>
</tr>
<tr>
<td>Betula papyrfera</td>
<td>Paper Birch</td>
</tr>
<tr>
<td>Betula occidentalis</td>
<td>Betula fontinalis</td>
</tr>
<tr>
<td>Carpinus betulus 'fastigata'</td>
<td>European Hornbeam</td>
</tr>
<tr>
<td>Catalpa Sp.</td>
<td>Northern Catalpa</td>
</tr>
<tr>
<td>Cercidiphyllum japonicum</td>
<td>Katsuratree</td>
</tr>
<tr>
<td>Cercis canadensis</td>
<td>Eastern Redbud or Judas Tree</td>
</tr>
<tr>
<td>Cercis occidentalis</td>
<td>Western Redbud</td>
</tr>
<tr>
<td>Cercocarpus intricatus</td>
<td>Littleleaf mountain mahogany</td>
</tr>
<tr>
<td>Cerocarpus ledifolius</td>
<td>Curlleaf Mountain Mahogany</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Chilopsis linearis</td>
<td>Desert Willow</td>
</tr>
<tr>
<td>Cladrastis lutea kentuckea</td>
<td>Yellowwood</td>
</tr>
<tr>
<td>Cornus florida</td>
<td>Flowering Dogwood</td>
</tr>
<tr>
<td>Cornus kousa</td>
<td>Kousa Dogwood</td>
</tr>
<tr>
<td>Cornus sericea &amp; alba</td>
<td>Red-osier or Red-Stemmed Dogwood</td>
</tr>
<tr>
<td>Corylus columna</td>
<td>Turkish Filber, Turkish Hazel</td>
</tr>
<tr>
<td>Cotinus coggyria &amp; obouatus</td>
<td>Smoketree</td>
</tr>
<tr>
<td>Crataegus sp.</td>
<td>Hawthorn; Paul Scarlet</td>
</tr>
<tr>
<td>Eucommia ulmoides</td>
<td>Hardy rubber tree</td>
</tr>
<tr>
<td>Fagus sylvatica cultivars</td>
<td>European Beech</td>
</tr>
<tr>
<td>Fraxinus</td>
<td>Ash</td>
</tr>
<tr>
<td>Ginkgo biloba</td>
<td>Ginkgo, Maidenhair Tree</td>
</tr>
<tr>
<td>Gleditsia triacanthos var. inermis</td>
<td>Thornless Honey Locust</td>
</tr>
<tr>
<td>Koelreuteria paniculata</td>
<td>Goldenraintree</td>
</tr>
<tr>
<td>Laburnum X watereri</td>
<td>Goldenchain tree, Waterer Laburnum</td>
</tr>
<tr>
<td>Larix decidua</td>
<td>European Larch</td>
</tr>
<tr>
<td>Liriodendron tulipifera</td>
<td>Yellow-Poplar, Tuliptree, Tulip Poplar</td>
</tr>
<tr>
<td>Maackia amurensis</td>
<td>Amur Maackia</td>
</tr>
<tr>
<td>Magnolia x loebneri</td>
<td>Magnolia</td>
</tr>
<tr>
<td>Magnolia x soulangiana</td>
<td>Saucer Magnolia</td>
</tr>
<tr>
<td>Magnolia sprengeri</td>
<td>Sprenger Magnolia</td>
</tr>
<tr>
<td>Magnolia stellata</td>
<td>Star Magnolia</td>
</tr>
<tr>
<td>Malus,</td>
<td>Flowering Crab, Prairiefire(pink) - Flowering Persistant Only, springsnow(white)</td>
</tr>
<tr>
<td>Porsha mexicana</td>
<td>Clifforse, Quininebush</td>
</tr>
<tr>
<td>Prunus sp</td>
<td></td>
</tr>
<tr>
<td>Prunus maackii</td>
<td>Amur Chokecherry</td>
</tr>
<tr>
<td>Prunus virginiana</td>
<td>Common Chokecherry</td>
</tr>
<tr>
<td>Pyrus Calleryana</td>
<td>Flowering Pear - red spine</td>
</tr>
<tr>
<td>Quercus sp</td>
<td></td>
</tr>
<tr>
<td>Quercus gambelii</td>
<td>Gambel Oak/Scrub Oak</td>
</tr>
<tr>
<td>Quercus macroparpa</td>
<td>Bur Oak</td>
</tr>
<tr>
<td>Quercus robur 'fastigiata'</td>
<td>English Oak</td>
</tr>
<tr>
<td>Quercus shumardii</td>
<td>Shumard  Red Oak</td>
</tr>
<tr>
<td>Quercus virginiana</td>
<td>Live oak</td>
</tr>
<tr>
<td>Robinia neomexicana</td>
<td>New Mexico Locust</td>
</tr>
<tr>
<td>Sorbus sp.</td>
<td>Mountain Ash</td>
</tr>
<tr>
<td>Tilia americana</td>
<td>American Linden or Basswood</td>
</tr>
<tr>
<td>Evergreen Trees</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Abies concolor</td>
<td>White Fir</td>
</tr>
<tr>
<td>Calocedrus decurrens</td>
<td>Incense Cedar</td>
</tr>
<tr>
<td>Cedrus atlantica 'glanca'</td>
<td>Atlas Cedar</td>
</tr>
<tr>
<td>Cedrus deodara</td>
<td>Deodar Cedar</td>
</tr>
<tr>
<td>Cedrus libani</td>
<td>Cedar of Lebanon</td>
</tr>
<tr>
<td>Chamaecyparis obtusa</td>
<td>Hinoki falsecypress</td>
</tr>
<tr>
<td>Cupressus sempervirens</td>
<td>Italian Cypress</td>
</tr>
<tr>
<td>Cupressus arizonica</td>
<td>Arizona Cypress</td>
</tr>
<tr>
<td>Juniperus osteosperma</td>
<td>Utah Juniper</td>
</tr>
<tr>
<td>Juniperus chinensis</td>
<td>Chinese Juniper</td>
</tr>
<tr>
<td>Juniperus scopulorum</td>
<td>Rocky Mountain Juniper</td>
</tr>
<tr>
<td>Juniperus virginiana</td>
<td>Eastern Red Cedar</td>
</tr>
<tr>
<td>Larix kaempferi</td>
<td>Japanese Larch</td>
</tr>
<tr>
<td>Metasequoia glyptostroboides</td>
<td>Dawn Redwood</td>
</tr>
<tr>
<td>Picea abies</td>
<td>Norway Spruce</td>
</tr>
<tr>
<td>Picea engelmannii</td>
<td>Engelmann spruce</td>
</tr>
<tr>
<td>Picea pungens glauca</td>
<td>White or Blackhills Spruce</td>
</tr>
<tr>
<td>Picea omorika</td>
<td>Serbian Spruce</td>
</tr>
<tr>
<td>Picea pungens</td>
<td>Blue Spruce</td>
</tr>
<tr>
<td>Pinus aristata</td>
<td>Bristlecone Pine - Rocky Mtn.</td>
</tr>
<tr>
<td>Pinus bungeana</td>
<td>Lacebark Pine</td>
</tr>
<tr>
<td>Pinus contorta var. latifolia</td>
<td>Lodge Pole Pine</td>
</tr>
<tr>
<td>Pinus edulis</td>
<td>Pinyon Pine</td>
</tr>
<tr>
<td>Pinus flexilis</td>
<td>Limber Pine</td>
</tr>
<tr>
<td>Pinus flexilis glauca</td>
<td>Vanderwolf Pine</td>
</tr>
<tr>
<td>Pinus leucodermis</td>
<td>Bosnian/Dwarf Pine</td>
</tr>
<tr>
<td>Pinus jeffreyi</td>
<td>Jeffrey Pine</td>
</tr>
<tr>
<td>Pinus monophylla</td>
<td>Singleleaf Pinyon Pine</td>
</tr>
<tr>
<td>Pinus monticola</td>
<td>Western White Pine</td>
</tr>
<tr>
<td>Pinus mugo</td>
<td>Mugo Pine</td>
</tr>
<tr>
<td>Pinus nigra</td>
<td>Austrian Pine</td>
</tr>
<tr>
<td>Tree Species</td>
<td>Common Name</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Pinus parviflora</td>
<td>Japanese White Pine</td>
</tr>
<tr>
<td>Pinus ponderosa</td>
<td>Ponderosa Pine</td>
</tr>
<tr>
<td>Pinus thunbergiana</td>
<td>Japanese Black Pine</td>
</tr>
<tr>
<td>Pinus wallichiana</td>
<td>Himalayan White Pine</td>
</tr>
<tr>
<td>Pseudotsuga menzeisii</td>
<td>Douglas Fir</td>
</tr>
<tr>
<td>Pseudotsuga menzeisii 'Glauc'</td>
<td>Rocky Mountain Fir</td>
</tr>
<tr>
<td>Sequoiadendron giganteum</td>
<td>Giant Sequoia</td>
</tr>
<tr>
<td>Taxodium distichum</td>
<td>Baldcypress</td>
</tr>
<tr>
<td>Thuja occidentalis</td>
<td>Arborvite</td>
</tr>
</tbody>
</table>

(5) Shrubs

<table>
<thead>
<tr>
<th>Shrub Species</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies balsame 'Nana'</td>
<td>Dwarf Balsam Fir</td>
</tr>
<tr>
<td>Amelanchier alnifolia</td>
<td>Saskatoon Serviceberry</td>
</tr>
<tr>
<td>Amelanchier utahensis</td>
<td>Utah Serviceberry</td>
</tr>
<tr>
<td>Amorpha canescens</td>
<td>Lead Plant</td>
</tr>
<tr>
<td>Amorpha fruticosa</td>
<td>Flase Indigo</td>
</tr>
<tr>
<td>Arctostaphylos patula</td>
<td>Greenleaf manzanita</td>
</tr>
<tr>
<td>Artemisia cana</td>
<td>Silver Sagebrush</td>
</tr>
<tr>
<td>Artemisia filifolia</td>
<td>Sand Sagebrush</td>
</tr>
<tr>
<td>Artemisia frigida</td>
<td>Fringed Sagebrush</td>
</tr>
<tr>
<td>Artemisia ludoviciana</td>
<td>Prairie Sagebrush</td>
</tr>
<tr>
<td>Artemisia nova</td>
<td>Black Sagebrush</td>
</tr>
<tr>
<td>Artemisia tridentata</td>
<td>Big Sage, Sagebrush</td>
</tr>
<tr>
<td>Atriplex canescens</td>
<td>Four winged Salt Bush</td>
</tr>
<tr>
<td>Atriplex conferifolia</td>
<td>Shade Scale</td>
</tr>
<tr>
<td>Atriplex gardneri</td>
<td>Gardner Salt Bush</td>
</tr>
<tr>
<td>Berberis sp</td>
<td>William Penn</td>
</tr>
<tr>
<td>Berdelea fremonti</td>
<td>Desert Holly</td>
</tr>
<tr>
<td>Buddleia davidii</td>
<td>Butterfly bush; black beauty</td>
</tr>
<tr>
<td>Caragana arborescens</td>
<td>Siberian Peashrub</td>
</tr>
<tr>
<td>Ceratoideas lanata</td>
<td>Winterfat</td>
</tr>
<tr>
<td>Cercocarpus ledifolius</td>
<td>Curl-leaf Mountain Mahogany</td>
</tr>
<tr>
<td>Chaenomeles japonica</td>
<td>Flowering quince</td>
</tr>
<tr>
<td>Chamaebatiaria millifolium</td>
<td>Fernbush</td>
</tr>
<tr>
<td>Chilopsis linearis</td>
<td>Desert Willow</td>
</tr>
<tr>
<td>Chrysothamnus nauseosus</td>
<td>Rubber Rabbitbrush</td>
</tr>
<tr>
<td>Continus coggygria</td>
<td>Smoke Tree or Smokebush</td>
</tr>
<tr>
<td>Cornus sp.</td>
<td>Red Twig Dogwood, Yellow Twig Dogwood, Tartarian Dogwood</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Cornus sericea 'Kelseyi'</td>
<td>Dwarf Kelsey Dogwood</td>
</tr>
<tr>
<td>Cowania mexicana</td>
<td>Cliff Rose</td>
</tr>
<tr>
<td>Cytisus scoparius</td>
<td>Broom: moonlight, Burkwood, Hollandia,</td>
</tr>
<tr>
<td></td>
<td>Lena, Lilac Time</td>
</tr>
<tr>
<td>Daphne burkwoodii</td>
<td>Daphne</td>
</tr>
<tr>
<td>Ephedra viridis</td>
<td>Mormon Tea or Brigham Tea</td>
</tr>
<tr>
<td>Euonymus alatus compacta</td>
<td>Dwarf Winged Euonymus</td>
</tr>
<tr>
<td>Fallugia paradoxa</td>
<td>Apache Plume</td>
</tr>
<tr>
<td>Forestiera neomexicana</td>
<td>New Mexico Privet or Desert Olive</td>
</tr>
<tr>
<td>Forsythia sp</td>
<td>Dwarf Forsythia</td>
</tr>
<tr>
<td>Forsythia courtaisol</td>
<td>Dwarf Gold tide</td>
</tr>
<tr>
<td>Grayia Spinosa</td>
<td>Snakebrush/Hop Sage</td>
</tr>
<tr>
<td>Hesperaloe parviflora</td>
<td>Red Yucca, Duct Red Yucca</td>
</tr>
<tr>
<td>Hibiscus syriacus</td>
<td>Rose of Sharon</td>
</tr>
<tr>
<td>Hippophae rhamnoides</td>
<td>Sea buckthorn</td>
</tr>
<tr>
<td>Ilex sp.</td>
<td>Holly</td>
</tr>
<tr>
<td>Ilex meservea</td>
<td>Holly Blue boy</td>
</tr>
<tr>
<td>Ilex verticillata</td>
<td>Winterberry holly</td>
</tr>
<tr>
<td>Juniperus chinesis</td>
<td>Phitzer Juniper, Blue Point Juniper and</td>
</tr>
<tr>
<td></td>
<td>other upright varieties</td>
</tr>
<tr>
<td>Juniperus horizontalis</td>
<td>Creeping Juniper</td>
</tr>
<tr>
<td>Juniperus Sabina</td>
<td>Juniper</td>
</tr>
<tr>
<td>Kerria japonica</td>
<td>Japanese Kerra</td>
</tr>
<tr>
<td>Kolkwitzia amabilis</td>
<td>Beauty Bush</td>
</tr>
<tr>
<td>Ligustrum vulgare</td>
<td>Common Privet (several varieties of</td>
</tr>
<tr>
<td></td>
<td>screening)</td>
</tr>
<tr>
<td>Lonicera japonica</td>
<td>Honeysuckle; Hilliana</td>
</tr>
<tr>
<td>Mahonia aquifolium</td>
<td>Oregon Grape</td>
</tr>
<tr>
<td>Mahonia repens</td>
<td>Dwarf oregon grape</td>
</tr>
<tr>
<td>Peraphyllium ramosissimum</td>
<td>Squaw Apple</td>
</tr>
<tr>
<td>Peraphyllium caespitosum</td>
<td>Rock Spirea, Tufted Rock Mat</td>
</tr>
<tr>
<td>Perovskia</td>
<td>Russian sage</td>
</tr>
<tr>
<td>Philadelphus sp.</td>
<td>Mockorange, Sweet Mockorange (dwarf</td>
</tr>
<tr>
<td></td>
<td>varieties also available)</td>
</tr>
<tr>
<td>Philadephus microphyllus</td>
<td>Littleleaf Mockorange</td>
</tr>
<tr>
<td>Physocarpus malvaceus</td>
<td>Mountain Ninebark</td>
</tr>
<tr>
<td>Physocarpus opulifolius</td>
<td>Ninebark; Darts gold, Diabolo, Dwarf</td>
</tr>
<tr>
<td>Pinus mugo cultivars</td>
<td>Dwarf Mugo Pine</td>
</tr>
<tr>
<td>Potentilla fruticosa</td>
<td>Shrubby Cinquefoil, 'Fronsty' or 'Hinrob',</td>
</tr>
<tr>
<td></td>
<td>Marion Red Robin</td>
</tr>
<tr>
<td>Prunus besseyi</td>
<td>Western Sand Cherry</td>
</tr>
<tr>
<td>Tree Species</td>
<td>Common Name</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Prunus x cistena</td>
<td>Purple Sand Cherry</td>
</tr>
<tr>
<td>Purshia mexicana var. stansburiana</td>
<td>Cliff Rose</td>
</tr>
<tr>
<td>Purshia tridentata</td>
<td>Antelope Bitterbrush</td>
</tr>
<tr>
<td>Pyracantha angustifolia</td>
<td>Dwarf Pyracantha</td>
</tr>
<tr>
<td>Rhamnus asplenifolia</td>
<td>Fernleaf Buckthorn</td>
</tr>
<tr>
<td>Rhamnus columnaris</td>
<td>Upright Buckthorn</td>
</tr>
<tr>
<td>Rhamnus smithii</td>
<td>Smith's Buckthorn</td>
</tr>
<tr>
<td>Rhus aromatica 'Grow Low'</td>
<td>Fragrant sumac</td>
</tr>
<tr>
<td>Rhus glabra</td>
<td>Smooth Sumac</td>
</tr>
<tr>
<td>Rhus glabra cismontanta</td>
<td>Dwarf Mountain Sumac</td>
</tr>
<tr>
<td>Rhus glabra laciniata</td>
<td>Cutleaf Smooth Sumac</td>
</tr>
<tr>
<td>Rhus trilobata</td>
<td>Oak three leaf</td>
</tr>
<tr>
<td>Rhus typhina laciniata</td>
<td>Tiger eye gold leaved</td>
</tr>
<tr>
<td>Ribes sp.</td>
<td>Alpine Currant, Golden Currant</td>
</tr>
<tr>
<td>Rosa meidiland</td>
<td>Meidiland Rose</td>
</tr>
<tr>
<td>Salix purpurea nana</td>
<td>Dwarf Blue Arctic Willow</td>
</tr>
<tr>
<td>Salvia dorrri</td>
<td>Dorr's Sage</td>
</tr>
<tr>
<td>Sambucus sp.</td>
<td>Elderberry, Black Beauty</td>
</tr>
<tr>
<td>Shepherdia argentea</td>
<td>Silver Buffaloberry</td>
</tr>
<tr>
<td>Spiraea x bumalda</td>
<td>Spirea; Anthony waterer</td>
</tr>
<tr>
<td>Spiraea x vanhouttei</td>
<td>Bridal Wreath Spiraea</td>
</tr>
<tr>
<td>Symphoricarpos sp</td>
<td>Coralberry/Snowberry</td>
</tr>
<tr>
<td>Symphoricarpos orbiculatus</td>
<td>Coralberry/Snowberry Indian current</td>
</tr>
<tr>
<td>Symphoricarpos oreophilus</td>
<td>Mountain Snowberry</td>
</tr>
<tr>
<td>Syringa meyeri 'Palibin'</td>
<td>Dwarf Korean Lilac</td>
</tr>
<tr>
<td>Syringa patula 'Miss Kim'</td>
<td>Miss Kim Lilac</td>
</tr>
<tr>
<td>Taxus cuspidata</td>
<td>Japanese Yew</td>
</tr>
<tr>
<td>Taxus sp. (low spreading)</td>
<td>Spreading English Yew, Upright Yew, Browns, Yew and Others</td>
</tr>
<tr>
<td>Thuja occidentalis</td>
<td>Eastern White Cedar</td>
</tr>
<tr>
<td>Viburnum burkwoodii</td>
<td>Burkwood Viburnum</td>
</tr>
<tr>
<td>Weigela florida</td>
<td>Weigela</td>
</tr>
<tr>
<td>Yucca filamentosa</td>
<td>Yucca; Garland gold, Ivory Tower, Color Guard</td>
</tr>
</tbody>
</table>

(6) Ground Covers

<table>
<thead>
<tr>
<th>Ground Cover</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajuga</td>
<td>Bugleweed</td>
</tr>
<tr>
<td>Arabis caucasica</td>
<td>Rock Cress</td>
</tr>
<tr>
<td>Cerastium tomentosum</td>
<td>Snow In Summer</td>
</tr>
<tr>
<td>Delosperma cooperi</td>
<td>Delosperma, Ice Plant</td>
</tr>
<tr>
<td>Delosperma nubigenum</td>
<td>Yellow Ice Plant</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Euonymus fortunei</td>
<td>Winter Creeper</td>
</tr>
<tr>
<td>Fargesia</td>
<td>Pink Panda' and 2 others</td>
</tr>
<tr>
<td>Genista pilosa</td>
<td>Vancouver Gold'</td>
</tr>
<tr>
<td>Hedera helix</td>
<td>English Ivy</td>
</tr>
<tr>
<td>Helianthemum nummularium</td>
<td>Sunrose, Rockrose</td>
</tr>
<tr>
<td>Hypericum calycinum</td>
<td>Aaron's Beard, St. John's Wort</td>
</tr>
<tr>
<td>Lamium maculatum</td>
<td>Spotted deadnettle</td>
</tr>
<tr>
<td>Pachistima canbyi</td>
<td>Dwarf Mountian Lover</td>
</tr>
<tr>
<td>Sedum sp.</td>
<td>Stonecrop</td>
</tr>
<tr>
<td>Thymus cultivars</td>
<td>Thyme; wooly</td>
</tr>
<tr>
<td>Veronica</td>
<td>Creeping Veronica</td>
</tr>
<tr>
<td>Vinca major and minor</td>
<td>Periwinkle</td>
</tr>
</tbody>
</table>

(7) Vines

<table>
<thead>
<tr>
<th>Campsis radicans</th>
<th>Trumpet Vine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clematis 'Hybrids'</td>
<td>Clematis</td>
</tr>
<tr>
<td>Clematis ligusticifolia</td>
<td>White Virgin's Bower</td>
</tr>
<tr>
<td>Hedera helix</td>
<td>English Ivy</td>
</tr>
<tr>
<td>Hydrangea anomala subsp. petiolaris</td>
<td>Climbing Hydrangea</td>
</tr>
<tr>
<td>Polygonum aubertii</td>
<td>Silverlace Vine</td>
</tr>
</tbody>
</table>

(8) Ornamental Grasses (use as accent or in masses)

<table>
<thead>
<tr>
<th>Achnatherum calamagrostis</th>
<th>Spear Grass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aristata purpurea</td>
<td></td>
</tr>
<tr>
<td>Bouteloa gracilis</td>
<td>Blue Grama</td>
</tr>
<tr>
<td>Calmagrostis acutiflora 'Karl Foerster'</td>
<td>Feather Reed Grass</td>
</tr>
<tr>
<td>Calmagrostis brachytricha</td>
<td>Korean Feather Reed Grass</td>
</tr>
<tr>
<td>Carex sp</td>
<td></td>
</tr>
<tr>
<td>Cespitosa 'Goldschleier'</td>
<td>Gold Vieled Tufted Hair Grass</td>
</tr>
<tr>
<td>Chasmanthium latifolium</td>
<td>Indian Woodoats</td>
</tr>
<tr>
<td>Cortaderia selloana</td>
<td>Pampas Grass</td>
</tr>
<tr>
<td>Deschampsia sp.</td>
<td>Tufted Hair Grass</td>
</tr>
<tr>
<td>Festuca sp.</td>
<td>Coyota</td>
</tr>
<tr>
<td>Hakonechloa macra</td>
<td>Japanese forest grass</td>
</tr>
<tr>
<td>Helictrichon sempervirens</td>
<td>Blue Oat Grass</td>
</tr>
<tr>
<td>Miscanthus &quot;Adagio&quot;</td>
<td>Idaho fescue</td>
</tr>
<tr>
<td>Miscanthus &quot;Purpurascens&quot;</td>
<td>Flame grass</td>
</tr>
<tr>
<td>Herbaceous Perennials</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Agastache ssp.</td>
<td>Hyssop, Hummingbird Mint</td>
</tr>
<tr>
<td>Alcea rosea</td>
<td>Hollyhock</td>
</tr>
<tr>
<td>Alcemilla</td>
<td>Ladys Mantle</td>
</tr>
<tr>
<td>Alyssum saxatalis compactum</td>
<td>Basket of Gold</td>
</tr>
<tr>
<td>Anacyclus depressus</td>
<td>Mount Atlas Daisy</td>
</tr>
<tr>
<td>Anemone hupehensis</td>
<td>Japanese Anemone</td>
</tr>
<tr>
<td>Anemone hybrids</td>
<td>Anemone</td>
</tr>
<tr>
<td>Anemone pulsatilla</td>
<td>Pasque Flower</td>
</tr>
<tr>
<td>Antennaria dioica</td>
<td>Pussy Toes</td>
</tr>
<tr>
<td>Aquilegia sp.</td>
<td>Columbine</td>
</tr>
<tr>
<td>Arabis caucasica</td>
<td>Rock Cress</td>
</tr>
<tr>
<td>Arenaria ssp.</td>
<td>Sandwort</td>
</tr>
<tr>
<td>Armeria maritima</td>
<td>Common Thrift or Sea Pink</td>
</tr>
<tr>
<td>Artemisia frigida</td>
<td>Fringed Sage</td>
</tr>
<tr>
<td>Artemisia ludoviciana</td>
<td>Prairie Sagebrush</td>
</tr>
<tr>
<td>Artemisia schmidtiana</td>
<td>Silver Mound</td>
</tr>
<tr>
<td>Artemisia versicolor 'Seafoam'</td>
<td>Curlicue Sage</td>
</tr>
<tr>
<td>Aselepias tuberosa</td>
<td>Butterfly Milkweed</td>
</tr>
<tr>
<td>Astilbe sp.</td>
<td>Astilbe</td>
</tr>
<tr>
<td>Aubretia</td>
<td>Rock Cress</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Baptisia</td>
<td>False Indigo</td>
</tr>
<tr>
<td>Brunnera sp.</td>
<td>Brunnera</td>
</tr>
<tr>
<td>Bulbs</td>
<td>Spring Flowering Bulbs</td>
</tr>
<tr>
<td>Callirhoe involucrata</td>
<td>Poppy Mallow</td>
</tr>
<tr>
<td>Calylophus spp.</td>
<td>Sundrops</td>
</tr>
<tr>
<td>Campanula sp.</td>
<td>Bellflower</td>
</tr>
<tr>
<td>Catananche sp.</td>
<td>Cupid's Dart</td>
</tr>
<tr>
<td>Chrysanthemum x superbum</td>
<td>Shasta Daisy</td>
</tr>
<tr>
<td>Coreopsis verticillata</td>
<td>Tickseed, moombean</td>
</tr>
<tr>
<td>Daphinium nattalianum</td>
<td>Perennial Larkspur</td>
</tr>
<tr>
<td>Dianthus sp</td>
<td>Dianthus Pinks</td>
</tr>
<tr>
<td>Diascia integerrima 'Coral Canyon'</td>
<td>Twinspur</td>
</tr>
<tr>
<td>Dicentra eximia</td>
<td>Fringed Bleeding Heart</td>
</tr>
<tr>
<td>Dicentra formosa</td>
<td>Pacific Bleeding Heart</td>
</tr>
<tr>
<td>Dicentra spectabilis</td>
<td>Bleeding Heart</td>
</tr>
<tr>
<td>Digitalis obscura</td>
<td>Dusty Foxglove, Willow Leaf Foxglove</td>
</tr>
<tr>
<td>Digitalis thapsi 'Spanish Peaks'</td>
<td>Spanish Peaks Foxglove</td>
</tr>
<tr>
<td>Echinacea purpurea</td>
<td>Purple Coneflower</td>
</tr>
<tr>
<td>Echinops sp.</td>
<td>Thistle</td>
</tr>
<tr>
<td>Epilobium angustifolium</td>
<td>Fireweed</td>
</tr>
<tr>
<td>Eriogonum umbellatum</td>
<td>Sulphur Flower</td>
</tr>
<tr>
<td>Eriophyllum lanatum</td>
<td>Woolyleaf, Oregon Sunshine</td>
</tr>
<tr>
<td>Eryngium alpinum</td>
<td>Blue Sea Holly</td>
</tr>
<tr>
<td>Eryngium sp.</td>
<td>Sea Holly</td>
</tr>
<tr>
<td>Gaillardia sp</td>
<td>Blanketflower</td>
</tr>
<tr>
<td>Gaura coccinea</td>
<td>Scarlet Gaura</td>
</tr>
<tr>
<td>Geranium sp.</td>
<td>Cranebill</td>
</tr>
<tr>
<td>Gilia aggregata</td>
<td>Scarlet Gilia</td>
</tr>
<tr>
<td>Guara lindheimeri</td>
<td>&quot;Siskyou Pink' Gaura</td>
</tr>
<tr>
<td>Gutierrezia sarothrae</td>
<td>Snakeweed</td>
</tr>
<tr>
<td>Hemerocallis hybrid</td>
<td>Daylily</td>
</tr>
<tr>
<td>Helianthera uniflora</td>
<td>Little Sunflower</td>
</tr>
<tr>
<td>Helianthemum nummularium</td>
<td>Sun Rose</td>
</tr>
<tr>
<td>Helleborus foetidus</td>
<td>bear's-paw hellebole</td>
</tr>
<tr>
<td>Heuchera sp.</td>
<td>Coral Bells</td>
</tr>
<tr>
<td>Hibiscus coccineus</td>
<td>Scarlet Hibiscus</td>
</tr>
<tr>
<td>Hosta sp.</td>
<td>Hosta</td>
</tr>
<tr>
<td>Houttuynia cordata</td>
<td>Chameleon plant</td>
</tr>
<tr>
<td>Hypericum calycinum</td>
<td>St. Johnswort</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Iberis sempervirens</td>
<td>Candytuft</td>
</tr>
<tr>
<td>Iliamna rivularis</td>
<td>Mountain Hollyhock</td>
</tr>
<tr>
<td>Iris Hybrids</td>
<td>Iris</td>
</tr>
<tr>
<td>Kniphofia uvaria</td>
<td>Red Hot Poker</td>
</tr>
<tr>
<td>Lavandula angustifolia</td>
<td>Lavender</td>
</tr>
<tr>
<td>Limonium latifolium</td>
<td>Statice, Sea Lavender</td>
</tr>
<tr>
<td>Linum sp.</td>
<td>Golden Flax, Perennial Flax, Native Blue Flax</td>
</tr>
<tr>
<td>Lychnis coronaria</td>
<td>Rose campion</td>
</tr>
<tr>
<td>Mirabilis multiflora</td>
<td>Showy Four-O-Clock</td>
</tr>
<tr>
<td>Monarda didyma</td>
<td>Bee Balm - Cultivars supposedly mildue resistant: 'Jacob Cline', 'Dark Ponticum', 'Marshalls Delight', 'Raspberry Wine', 'Colrain Red'.</td>
</tr>
<tr>
<td>Narcissus species</td>
<td>Daffodil</td>
</tr>
<tr>
<td>Nepeta x Faassenii</td>
<td>Catmint</td>
</tr>
<tr>
<td>Oenothera sp.</td>
<td>Evening Primrose</td>
</tr>
<tr>
<td>Oenothera caespitosa</td>
<td>Evening Primrose</td>
</tr>
<tr>
<td>Papaver orientale</td>
<td>Oriental Poppy</td>
</tr>
<tr>
<td>Papaver sp.</td>
<td>Poppy, Oriental Poppy</td>
</tr>
<tr>
<td>Penstemon sp.</td>
<td>Firecracker Penstemon, Palmer Penstemon, Shrublet Penstemon, Wasatch Penstemon</td>
</tr>
<tr>
<td>Penstemon palmeri</td>
<td>Balloon Flower</td>
</tr>
<tr>
<td>Penstemon pinifolius</td>
<td>Pine leaf Penstemon</td>
</tr>
<tr>
<td>Perovskia atriplicifolia</td>
<td>Russian Sage</td>
</tr>
<tr>
<td>Phlox hoodii</td>
<td>Carpet Phlox</td>
</tr>
<tr>
<td>Phlox longifolia</td>
<td>Long leaved Phlox</td>
</tr>
<tr>
<td>Phlox subutata</td>
<td>Creeping Phlox</td>
</tr>
<tr>
<td>Physostegia sp.</td>
<td>Obedient plant</td>
</tr>
<tr>
<td>Polemonium</td>
<td>Jacob's ladder</td>
</tr>
<tr>
<td>Pulmonaria langifolia</td>
<td></td>
</tr>
<tr>
<td>Ratibida columnaris</td>
<td>Prairie Coneflower, Mexican Hat</td>
</tr>
<tr>
<td>Rudbeckia sp.</td>
<td>Black Eyed Susan, Dwarf Rustic Coneflower</td>
</tr>
<tr>
<td>Salvia sp.</td>
<td>Salvia</td>
</tr>
<tr>
<td>Santolina sp.</td>
<td>Lavender Cotton</td>
</tr>
<tr>
<td>Saponaria ocymoides</td>
<td>Rock Soap Wort</td>
</tr>
<tr>
<td>Sedum sp.</td>
<td></td>
</tr>
<tr>
<td>Solidago sp.</td>
<td></td>
</tr>
<tr>
<td>Stanleya sp.</td>
<td></td>
</tr>
<tr>
<td>Tradescantia sp.</td>
<td></td>
</tr>
<tr>
<td>Tulipa hybrides</td>
<td>Tulip</td>
</tr>
</tbody>
</table>
Verbena sp.  
Zauschneria california Orange Carpet; catalina  
Zauschneria latifolia Orange Carpet; Garrettii  
Zinnia grandiflora Rocky Mtn. Zinnia

(10) Cacti

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coryphantha vivapara Nuttal's Pincushion</td>
</tr>
<tr>
<td>Echinocereus engelmanii Hedge Hog Cactus</td>
</tr>
<tr>
<td>Echinocereus triglochidiatus Claret Cup</td>
</tr>
<tr>
<td>Opuntia ssp. Common Pricklypear</td>
</tr>
<tr>
<td>Pediocactus simpsonii Simpson's Footcactus</td>
</tr>
</tbody>
</table>

(11) Turf Grass

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xerilawn</td>
</tr>
<tr>
<td>Bella Blue</td>
</tr>
<tr>
<td>BioMeadow</td>
</tr>
<tr>
<td>RTF – preferred in areas that will have minimum foot traffic – substitute for bluegrass</td>
</tr>
<tr>
<td>Blue Grass – high traffic areas</td>
</tr>
</tbody>
</table>

Note: Do not plant turf in areas between hard surfaces less than 8’ wide.

(12) Rock

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decorate rock and boulders preferred in landscape, where feasible</td>
</tr>
</tbody>
</table>

ADDED:

4.12 Resources
See 4.1 / A. / (6) / g. U OF U LANDSCAPE REFERENCE STANDARDS and 4.1 / A. / (6) / h. TREE AND PLANTING SPECIFICATIONS for specific University of Utah resource document requirements.

End of 4.0 Landscape and Irrigation Standards
## UNIVERSITY OF UTAH DESIGN STANDARDS
### PROJECT VARIANCE REQUEST FORM

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Date Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>University Project Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Project Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requested By</th>
<th>Requestor’s Office / Shop Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Current Design Requirement (Reference the Applicable Design Standard)**

<table>
<thead>
<tr>
<th>Brief Description of the Problem (Include the Proposed Addition / Deletion / Change to the Design Requirement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Committee Review Date</th>
<th>Committee Decision / Action Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>