Introduction (Abbreviation)
Introduction and Intent of the U of O Construction Standards (Intro)
Design Review Requirements (Design)
University of Oregon Policies and References (P&R)
Construction Change Request (CR) – Added 5/10/11
Campus Operations Organizational Chart (CO)

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Summary of Work; Multiple Contracts; Work Restrictions
Section 01 20 00 – Price & Payment Procedures
Payments
Section 01 30 00 – Administrative Requirements
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Special Procedures
Section 01 40 00 – Quality Requirements
References; Quality Control
Section 01 50 00 – Temporary Facilities & Controls
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Access & Parking; Temporary Barriers & Enclosures; Temporary Controls; Project Identification
Section 01 60 00 – Product Requirements
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& Handling
Section 01 70 00 – Execution & Closeout Requirements
Examination & Preparation; Execution; Cleaning & Waste Management; Protecting Installed
Construction; Closeout Procedures; Closeout Submittals; Demonstration & Training

Division 02 – Site Construction
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Section 02 40 00 – Demolition & Structure Moving
Demolition

Division 03 – Concrete
Section 03 00 00 – Concrete
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Section 03 10 00 – Concrete Forming & Accessories
Forming; Accessories
Section 03 30 00 – Cast-in-Place Concrete
Finishing; Post-Tensioned
Section 03 80 00 – Concrete Cutting & Boring
Cutting; Boring

Division 04 – Masonry
Section 04 00 00 – Masonry
Maintenance; Common Work Results; Schedules
# Division 05 – Metals

**Section 05 00 00 – Metals**
Maintenance; Common Work Results; Schedules

**Section 05 10 00 – Structural Metal Framing**
Structural Steel

**Section 05 40 00 – Cold-Formed Metal Framing**
Structural Metal Stud Framing; Cold-Formed Metal Joist Framing; Slotted Channel Framing; Metal Support Assemblies

**Section 05 50 00 – Metal Fabrications**
Stairs; Railings; Gratings; Metal Stair Treads & Nosings

**Section 05 70 00 – Decorative Metal**
Stairs; Railings; Castings; Formed Metal; Forged Metal

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# Division 06 – Wood & Plastics

**Section 06 00 00 – Wood, Plastics, & Composites**
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**Section 06 10 00 – Rough Carpentry**
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**Section 06 40 00 – Architectural Woodwork**
Wood Casework; Wood Paneling; Stairs & Railings; Ornamental Woodwork; Wood Trim; Wood Frames; Wood Screens & Exterior Wood Shutters

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# Division 07 – Thermal & Moisture Protection

**Section 07 00 00 – Thermal & Moisture Protection**
Maintenance; Common Work Results; Schedules

**Section 07 10 00 – Dampproofing & Waterproofing**
Built-Up Bituminous; Sheet; Fluid-Applied; Sheet Metal; Cementitious & Reactive; Bentonite; Water Repellents

**Section 07 20 00 – Thermal Protection**
Insulation; Roof & Deck Insulation; Exterior Insulation & Finish Systems; Weather Barriers; Vapor Retarders; Air Barriers

**Section 07 30 00 – Steep Slope Roofing**
Shingles & Shakes; Roof Tiles; Natural Roof Coverings

**Section 07 40 00 – Roofing & Siding Panels**
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**Section 07 50 00 – Membrane Roofing**
Built-Up Bituminous; Modified Bituminous Membrane; Elastomeric Membrane; Thermoplastic Membrane; Protected Membrane; Fluid-Applied; Coated Foamed; Roll

**Section 07 60 00 – Flashing & Sheet Metal**
Sheet Metal Roofing; Flashing & Trim; Roofing Specialties; Flexible Flashing

**Section 07 90 00 – Joint Protection**
Preformed Seals; Sealants; Expansion Control

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# Division 08 – Openings

**Section 08 00 00 – Openings**
Maintenance; Common Work Results; Schedules

**Section 08 10 00 – Doors & Frames**
Metal Doors & Frames; Wood Doors; Plastic Doors; Composite Doors; Integrated Opening Assemblies
Division 08 – Openings continued

Section 08 30 00 – Specialty Doors & Frames
Access Doors & Panels; Coiling Doors & Grilles; Special Function Doors; Folding Doors & Grilles; Panel Doors

Section 08 40 00 – Entrances, Storefronts, & Curtain Walls
Curtain Wall & Glazed Assemblies; Windows; Special Function Windows

Section 08 60 00 – Roof Windows & Skylights
Skylight Protection & Screens

Section 08 70 00 – Hardware
Door Hardware; Access Control Hardware; Window Hardware; Special Function Hardware; Hardware Accessories

Section 08 80 00 – Glazing
Glass Glazing; Mirrors; Glazing Accessories; Glazing Surface Films; Special Function Glazing

Section 08 90 00 – Louvers & Vents
Louvered Equipment Enclosures; Vents

Division 09 – Finishes

Section 09 00 00 – Finishes
Maintenance; Common Work Results; Schedules

Section 09 20 00 – Plaster & Gypsum Board
Assemblies; Supports; Gypsum Plastering; Portland Cement Plastering; Other Plastering; Veneer Plastering; Backing Boards & Underlayments

Section 09 30 00 – Tiling
Thin-Set; Mortar-Bed; Conductive; Waterproofing-Membrane; Chemical-Resistant

Section 09 50 00 – Ceilings
Acoustical; Acoustical Ceiling Suspension Assemblies; Specialty; Textured Ceilings; Special Function; Integrated Ceiling Assemblies

Section 09 60 00 – Flooring
Treatment; Specialty; Masonry; Wood Flooring; Resilient; Terrazzo; Fluid-Applied; Carpeting; Access Flooring

Section 09 90 00 – Painting & Coating
Staining & Transparent Finishing; Decorative Finishing; High-Performance Coatings; Special Coatings

Division 10 – Specialties

Section 10 10 00 – Information Specialties
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Section 10 20 00 – Interior Specialties
Compartments & Cubicles; Partitions; Service Walls; Wall & Door Protection; Toilet, Bath, & Laundry Accessories

Section 10 40 00 – Safety Specialties
Fire Protection Specialties; Emergency Aid Specialties

Section 10 50 00 – Lockers
Storage Specialties; Storage Assemblies; Wardrobe & Closet Specialties

Section 10 70 00 – Exterior Specialties
Exterior Protection; Protective Covers; Manufactured Exterior Specialties

Section 10 80 00 – Other Specialties
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Division 11 – Equipment

Section 11 40 00 – Foodservice Equipment
  Food Storage; Food Preparation; Food Delivery Carts & Conveyors; Food Cooking; Food Dispensing; Ice Machines

Section 11 52 00 – Audio-Visual Equipment

Section 11 53 00 – Laboratory Equipment

Section 11 80 00 – Collection & Disposal Equipment
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Division 12 – Furnishings

Section 12 00 00 – Furnishings
  Maintenance; Common Work Results; Schedules

Section 12 20 00 – Window Treatments
  Blinds; Curtains & Drapes; Window Shades; Window Treatment Operating Hardware

Section 12 30 00 – Casework
  Manufactured Metal; Manufactured Wood; Manufactured Plastic; Specialty; Countertops

Section 12 40 00 – Furnishings & Accessories
  Office; Table; Furnishing Accessories; Rugs & Mats

Section 12 50 00 – Furniture
  Office; Seating; Institutional; Industrial; Systems Furniture

Section 12 90 00 – Other Furnishings
  Site Furnishings

Division 13 – Special Construction

Section 13 00 00 – Special Construction
  Maintenance; Common Work Results; Schedules

Section 13 10 00 – Special Facility Components
  Swimming Pools; Fountains

Section 13 20 00 – Special Purpose Rooms
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Section 13 40 00 – Integrated Construction
  Building Modules; Sound, Vibration, & Seismic Control; Radiation Protection

Division 14 – Conveying Equipment

Section 14 00 00 – Conveying Equipment
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Section 14 20 00 – Elevators
  Electric Traction; Hydraulic; Limited-Use / Limited-Application; Custom Cabs; Equipment & Controls

Section 14 80 00 – Scaffolding

Division 21 – Fire Suppression

Section 21 00 00 – Fire Suppression
  Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control

Section 21 10 00 – Water-Based Fire Suppression Systems
  Facility Water-Service Piping; Standpipes; Sprinkler Systems
Division 22 – Plumbing (Revised 5/10/11)
Section 22 00 00 – Plumbing
  Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control
Section 22 10 00 – Plumbing Piping & Pumps
  Water Distribution; Sanitary Sewerage; Storm Drainage; General Service Compressed-Air Systems
Section 22 30 00 – Plumbing Equipment
  Water Filtration Equipment; Electric Water Heaters; Fuel-Fired Water Heaters; Water Heat Exchangers
Section 22 40 00 – Plumbing Fixtures
  Commercial; Emergency Fixtures; Security Fixtures; Drinking Fountains & Water Coolers

Division 23 – Heating, Ventilating, & Air-Conditioning (HVAC)
Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC)
  Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control
Section 23 20 00 – HVAC Piping & Pumps
  Hydronic; Steam & Condensate; Chilled Water
Section 23 30 00 – HVAC Air Distribution
  Ducts & Casings; Air Plenums & Chases; Air Duct Accessories; Fans; Special Exhaust Systems; Air Terminal Units; Air Outlets & Inlets; Ventilation Hoods
Section 23 40 00 – HVAC Air Cleaning Devices
  Particulate Air Filtration
Section 23 50 00 – Central Heating Equipment
  Breechings, Chimneys, & Stacks; Heating Boilers; Heating Boiler Feedwater; Fuel-Fired Heaters; Solar Energy Heating; Heat Exchangers
Section 23 70 00 – Central HVAC Equipment
  Air-to-Air Energy Recovery; Indoor Central-Station Air-Handling Units; Packaged Outdoor HVAC; Custom-Packaged Outdoor HVAC
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  Decentralized Unitary HVAC; Convection Heating & Cooling Units; Radiant Heating Units; Humidity Control

Division 25 – Integrated Automation
Section 25 00 00 – Integrated Automation
  Maintenance; Common Work Results; Schedules

Division 26 – Electrical
Section 26 00 00 – Electrical
  Maintenance; Common Work Results; Schedules; Instrumentation & Control
Section 26 10 00 – Medium-Voltage Electrical Distribution
  Substations; Medium-Voltage Transformers; Medium-Voltage Switchgear; Medium-Voltage Circuit Protection Devices
Section 26 20 00 – Low-Voltage Electrical Distribution
  Overhead Power Systems; Transformers; Switchgear; Switchboards & Panelboards; Enclosed Bus Assemblies; Power Distribution Units; Distribution Equipment; Circuit Protective Devices; Controllers
Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment
  Photovoltaic Collectors; Packaged Generator Assemblies; Battery Equipment; Power Filters & Conditioners; Transfer Switches
Section 26 50 00 – Lighting
  Interior; Emergency; Exit Signs; Special Purpose; Exterior
Division 27 – Communications
Section 27 00 00 – Communications
  Maintenance; Common Work Results; Identification; Schedules
Section 27 10 00 – Structured Cabling
  Telephone Backbone Cabling; Optical Fiber Backbone Cabling; Category 6A Backbone Cabling;
  Category 5E Horizontal Cabling
Section 27 30 00 – Voice Communications
  Switching & Routing Equipment; Telephone Sets, Facsimiles, & Modems; Messaging; Call
  Accounting; Call Management
Section 27 40 00 – Audio-Visual Communications
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Section 27 70 00 – Cable Television
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Division 28 – Electronic Safety & Security
Section 28 00 00 – Electronic Safety & Security
  Maintenance; Common Work Results; Schedules
Section 28 10 00 – Electronic Access Control & Intrusion Detection
  Access Control; Intrusion Detection
Section 28 20 00 – Electronic Surveillance
  Video Surveillance; Electronic Personal Protection
Section 28 30 00 – Electronic Detection & Alarm
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Division 31 – Earthwork
Section 31 00 00 – Earthwork
  Maintenance; Common Work Results; Schedules
Section 31 10 00 – Site Clearing
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Division 32 – Exterior Improvements
Section 32 00 00 – Exterior Improvements
  Maintenance; Common Work Results; Schedules
Section 32 10 00 – Bases, Ballasts, & Paving
  Base Courses; Flexible Paving; Rigid Paving; Unit Paving; Aggregate Surfacing; Curbs & Gutters;
  Paving Specialties
Section 32 30 00 – Site Improvements
  Retaining Walls
Section 32 80 00 – Irrigation
  Pumps; Planting Irrigation
Section 32 90 00 – Planting
  Preparation; Turf & Grasses; Plants; Accessories; Transplanting
## Division 33 – Utilities

### Section 33 00 00 – Utilities
- Maintenance; Common Work Results; Schedules; Instrumentation & Control

### Section 33 10 00 – Water Utilities
- Distribution Piping; Distribution Equipment; Storage Tanks

### Section 33 40 00 – Storm Drainage Utilities
- Piping; Drains; Pumps; Subdrainage; Structures

### Section 33 50 00 – Fuel Distribution Utilities
- Hydronic & Steam; Hydronic Energy; Steam Energy

### Section 33 70 00 – Electrical Utilities
- Transmission & Distribution; Substations; Transformers; High-Voltage Switchgear & Protection Devices; Medium-Voltage Switchgear & Protection Devices; Site Grounding

## Appendices: Room Types (Abbreviation)

- Classrooms, Conferencing, & Distance Learning Rooms (Classrooms)
- Communication Rooms (CR)
- Construction Overstock Storage Room (COR)
- Custodial Closets (CC)
- Faculty Offices (Offices)
- Laboratories (Labs)
- Lactation / Nursing Rooms (LR)
- Loading Docks and Exterior Service Areas (LD)
- Mechanical, Plumbing, and Electrical Rooms (MEP)
- Public & Circulation Spaces; Hallways, Corridors, Lobbies, Atriums, etc. (PC)
- Room Numbering Guide (Room No.)
- Stairways & Stairwells (Stairs)
- Toilet Rooms (TR)

## End of Table of Contents
Introduction and Intent of the Construction Standards:

The mission of The University of Oregon is to provide students a higher education experience that expands knowledge through advanced research and service to the public. Physical facilities at the UO exist to aid in the achievement of this mission. Therefore our facilities must not only be accommodating and inspirational in their design, they must also be cost efficient to operate and maintain. The University of Oregon Campus Construction Standards document is written with the contributions from Facilities Services (FS) personnel, and various campus departments.

The overall goal of the Standards is to document institutional experience and knowledge associated with providing maintainable facilities for the campus. Additional and individual goals targeted during the design and construction process for each UO facility include sustainability, maintainability, serviceability and high-performance, all leading to a manageable and efficient campus inventory.

The University of Oregon works to incorporate best practices in sustainable design that exceed the base standards defined by SEED and LEED guidelines. Campus sustainable building practices are born during the planning phase of a project with enforcement during construction and operational implementation during occupancy. The UO building inventory combines buildings that work individually with a network of systems that generate an interconnected campus system. The design and construction of each building on the UO campus needs to consider both how the internal operational building functions as well as its impact on surrounding buildings, spaces and systems as a whole.

The Construction Standards do not replace professional responsibilities for design analyses, building code enforcement, contractual services of a professional design team, or applicable UO policies. The following section, ‘University of Oregon Policies and References’, lists items for design team reference and use. Design teams shall conduct appropriate evaluations at the start of every project start. The use of proven technologies and systems that provide cost effective alternative designs are encouraged, though any and deviations from the Standards will be authorized by the Owner’s Facilities Services personnel through implementation of the Substitution Request process described in Division 01. This substitution request process and associated Owner review must also be followed for the approval of variations to any product or system explicitly not allowed in the Standards.

The Construction Standards document is not distributed to General Contractors (GC) or Construction Managers (CM) but to lead consultants of design teams only; lead consultants shall distribute to all sub-consultants. Where ‘Contractor’ responsibility is referenced within the Standards it is the sole responsibility of the Architect/Engineer design team per Article 2 of the U of O’s contract for Architectural / Engineering Services to communicate Contractor responsibilities into the final Construction Documents (CDs), from which projects are built and by which the GC / CM are contracted. The GC / CM will only implement Standards as they are documented.

The Construction Standards follow a format that directly corresponds with the Construction Specification Institute (CSI) MasterFormat 2004 which is recognized industry wide.

This is a dynamic and ‘living’ document, designed to keep abreast of new and better procedures, technologies, materials, products, and strategies available in the construction industry. The Standards document will be reviewed, edited, and amended on an annual and/or as needed basis enabling us to incorporate items that we become aware of and familiar with.

Abbreviations used in the following document:

1. A/E – Architect / Engineer
2. AHJ – Authority Having Jurisdiction
3. GC – General Contractor
4. CC – Capital Construction
5. CFCI – Contractor Furnished Contractor Installed
6. CMET – Center for Media & Educational Technologies
7. CM/GC – Construction Manager / General Contractor
Abbreviations used in the following document continued:

8. CPRE – Campus Planning and Real Estate
9. CPC – Campus Planning Committee
10. CPS – Central Power Station, Facilities Services
11. DPS – Department of Public Safety
12. EH&S – Environmental Health & Safety, Facilities Services
13. FS – Facilities Services
14. N&TS – Network & Telecom Services
15. PM – Project Manager, Facilities Capital Construction
16. PP – Project Planner, Campus Planning and Real Estate
17. OFCI – Owner Furnished Contractor Installed
18. OFOI – Owner Furnished Owner Installed
19. Owner – University of Oregon
20. UO – University of Oregon
Design Requirements for Maintainability & Serviceability of Building Systems:

Every building component shall be designed for safe and efficient maintainability and serviceability by UO Facilities Services (FS), Housing, etc. personnel. Documentation during programming, design phases, and construction documentation shall clearly document all clear and accessible spaces where maintenance is, or may be, required. Such spaces shall be noted ‘Maintenance Access’ on all drawings submitted for review, and shall be included in final contract documents for construction. Maintenance Access shall be defined as the 3 dimensional obstruction free spaces required to properly and safely service and maintain a built in item or component. Construction coordination is then required to assure the preservation of these mandatory maintenance access spaces and clearances remain obstruction free.

Mandatory Design Meetings, Reviews, and Submittals:

Several levels of document review are mandatory for Facilities personnel. These are necessary in order for FS to become familiar with the project in question, understand the project goals, and review documents for compliance with these Standards. The following points of review may vary depending upon project size, type, scope, complexity, etc. However, they are not to be modified without prior approval by both the Campus Planning & Real Estate and Facilities Capital Construction Personnel assigned to the project. Project planning and management for small to medium projects may or may not include CPRE, while larger projects require collaboration with Campus Planning & Real Estate offices:

- Specific Owner and FS personnel will be defined at the beginning of each project jointly by the Project Manager (PM), Capital Construction and Project Planner (PP).

- Owner Personnel schedules will take first priority when scheduling a meeting. All pertinent Owner and FS Personnel must be in attendance.

- All meeting minutes shall be recorded and distributed by the design team.

- All Owner review comments will be coordinated and compiled by the Campus Planning & Real Estate PP into 1 deliverable to the design team; copies will be distributed to all involved.

- The submittal of any and all design documents to the Owner for review implies they are in compliance with the Construction Standards; unless approved Substitution Requests are submitted and approved via the process found in Division 01. If not in compliance, the submittal may be rejected and returned to the design team for completion prior to any Owner review.

- Any and all Owner review comments shall be tracked and responded to by the design team to ensure consideration, implementation, and/or discussion. Any redesign required due to the failure of the design team to adhere to this requirement shall be at the expense of the design team.

- The design team shall be responsible for any expenses associated with corrections and/or redesign of the 100% CD documents that may be required due to deviations or omissions from documented Owner review comments that have not been addressed, answered in writing, and/or deviations or omissions of the Construction Standards that did not follow the Construction Standards Substitution Request process.
### Schematic Design (SD):

1. The following requirements are those of specific concern to FS Personnel.
2. It is required that the design team meets with FS personnel during the SD phase to discuss the following:
   a. Project introduction to FS to the extent known by the design team, Project Planner (PP) or Project Manager (PM) representative.
   b. Discussion of project specific items such as FS concerns, interests, suggestions, specific building needs, space needs, general scope, program, etc.
   c. All topics of discussion are to be recorded in the form of meeting minutes by the design team for consideration and tracking in the design process.
   d. A tracking list of issues is to begin and to be managed by the design team.
3. Building systems and strategies must be documented, reviewed, and approved by the end of SD phase; detailing of systems will follow in DD and CD phases.
4. At completion of 100% SD documents a meeting presentation shall be scheduled with the defined FS personnel and design team prior to official review and comment of SD documents. The discussion should include the following and meeting minutes shall be recorded and distributed by the design team:
   a. Review of project specifics, building systems selected, scope, etc. per the items listed above.
   b. Design team items and questions needing FS attention during document review.
   c. FS project specific questions.
5. At completion of 100% SD document review a meeting shall be scheduled with the defined FS personnel and design team to debrief and discuss FS questions / comments arising from review and recorded comments.
6. Design team shall record meeting minutes and update issues tracking list for distribution to all.
7. Documents for completion of SD shall include the following information at a minimum and as appropriate per the scope:

<table>
<thead>
<tr>
<th>Schematic Design: Facilities Requirements for 100% SD documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Description:</strong></td>
</tr>
<tr>
<td>1. Scope of work narrative.</td>
</tr>
<tr>
<td>2. Building Program.</td>
</tr>
<tr>
<td>3. List of applicable building codes on drawing title sheet.</td>
</tr>
<tr>
<td>4. Building code review with list of anticipated building code variance requests.</td>
</tr>
<tr>
<td>5. Evaluation of anticipated sustainability performance; SEED and LEED-DAS.</td>
</tr>
<tr>
<td>6. Defined zones of ‘Maintenance Access’ per requirement noted in the Standards Introduction.</td>
</tr>
<tr>
<td>7. Maintainability of the facility.</td>
</tr>
<tr>
<td>8. Proposed routes of access and egress: fire access; emergency life safety egress; ADA access; pedestrian access &amp; egress; etc.</td>
</tr>
<tr>
<td><strong>Specification:</strong></td>
</tr>
<tr>
<td>1. System and material narrative description in outline form.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Storm water management strategy.</td>
</tr>
<tr>
<td>2. Site plans that include the following:</td>
</tr>
<tr>
<td>• Existing conditions</td>
</tr>
<tr>
<td>• Demolition</td>
</tr>
<tr>
<td>• Building outline(s)</td>
</tr>
<tr>
<td>• Future expansion</td>
</tr>
<tr>
<td>• Site entrance</td>
</tr>
<tr>
<td>• Roads &amp; driveways</td>
</tr>
<tr>
<td>• Parking locations</td>
</tr>
<tr>
<td>• Bike parking locations</td>
</tr>
<tr>
<td>Schematic Design: Facilities Requirements for 100% SD documentation continued</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Site continued:</td>
</tr>
<tr>
<td>• Loading dock location</td>
</tr>
<tr>
<td>• Waste &amp; recycling collection location</td>
</tr>
<tr>
<td>• Walkway and stairway locations</td>
</tr>
<tr>
<td>• Emergency telephone locations</td>
</tr>
<tr>
<td>• Utility requirements</td>
</tr>
<tr>
<td>• Site utilities</td>
</tr>
<tr>
<td>• Preliminary grading plan</td>
</tr>
<tr>
<td>• Soil remediation work by Owner, if needed</td>
</tr>
<tr>
<td>• Site lighting layout concept</td>
</tr>
<tr>
<td>Landscaping:</td>
</tr>
<tr>
<td>1. Existing conditions</td>
</tr>
<tr>
<td>2. Landscaping concept</td>
</tr>
<tr>
<td>3. Existing &amp; new irrigation zones</td>
</tr>
<tr>
<td>Structural:</td>
</tr>
<tr>
<td>1. Structural scheme</td>
</tr>
<tr>
<td>2. Written description</td>
</tr>
<tr>
<td>Building Exterior Envelope:</td>
</tr>
<tr>
<td>1. Typical elevations</td>
</tr>
<tr>
<td>2. Fenestration layout</td>
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<tr>
<td>3. Material designations</td>
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<tr>
<td>4. Overall building cross-sections</td>
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<tr>
<td>5. Roof layout</td>
</tr>
<tr>
<td>6. Energy code support information required for SEED / LEED</td>
</tr>
<tr>
<td>Building Interior:</td>
</tr>
<tr>
<td>1. Typical floor plans with legends</td>
</tr>
<tr>
<td>2. Demolition</td>
</tr>
<tr>
<td>3. Beginning of room numbering complying with ‘Room Numbering Guide’ Appendix</td>
</tr>
<tr>
<td>4. Area use identification &amp; area in square feet</td>
</tr>
<tr>
<td>5. Mechanical, electrical, and other service closets and rooms</td>
</tr>
<tr>
<td>6. Circulation paths</td>
</tr>
<tr>
<td>7. Area tabulations compared to program requirements</td>
</tr>
<tr>
<td>8. Show flexibility for expansion and alterations</td>
</tr>
<tr>
<td>9. Preliminary layout of major spaces with fixed equipment</td>
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<tr>
<td>Elevators:</td>
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<tr>
<td>1. Elevator locations</td>
</tr>
<tr>
<td>2. Equipment room locations</td>
</tr>
<tr>
<td>HVAC:</td>
</tr>
<tr>
<td>1. One-line diagrams for each air, hydronic, steam, condensate, and all other HVAC related systems, and other materials as required to describe the fundamental design concept for all mechanical systems.</td>
</tr>
<tr>
<td>2. Indication of the amount of redundancy for all major pieces of mechanical equipment. Ex: 2 pumps with 100% capacity each, etc.</td>
</tr>
<tr>
<td>3. Major equipment locations</td>
</tr>
<tr>
<td>4. Air intake and discharge locations for major systems</td>
</tr>
<tr>
<td>5. Strategy for HVAC zoning and typical individual space zoning. Ex: VAV boxes per office = x, etc.</td>
</tr>
<tr>
<td>6. Mechanical legend</td>
</tr>
<tr>
<td>7. Special occupancy zones if any</td>
</tr>
<tr>
<td>8. Dimensioned 3 dimensional clear maintenance space to be maintained at all service points on fan coil units, filter banks, motor locations, dampers, etc shall be graphically shown.</td>
</tr>
<tr>
<td>9. General layout of mechanical rooms</td>
</tr>
</tbody>
</table>
### Schematic Design: Facilities Requirements for 100% SD documentation continued

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HVAC continued:</strong></td>
<td>10. One-line diagrams for every plumbing system (ex: domestic water, sanitary, storm, gas, etc.) and other materials as required to describe the fundamental design concept for all plumbing systems.</td>
</tr>
<tr>
<td></td>
<td>11. Indication of the amount of redundancy for all major pieces of mechanical equipment. Ex: 2 pumps with 100% capacity each, etc.</td>
</tr>
<tr>
<td></td>
<td>12. Building water supply, storm, and sanitary leads.</td>
</tr>
<tr>
<td></td>
<td>13. Major equipment locations.</td>
</tr>
<tr>
<td></td>
<td>14. Restroom locations</td>
</tr>
<tr>
<td></td>
<td>15. Plumbing legend</td>
</tr>
<tr>
<td><strong>Fire Protection:</strong></td>
<td>1. One-line diagrams for each plumbing system and other materials as required describing the fundamental design concept for all fire protection systems.</td>
</tr>
<tr>
<td></td>
<td>2. Report documenting adequacy of utility system, flow, etc.</td>
</tr>
<tr>
<td></td>
<td>3. Location of connections to utilities</td>
</tr>
<tr>
<td></td>
<td>4. Location of fire pump and controller</td>
</tr>
<tr>
<td></td>
<td>1. Fire Alarm system description.</td>
</tr>
<tr>
<td></td>
<td>2. FA panel / subpanel locations.</td>
</tr>
<tr>
<td></td>
<td>5. Preliminary FA device and appliance location plans.</td>
</tr>
<tr>
<td><strong>Lighting:</strong></td>
<td>1. Electrical symbols legend</td>
</tr>
<tr>
<td></td>
<td>2. General drawing notes</td>
</tr>
<tr>
<td></td>
<td>3. General photometric levels</td>
</tr>
<tr>
<td></td>
<td>4. Fixture, lamp, and controls descriptions</td>
</tr>
<tr>
<td></td>
<td>5. Preliminary interior lighting plans.</td>
</tr>
<tr>
<td></td>
<td>6. Preliminary outdoor lighting plans.</td>
</tr>
<tr>
<td><strong>Electrical Power Distribution:</strong></td>
<td>1. Electrical demolition</td>
</tr>
<tr>
<td></td>
<td>2. One-line diagrams</td>
</tr>
<tr>
<td></td>
<td>3. Manhole, duct bank, and building entry locations.</td>
</tr>
<tr>
<td></td>
<td>4. Exterior equipment locations.</td>
</tr>
<tr>
<td></td>
<td>5. Substation, generator, and ATS descriptions.</td>
</tr>
<tr>
<td></td>
<td>6. Substation, generator, and electrical room locations.</td>
</tr>
<tr>
<td><strong>Communications (Voice, Data, &amp; Video Systems):</strong></td>
<td>1. Manhole, duct bank, and building entry locations.</td>
</tr>
<tr>
<td></td>
<td>2. Building entrance and phone/data room locations.</td>
</tr>
<tr>
<td></td>
<td>3. Riser diagram.</td>
</tr>
<tr>
<td></td>
<td>4. Preliminary cable tray plans.</td>
</tr>
<tr>
<td></td>
<td>5. Communication room plan layouts.</td>
</tr>
<tr>
<td></td>
<td>2. Panel locations.</td>
</tr>
<tr>
<td><strong>A/V and Special Systems:</strong></td>
<td>1. System descriptions.</td>
</tr>
<tr>
<td></td>
<td>2. Panel locations.</td>
</tr>
<tr>
<td><strong>Other Graphics:</strong></td>
<td>1. Renderings, models, or other graphics as necessary to clearly present concept.</td>
</tr>
</tbody>
</table>
**Design Development (DD):**
1. The following requirements are those of specific concern to Facilities Personnel.
2. Following FS input of SD documents, consultants shall prepare the next level of DD documents.
3. At completion of 100% DD documents a meeting presentation shall be scheduled with the defined FS personnel and design team prior to review and comment on DD document review. The discussion shall include the following and meeting minutes shall be recorded and distributed:
   a. Building systems additions and/or refinements.
   b. Design team items and questions needing FS attention during document review.
   c. FS project specific questions.
4. At completion of FS review of 100% DD documents a meeting shall be scheduled with the defined FS personnel and design team to debrief and discuss FS questions / comments arising from review and recorded comments.
5. Design team shall record meeting minutes and update issues tracking list for distribution to all.
6. Documents for completion of DD shall include the following information at a minimum and as appropriate per the scope:

<table>
<thead>
<tr>
<th><strong>Design Development: Facilities Requirements for 100% DD documentation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Description:</strong></td>
</tr>
<tr>
<td>1. Maintained and developed SD items listed above.</td>
</tr>
<tr>
<td>2. Specifics of building systems and components with three-dimensional accuracy.</td>
</tr>
<tr>
<td>3. Description of construction phasing.</td>
</tr>
<tr>
<td>4. Description of any proposed occupancy within construction area.</td>
</tr>
<tr>
<td>5. Description of water &amp; vapor characteristics for roof &amp; exterior walls.</td>
</tr>
<tr>
<td>6. All ‘Maintenance Access’ zones should be identified</td>
</tr>
<tr>
<td><strong>Specification:</strong></td>
</tr>
<tr>
<td>1. Outline specifications indicating features of major equipment as well as component materials (ex: ‘welded schedule 40 steel pipe’, etc.) with same section numbering as final specification.</td>
</tr>
<tr>
<td>2. Provide complete systems descriptions and where possible material selections</td>
</tr>
<tr>
<td>3. Specifications to conform to materials and standards set in UO Campus Construction Standards</td>
</tr>
<tr>
<td>4. List of sole-source materials and/or systems</td>
</tr>
<tr>
<td><strong>Site:</strong></td>
</tr>
<tr>
<td>1. General dimensions and elevations.</td>
</tr>
<tr>
<td>2. Permanent exterior signage.</td>
</tr>
<tr>
<td>3. Parking / roadway plans and elevations.</td>
</tr>
<tr>
<td>4. Vehicle and pedestrian traffic controls, as needed.</td>
</tr>
<tr>
<td>5. Grading plan.</td>
</tr>
<tr>
<td>6. Site lighting plan with photo metrics</td>
</tr>
<tr>
<td>7. Concept details of site fixtures and equipment.</td>
</tr>
<tr>
<td>8. Utility plans, elevations, and details for tunnels, chilled water system, steam system, storm water system, power distribution, etc.</td>
</tr>
<tr>
<td>10. Plan to address existing hazardous / contaminated materials, as needed.</td>
</tr>
<tr>
<td>11. Soil erosion and sedimentation control plan.</td>
</tr>
<tr>
<td>12. Dewatering plan, as needed.</td>
</tr>
<tr>
<td><strong>Landscaping:</strong></td>
</tr>
<tr>
<td>2. Planting plan.</td>
</tr>
<tr>
<td>3. Irrigation plan.</td>
</tr>
<tr>
<td><strong>Structural:</strong></td>
</tr>
<tr>
<td>1. Foundation plan.</td>
</tr>
<tr>
<td>2. Typical floor framing plan.</td>
</tr>
</tbody>
</table>
### Design Development: Facilities Requirements for 100% DD documentation continued

| Structural continued: | 3. Framing plans at unique features. |
|                      | 4. Main member sizing.               |
|                      | 5. Structural sections.              |
|                      | 6. Tunnel connections.               |
| Building Exterior    | 1. All building elevations with dimensioned heights. |
| Envelope:            | 2. Typical wall heights.             |
|                      | 3. Roof and drainage plans.          |
|                      | 4. Exterior door details.            |
|                      | 5. Typical window details.           |
|                      | 6. Details of unique features.       |
|                      | 7. Expansion joint locations.        |
|                      | 8. Large scale building cross-sections. |
| Building Interior:   | 1. All floor plans.                  |
|                      | 2. Enlarged plans at elevation changes such as stairs. |
|                      | 3. Enlarged plans at toilet rooms.   |
|                      | 4. Reflected ceiling plans.          |
|                      | 5. Wall types, fire ratings, and smoke control zones. |
|                      | 6. Plan to address existing hazardous materials, if applicable. |
|                      | 7. Fixed seating.                   |
|                      | 8. Defined seating, serving, and kitchen facilities. |
|                      | 9. Equipment and furniture layouts.  |
|                      | 10. Important interior elevations.   |
|                      | 11. Details of unique features.      |
|                      | 12. Details of fixed equipment.      |
|                      | 13. Preliminary finish and door schedules. |
|                      | 14. Door and hardware schedules.     |
|                      | 15. Informational signage.           |
| Elevators:           | 1. Elevator shaft section.           |
|                      | 2. Equipment description.            |
| HVAC:                | 1. Overall HVAC diagram indicating air handlers, exhaust fans, duct risers, and duct mains. |
|                      | 2. Plans indicating shaft, chase, and recess requirements. |
|                      | 3. Duct layout for typical spaces.   |
|                      | 4. Equipment schedules.              |
|                      | 5. Equipment locations with enlarged mechanical room plan(s). |
|                      | 6. Indication of typical locations of fire dampers, smoke dampers, and combination fire / smoke dampers. |
|                      | 7. Control diagrams (concept form) for all mechanical and plumbing systems. |
|                      | Clarification?                       |
|                      | 8. Outline of major control sequence of operation. |
|                      | 9. Mechanical and electrical smoke control schemes. |
|                      | 10. Enlarged preliminary floor plans of mechanical rooms with all components and required service areas drawn to scale. |
|                      | 11. Preliminary calculations.        |
|                      | 12. Meter locations and types.       |
|                      | 13. Campus utility feeds.            |
|                      | 14. Variable Frequency Drives (VFD) for HVAC description and locations. |
### Design Development: Facilities Requirements for 100% DD documentation continued

| HVAC continued: | 15. Dimensioned 3 dimensional clear maintenance space to be maintained at all service points on fan coil units, filter banks, motor locations, dampers, etc shall be graphically shown.  
16. General layout of mechanical rooms with sections both ways  
17. All ducts 12” or greater in any dimension to be shown graphically full size |
| -------------- | ------------------------------------------------------------------------------------------------- |
| Plumbing & Piping: | 1. Design criteria for each system including set points, water quality levels, etc.  
2. Preliminary piping plans (domestic & process) with indication of required service access areas.  
3. Meter locations and types.  
5. Fixtures schedules  
6. Equipment schedules  
7. Enlarged preliminary floor plans of mechanical rooms with all components and required service areas drawn to scale. |
| Fire Protection (Mechanical): | 1. Location of test headers and fire department connections.  
2. Preliminary piping plans.  
3. Enlarged preliminary floor plans of mechanical rooms with all components and required service areas drawn to scale.  
4. Fire pump sizing calculations and devices when applicable. |
| Fire Alarm: | 1. Riser diagram.  
2. FA panel, device, and appliance location plans. |
| Lighting: | 1. Typical interior lighting and control plans.  
2. Outdoor lighting and control plans.  
3. Fixture types, schedules, and cut sheets.  
4. Control system and control device descriptions.  
5. Photometric calculations and diagrams.  
6. Dimming, daylighting, and low voltage control zones.  
7. Documentation of energy code to support SEED, and LEED compliance level. |
2. Normal power riser diagram with circuit breaker sizes.  
3. Standby and Emergency power diagram with circuit breaker sizes.  
4. Grounding riser diagram.  
5. List of equipment on standby / emergency power.  
6. Electrical load calculations.  
7. Panel schedules and locations.  
8. Electrical equipment location plans.  
9. Typical electrical outlet location plans.  
| Communications (Voice, Data, & Video Systems): | 1. Building entry and phone/data room locations, sizes, and door swings.  
2. Backboard locations.  
3. Raceway and grounding riser diagrams.  
4. Conduit and cable tray plans with conduit and cable tray sizes.  
5. Material cut-sheets.  
7. Typical voice, data, and video outlet location plans.  
8. Emergency phone locations and types (wall or pedestal).  
9. Courtesy phone locations. |
<table>
<thead>
<tr>
<th>Design Development: Facilities Requirements for 100% DD documentation continued</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communications</strong> (Voice, Data, &amp; Video Systems) continued:</td>
</tr>
<tr>
<td>10. Emergency phone locations.</td>
</tr>
<tr>
<td>11. Communication room plan layouts.</td>
</tr>
<tr>
<td>12. Interior elevations.</td>
</tr>
<tr>
<td><strong>Security (CCTV and Access Control Systems):</strong></td>
</tr>
<tr>
<td>1. Riser diagrams.</td>
</tr>
<tr>
<td>2. Equipment location plans.</td>
</tr>
<tr>
<td>3. Security office layout, if applicable.</td>
</tr>
<tr>
<td>4. Card access control equipment closet layout and elevations.</td>
</tr>
<tr>
<td><strong>A/V and Special Systems:</strong></td>
</tr>
<tr>
<td>1. Riser diagrams.</td>
</tr>
<tr>
<td>2. Equipment descriptions.</td>
</tr>
<tr>
<td>3. A/V equipment location plans.</td>
</tr>
<tr>
<td>4. Clock and other equipment location plans.</td>
</tr>
<tr>
<td><strong>Other Graphics:</strong></td>
</tr>
<tr>
<td>1. Updated renderings, models, etc. required as appropriate for design development.</td>
</tr>
</tbody>
</table>
**Construction Documents (CD):**

1. The following requirements are those of specific concern to Facilities Personnel.
2. Following FS input of DD documents, consultants shall prepare the next level of CD documents:
3. 50% and 95%/100% CD documents (at a minimum) shall be reviewed by FS to ensure that all items have been addressed and incorporated appropriately. The decision to provide either or both a 95% CD or 100% CD set must be discussed with and decided by the Owner.
4. At issuance of 50%, and 95%/100% CD’s (at a minimum) and prior to FS review, meeting presentations shall be scheduled with previously defined FS personnel and design team prior to official FS review and comment on CD document review. At a minimum the discussion shall include any changed items from previous reviews, unanswered questions, concerns from all parties.
5. At completion of FS review of 50% and 95%/100% CD documents discussions shall be scheduled with defined FS personnel and design team to debrief and discuss questions / comments arising from review and recorded comments.
6. Design team shall record meeting minutes and update issues tracking list for distribution to all.
7. Project bidding and or submission of plans to the City for permitting may **not** occur until 100% CD documents are complete and reviewed by the Owner (FS and CPRE) **unless** prior written Owner approval is obtained (approval from both FS and CPRE).
8. Documents for completion of CD shall include the following information at a minimum and as appropriate per the scope:

<table>
<thead>
<tr>
<th><strong>Construction Documents: Facilities Requirements for 50% and subsequent 95%/100% CD documentation</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>General Description:</strong></td>
</tr>
<tr>
<td>1. Maintained and developed SD items listed above.</td>
</tr>
<tr>
<td>2. Documentation on drawings as required by building codes; specifically to include indication of maximum allowable number of people in each room.</td>
</tr>
<tr>
<td>3. If multiple bid packages, clear indication of scope for each release.</td>
</tr>
<tr>
<td>4. Identification of construction phasing, including temporary requirements during each phase of construction.</td>
</tr>
<tr>
<td><strong>Specification:</strong></td>
</tr>
<tr>
<td>1. Complete specification for all divisions and trades, including draft front end documents.</td>
</tr>
<tr>
<td>2. List of items which are sole-sourced or dual-sourced and justification for not specifying three acceptable products.</td>
</tr>
<tr>
<td><strong>Site:</strong></td>
</tr>
<tr>
<td>1. Extent of construction area.</td>
</tr>
<tr>
<td>2. Area traffic plan, if existing roads / walks are impacted.</td>
</tr>
<tr>
<td>3. Site development phasing.</td>
</tr>
<tr>
<td>4. Construction site access.</td>
</tr>
<tr>
<td>5. Staging area.</td>
</tr>
<tr>
<td>7. Site details, including hardscapes.</td>
</tr>
<tr>
<td>8. Profiles for underground utilities.</td>
</tr>
<tr>
<td>10. Connection details.</td>
</tr>
<tr>
<td>11. Local government review comments on utilities and modifications in right(s)-of-way.</td>
</tr>
<tr>
<td>12. Final photometric of site lighting.</td>
</tr>
<tr>
<td><strong>Landscaping:</strong></td>
</tr>
<tr>
<td>1. Protection for existing trees and significant plantings during construction.</td>
</tr>
<tr>
<td>2. Soil preparation and planting specifications.</td>
</tr>
<tr>
<td>4. Piping diagrams.</td>
</tr>
<tr>
<td>5. Pipe sizes.</td>
</tr>
<tr>
<td>6. Landscape and irrigation details and legends.</td>
</tr>
</tbody>
</table>
### Construction Documents: Facilities Requirements for 50% and subsequent 95%/100% CD documentation

**Structural:**
1. Definition of control joints.
2. Beam, column, and slab schedules.
3. Mechanical and electrical house keeping pads.
4. Foundation details.
5. Structural details and notes.

**Building Exterior Envelope:**
1. Roof-mounted equipment.
2. Roof details.
3. Exterior details.
4. Flashing details.
5. Control joint definition and details.

**Building Interior:**
1. Dimensioned floor plans.
2. Enlarged plans.
3. Partition details.
4. Interior details.
5. Interior elevations.
6. Finish schedules.
7. Door and hardware schedules.
8. Room signage.
9. Schedule of proposed movable equipment that is NOT indicated on documents.
10. Schedule of lab fixtures (turrets, etc.), if applicable.

**Elevators:**
1. Dimensioned plans.
2. Sections and details of hydraulic cylinder, if applicable.
3. Description of shaft sump pits.
4. Elevator car and equipment support details.
5. Description of controls and fixtures.
6. Door and frame details.
7. Interior Details including lighting.

**HVAC:**
1. Detailed piping and duct design with all sizes indicated.
2. Floor plans with all components and required service access areas drawn to scale. On the plans, indicate ducts sizes and air flow quantities relative to each room, including CFM in and out of all doors. Indicate location of control panels.
3. Lab air valves and volume control boxes. Provide a schedule that indicates the control sequence that applies to each room.
4. Detailed and enlarged floor plans of mechanical rooms with all components and required service areas drawn to scale.
5. Enlarged cross-sections through mechanical rooms and areas where there are installation / coordination issues (tight space, zoning of utilities, etc.). Indicate required service access areas.
6. In common mechanical space, indication of space zoning by system.
7. Connection to fire alarm and campus control systems.
8. Equipment details, including structural support requirements.
9. Penetration and sleeve details.
10. Installation details.
11. Duct construction schedule indicating materials and pressure class for each duct system; either on drawings or in specifications.
### Construction Documents: Facilities Requirements for 50% and subsequent 95%/100% CD documentation

| **HVAC continued:** | 12. Detailed controls drawings, including clear differentiation of trade responsibility for control, fire, and control power wiring.  
13. Detailed sequences of operation including the initial values for all control loops that will result in attainment of the required design criteria, as well as alarm set points and time delays. Final values establishment during system commissioning.  
15. Dimensioned 3 dimensional clear maintenance space to be maintained at all service points on fan coil units, filter banks, motor locations, dampers, etc shall be graphically shown.  
16. Detailed layout of mechanical rooms with sections both ways  
17. All ducts 12” or greater in any dimension to be shown graphically full size |
| **Plumbing & Piping:** | 1. Water riser diagram, including assumed fixture counts per floor connection. (May not be required for 1 to 2 story buildings; project decision.)  
2. Waste and vent riser diagrams including assumed fixture counts per floor connection. (May not be required for 1 to 2 story buildings; project decision.)  
3. Foundation drains; unless identified in Architectural.  
4. Detailed piping design with all pipe sizes indicated.  
5. Typical plumbing details, including structural support requirements.  
7. Penetration and sleeve details.  
8. Design calculations. (May not be required; project decision.) |
| **Fire Protection (Mechanical):** | 1. Fire protection service entrance details.  
2. Fire protection plans (including header and riser layout) with indication of any required service access areas.  
3. Detailed piping design with all major pipe sizes indicated.  
4. Location of all sprinkler zone valve and drain connections.  
5. Zoning extents, for areas where the contractor will size the piping.  
6. Typical sprinkler installation details, including structural support requirements.  
7. Penetration and sleeve details.  
8. Design calculations. (May not be required if a design-build system; project decision.) |
| **Fire Alarm:** | 1. Detailed FA panel, device, and appliance location plans including duct detectors, fire/smoke dampers, sprinkler flow and tamper switches, monitor and control modules, door hold-opens, door lock releases, etc.  
2. Strobe light candela ratings.  
3. General notes on conduit and wire sizes.  
4. Details of connections to HVAC, fire pump, fire suppression, door hold-open, and door lock systems.  
5. Detailed sequence of operations. |
| **Lighting:** | 1. Interior and exterior lighting plans, including control systems and devices, lighting panels, switching, and circuiting.  
2. Lighting control system and wiring diagrams.  
3. Installation details, including structural support details.  
4. Normal lighting photometric calculations.  
5. Emergency lighting photometric calculations.  
6. Final fixtures cut sheets.  
7. General notes on conduit and wire sizes for lighting branch circuits. |
**Construction Documents:  Facilities Requirements for 50% and subsequent 95%/100% CD documentation continued**

| **Electrical Power Distribution:** | 1. | Details of power service to the building. |
| | 2. | Power plans, including primary cable raceways, feeder conduits, electrical loads, duplex and special receptacles, and circuiting. |
| | 3. | Standby and emergency power system plans, controls, and details. |
| | 4. | Connections to other building systems, including fire alarm and HVAC systems. |
| | 5. | Details of non-standard electrical installations. |
| | 6. | Conduit and wire sizes for services, feeders, and special branch circuits. |
| | 7. | General notes on conduit and wire sizes for 10 amp single phase branch circuits. |
| | 8. | Notes identifying locations of separate and shared neutrals. |
| | 9. | MCC elevations. |
| | 11. | Roof and floor penetration details. |
| | 12. | Design calculations. |

| **Communications (Voice, Data, & Video Systems):** | 1. | Detailed voice, data, and video outlet locations. |
| | 2. | Details of telecommunications services to the building. |
| | 3. | Floor box schedule. |
| | 4. | Conduit, outlet box, and floor box installation details. |
| | 5. | Power outlet locations in the building entry and phone/data rooms. |
| | 6. | Communication room plan layouts |
| | 7. | Interior elevations |

| **Security (CCTV and Access Control Systems):** | 1. | Detailed equipment location plans. |
| | 2. | Equipment schedules. |
| | 3. | Concealed and exposed raceways. |
| | 4. | Wiring diagrams. |
| | 5. | Installation details. |

| **A/V and Special Systems:** | 1. | Detailed Equipment location plans. |
| | 2. | Equipment schedules. |
| | 3. | Wiring diagrams. |
| | 4. | Installation details including cabinets, hangers, and connection boxes. |

| **Other Graphics:** | 1. | Updated renderings, models, or other graphics required only as appropriate for construction document preparation. |

**End of Section**
The following list of University of Oregon policies, forums, documents, etc. is to be used in conjunction with this Construction Standards document. Throughout the Construction Standards these policies are noted and should be referenced by design professionals. The most current and to date documents shall be sought and used.

**University of Oregon Campus Plan: May 31, 2005**

http://www.uoregon.edu/~uplan/plandoc/CampusPlan/CampusPlan.html

**University of Oregon Policy Requirements:**

1. Bicycle Plan; August 1991:  
   http://www.uoregon.edu/~uplan/plandoc/BikePlan.html

2. Bicycle Management Program; revised May 20, 2003:  
   http://uplan.uoregon.edu/plandoc/BikeManagementProgram.pdf

3. Campus Outdoor Lighting Plan; November 2004, Edited January 9, 2008:  
   http://uplan.uoregon.edu/plandoc/LightingPlan_Update02_2008.pdf

4. Campus Tree Plan; October 2001, Updated July 2008:  
   http://uplan.uoregon.edu/plandoc/TreePlan2008.pdf

5. East Campus 2003 Development Policy; Revised March 2004, Reprinted August 2008:  
   http://www.uoregon.edu/~uplan/projects/EastCampus/ECPolicyrvsd4_04.pdf

6. Long Range Campus Transportation Plan; November 1976:  
   http://darkwing.uoregon.edu/~uplan/subjects/transpo/TransPlan1976.html

7. Campus Outdoor Sign Plan; edited November 15, 2007:  

8. Sustainable Development Plan; updated September 2005:  
   http://www.uoregon.edu/~uplan/subjects/Sustainability/sustainable.html

9. Wood Products Purchasing Policy:  
   https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/6748/html_fac_wood.pdf?sequence=1

10. The Oregonized 2010 ADA Standards for Accessible Design; November 2009:  
    http://darkwing.uoregon.edu/~ftepfer/access/ADAAGuplan/adaag.htm

**Additional References & Guidelines:**

1. Transition Plan, Americans with Disabilities Act; July 26, 1992:  
   http://www.uoregon.edu/~uplan/plandoc/ADAtransitionPlan.html

2. Biennial Capacity Plan (BCP); updated June 14, 2010:  
   http://www.uoregon.edu/~uplan/plandoc/BCPsum.html

3. Campus Diagnosis Studies:  
   http://www.uoregon.edu/~uplan/plandoc/DiagnosisStudies.htm

4. Telecommunications Facilities Guidelines; March 7, 2002:  
   http://www.uoregon.edu/~uplan/plandoc/TelecomFacGuidelines.pdf

5. Campus Planning Committee (CPC):  
   http://www.uoregon.edu/~uplan/CPC/CPC.htm
Additional References & Guidelines continued:

6. Classroom Space Utilization Study; Fall 2007:  
   http://uplan.uoregon.edu/plandoc/ClassroomUtilization.html

7. Comprehensive Environmental Policy:  
   http://policies.uoregon.edu/policy/by/1/04000-facilities/comprehensive-environmental-policy

8. Historic Preservation:  
   http://www.uoregon.edu/~uplan/subjects/HistoricPreservation/histprescover.html

9. State Energy-Efficient Design Program; SEED Rules, OAR 330-130:  

10. Procedure Guide, Interaction with the University Planning Office during project development, September 2000:  
    http://www.uoregon.edu/~uplan/plandoc/procedurecomplete%201.pdf

11. Construction Demolition:  
    http://www.uoregon.edu/~recycle/cd.htm

12. Facilities Standards and Guidelines, Oregon University System (OUS); August 1998.  
    http://www.ous.edu/dept/capcon/files/facilstand.pdf

13. EWEB (Eugene Water & Electric Board) Energy Rebates:  
    http://www.eweb.org/

End of Section
UO CONSTRUCTION CHANGE REQUEST
After 100% CDs are complete and construction is in progress

This form is for ANY UO entity (or Design Team) to use to request a change after the 100% CDs are complete, construction is in progress, and/or construction is complete. The Requestor may have to take financial responsibility for the change if the opportunity to comment in plan review was provided and the Requester and/or the Department failed to do so in a timely way, or if project contingency funds are insufficient.

Submit this UO CONSTRUCTION CHANGE REQUEST to the Capital Construction Project Manager.

Name and Department of Requestor:
Date of Request:
Building Location or Building System:
Project Name:
SCOPE OF CHANGE:
[Briefly describe proposed change(s). Attach further information or documentation as necessary].

REASON CHANGE IS REQUESTED:
[Briefly describe why the change is needed and the impacts of not making the change. Attach further information or documentation as necessary].

Requestor ability to provide funding resources for the change: Yes No Partial
If yes or partial, funding amount or funding limitation $__________

Approvals Required:
☐ Capital Construction Project Manager
☐ Campus Planning & Real Estate Project Planner
☐ Capital Construction Project Planner
☐ User Group Chairperson
☐ Department Head of Requestor, if Department is providing funding

When this UO Internal Construction Change Request is approved by UO entities, final efforts will be made with the design team and Contractor to determine final associated costs (design, engineering, construction) and the impact to the project schedule.

Final review, approval, signature, and funding commitment for the change will be determined and documented on a separate form.
Section 01 10 00 – Summary (Summary of Work; Multiple Contracts; Work Restrictions)

1. Third party entities hired by the Owner may include, but are not limited to, the following:
   a. Cost estimator
   b. Site survey
   c. Certified Arborist services
   d. Special inspections and testing
   e. Water & air balancing and testing
   f. Commissioning
   g. Energy analyst
   h. Geotechnical Consultant
   i. Hazardous materials testing and monitoring
   j. Asbestos removal
      • In the event the Contractor encounters material that is believed to be hazardous, asbestos containing, coated with lead-based paint, and/or oily debris the Contractor shall immediately stop work in the affected area and report the condition to the PM. At no time shall such material be handled or disposed of by the Contractor. The Contractor will cooperate and work with the PM, EH&S, any Consultants, and abatement Contractors engaged by the Owner.

2. Permit fees with the City of Eugene will be paid for by The University of Oregon.

3. NO disposal or recycling on university property outside construction area(s) unless approved by PM.

4. NO burying of any demolition or construction materials on site.

5. NO stockpiling of waste on-site beyond the period necessary for sorting and accumulation of practical quantities for transport off-site.

6. Description of work times may be limited beyond requirements set by city codes.

End of Section

Section 01 20 00 – Price & Payment Procedures (Payments)

1. All Contractor payment requests must be accompanied by all wage certificates for the billing period.

2. Prior to any final payment(s) all keys checked out to Contractor(s) and/or Consultant(s) must be returned to DPS and a receipt of return provided to PM by DPS.

3. Prior to any final payment(s) all required as-built and O&M documentation as listed in Section 01 70 00 must be received by Owner.

End of Section

Section 01 30 00 – Administrative Requirements (Project Management & Coordination; Construction Progress Documentation; Submittal Procedures; Special Procedures)

1. Historic preservation or historic renovation requires Owner (both CPRE and CC) review and participation.

2. Construction Standard Substitution Request Process Requirements:
   a. The Construction Standard Substitution Request Process is for design teams / consultants (only) to request variance and/or substitution of items, strategies, etc. from the March 2011 edition of the Campus Construction Standards.
Section 01 30 00 – Administrative Requirements continued

b. A formal Construction Standard Substitution Request and FS approval is required prior to any deviation from the Construction Standards. Only upon prior approval can they be included in SD, DD, or CD documents for review or implementation

- If deviations from the Construction Standards are included in project design or construction documents generated by the design team / consultants and the deviation did not obtain prior Owner approval through the Construction Standard Substitution Request process the cost of revision and/or redesign will be the responsibility of the design team / consultants and not the UO project.
- If deviations from the Construction Standards are included in project construction documents generated by the design team / consultants and the deviation did not obtain prior Owner approval through the Construction Standard Substitution Request process the cost of any resulting change order to revise and/or redesign the item/condition will be the responsibility of the design team / consultants and not the UO project.

c. Submit requests using the provided Construction Standard Substitution Request form.

- Requests may take the form of a 2-part request process as needed but this approach must be indicated at submission of the request.
- Part 1 may consist of initial proposal/substitution information for Owner feedback of viability and whether or not the design team should proceed with further investigation towards a substitution.
- Part 2 would then include all the required information listed below for final Owner approval of substitution.

d. Submit four (4) complete copies of each request and the required supporting documentation for consideration to the Project Planner (PP).

- The PP will log and distribute these copies to internally designated FS personnel for review.

e. Identify the design strategy, product, fabrication, or installation Standard to be substituted, including the Standard section number and page number.

f. Documentation: Show compliance with requirements for substitutions and the following as it applies.

- Statement(s) indicating why the Standard method, product, or material cannot be provided.
- Coordination information, including a list of changes or modifications needed to other parts of the design or work that will be necessary to accommodate proposed substitution.
- Comparison(s) of significant qualities of the proposed substitution with those of the design or work; may include attributes such as performance, weight, size, durability, maintainability, serviceability, visual effect, and specific features and requirements.
- Product and/or material data including drawings and descriptions of products / materials and fabrication and installation procedures.
- Sample(s) where applicable or requested.
- List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Owners.
- Show compliance with current building code and acceptable to authorities having jurisdiction.
- Comparison of design and construction schedules using proposed substitution, including effect on the overall contract time. For example, if the Standard design method, material, product, or method of construction cannot be provided within the contract time, include a letter from the manufacturer, on manufacturer’s letterhead, stating the lack of availability or delay in delivery. Likewise, for a substitution of an accelerated availability, include a letter from the manufacturer, on manufacturer’s letterhead, stating the availability or accelerated delivery.
- Cost information, including a proposal of change, if any, in the construction estimate.
- The proposed substitution complies with performance, maintenance, and serviceability requirements in the Construction Standards and is appropriate for applications indicated.
Section 01 30 00 – Administrative Requirements continued

g. Owner Facilities Action:

- Designated FS personnel review and approval is required for substitution requests varying from the approved Construction Standards.
- If necessary, FS will request additional information, documentation, or discussion to evaluate a substitution request; through the PP.
- PP will notify Architect / Consultant of approval or rejection of proposed substitution(s).
U of O CONSTRUCTION STANDARDS SUBSTITUTION REQUEST

TO: _______________________________________________________(Campus Planning Project Planner)

PROJECT: _____________________________________________________________

STANDARD ITEM: __________________________________________________________

STANDARD SECTION NUMBER: ___________________________ PAGE NUMBER________________

PROPOSED STANDARD SUBSTITUTION:
Attached data includes design or product description, specifications, drawings, photographs, performance and test data, product information, etc. adequate for evaluation of requested Standard substitution.

Attached data also includes description of changes to related and/or impacted building system(s) or component(s) that will result from the requested Standard substitution.

Proposing party certifies that the following items are correct unless noted & described in attachments:
1. Proposed Standard substitution does not affect U of O maintainability / serviceability.
2. Proposing party pays for changes to the building design and/or redesign caused by the Standard substitution.
3. Proposing party will supply appropriate detailing, specification, etc. for construction of the Standard substitution.
4. Proposed Standard substitution notes and describes all adverse effects on other trades, design schedule, drawing coordination, construction schedule, warranty requirements, project budget, etc.
5. Maintenance and service parts are available locally or readily obtainable for the proposed Standard substitution.

Proposing party further certifies function, appearance, and quality of proposed Standard substitution are equivalent or superior to the Standard.

Submitted by:

_____________________________________________________________________________________
Name (printed or typed)

_____________________________________________________________________________________
Signature

_____________________________________________________________________________________
Firm Name (printed or typed)

_____________________________________________________________________________________
Date (printed or typed) Phone Number (printed or typed)

For use by Designated U of O Representative / Owner of Standard in question:

APPROVED

APPROVED AS NOTED

NOT APPROVED

RECEIVED TOO LATE

By, Printed Name: ________________________ Date: ________________________

By, Signature:

Remarks:__________________________
Section 01 30 00 – Administrative Requirements continued

3. Pre-Construction Meeting Requirements:
   a. Meeting location shall be either on site at FS or conducted by the Lead Consultant with PM.
   b. Meeting minutes shall be by the Lead Consultant and distributed to all attendees.
   c. Agenda items at a minimum and/or applicable include the following; list is subject addition as needed:
      - Designation of key personnel and complete list of sub-contractors with contact information.
      - Construction schedule.
      - Owner occupancy, schedule, and activities requiring accommodation and/or coordination.
      - Impacts to building operations, building systems, and/or building occupants.
      - Site safety and access specific to project.
      - Critical work sequencing and long-lead items.
      - Procedures for processing field decisions, Change Orders, RFI’s, testing & inspecting, applications or payment, submittals, etc.
      - Distribution of Contract Documents as needed.
      - Use of the site, campus premises, and existing building(s).
      - Work restrictions.
      - Temporary facilities and controls.
      - Parking availability.
      - Office, work, and storage areas.
      - Equipment deliveries and priorities.
      - Site security.
      - Progress cleaning.
      - Submittal schedule.
      - ALL shut-off locations.
      - Define plan to reduce impact to building users regarding application of finishes, paints, adhesives, etc.
      - Utility meter removals or connections.
      - Facilities EH&S items include but are not limited to the following:
         i. List of emergency contacts and contact information.
         ii. Process for accessing emergency assistance.
         iii. Process for spills & clean-up.
         iv. EH&S expectations regarding maintaining safe conditions for UO employees, students, visitors, construction workers, etc. including odors, egress, avoidance of fire alarms, etc.
         v. If applicable, EH&S expectations regarding compliance with erosion control permits.

4. Construction Progress Meeting Requirements:
   a. Meeting location shall be onsite and conducted by the GC or CM.
   b. Meeting minutes shall be by the GC or CM and distributed to attendees and to individuals requesting courtesy copies.
      - Courtesy meeting minutes shall be provided to N&TS.
   c. Agenda items at a minimum and/or applicable include the following; list is subject addition as needed:
      - Overall construction schedule progress and status.
      - 2 to 3 week detailed schedule of coming weeks’ activities and needed shutdowns.
      - Owner schedule and activities requiring accommodation and/or coordination.
      - Submittal schedule and status.
      - Site access & utilization and any changes due to construction or delivery activities.
      - Work hours and notification of evening or weekend events needing notification to campus.
Section 01 30 00 – Administrative Requirements continued

- Status of correction of deficient items.
- Field observations.
- RFI progress, status, and/or outstanding responses.
- Proposal Request progress, status, and outstanding questions / responses.
- Pending changes.
- Change Order status and budget update(s).
- Payment request status.

5. Construction Schedule Requirements:
   a. All Owner (building users & neighbors, FS, etc.) activities and milestones are to be listed.
   b. All OFCI / OFOI items, delivery dates, and completion dates are to be listed.
   c. All required shutdowns must be requested by the Contractor to PM a minimum of 2 weeks in advance.
   d. For all disruptive, noise, odor, etc. work within occupied buildings (or close neighboring buildings) the Contractor must notify PM for distribution of such notice to campus a minimum of 48 hrs prior to start of such work.
   e. All commissioning activities and milestones are to be listed.

6. Construction Submittal Requirements:
   a. PM shall receive a minimum of one stamped original of all submittals at the time of Consultant approval.
   b. PM will provide the A/E and GC with a list of submittal items that require concurrent FS Maintenance & PM review and approval prior to official submittal acceptance. This list consists of, but is not limited to the following items:
      - Variable Frequency Drives, VFD
      - AHU and motor-mounts
      - Transformers
      - Building controls
      - Soils
      - Light Fixtures
      - Backflow devices
      - Fire Alarm systems
      - Fire sprinkler components

7. Photographic Documentation Requirements by Contractor:
   a. This requirement may be waived at Owner discretion.
   b. Monthly, an 8"x10" printed photograph. On the front of the photograph identify the project name, location where photograph was taken, and month/date/year.
   c. At project start before demolition, a photo record of the project site, surrounding and adjacent structures and conditions.
   d. At final completion, final color photo documentation; date stamped on the back of the photo.
   e. With closeout documentation submittal a complete digital set of all construction photographs shall be included.

8. Construction Overstock Requirements:
   a. Specific construction overstock requirements are stated in each section as applicable
   b. Overstock goods shall be from the same manufacturer, lot and/or run as the material installed
   c. Contractor shall provide complete written inventory of overstock goods in Excel format indicating product type, model number, installed location(s), name of supplier, quantity supplied, and storage location. Inventory shall be confirmed prior to issuance of Substantial Completion.

End of Section
Section 01 40 00 – Quality Requirements

1. Need for mockups and/or field samples are to be determined by 100% CD and included in contract documents.

End of Section

Section 01 50 00 – Temporary Facilities & Controls

1. Unless written approval is obtained, construction must not obstruct private or public streets, driveways, pedestrian walkways, ADA routes, fire lanes, egress of occupied buildings, etc.

2. Coordinate construction detour routes for bikes, pedestrians, vehicles, etc. with FS Exterior Supervisor, PP, PM, and as needed DPS.

3. All scaffolding use requires qualified and certified erectors following OSHA guidelines.

4. Protection of existing conditions:
   a. Restore permanent facilities used during construction to their specified and/or original condition.
   b. Contact documents shall include provisions to fully protect existing conditions.

5. Only two types of signs fixed to construction fencing are allowed:
   a. One sign to identify the project, project purpose, project rendering and design team.
   b. One sign to list the general and sub contractors.

6. Temporary and Construction Utilities:
   a. ALL shut-off locations are to be documented for emergency purposes prior to pre-construction meeting.
   b. Documentation of locations is to be distributed to PM, Facilities Zone Supervisor, DPS, EH&S, and any others determined by individual projects.

7. Security and access to construction sites:
   a. DPS and PM are to be consulted to determine strategies to be implemented.
   b. UO Fire Marshal and EH&S consultation regarding egress routes from the project site and adjacent buildings to be provided and maintained at all times.
   c. ADA routes must be provided and maintained at all times from the site & adjacent buildings.
   d. Parking within site fencing is controlled and managed by the GC.
   e. If the project does not have site fencing then parking is restricted by issued parking permits through DPS in designated locations only. Parking permits are requested of DPS by the PM.

8. Protection of Existing Asbestos Containing Materials:
   a. Due to the age of many facilities, asbestos containing materials are known to be present
   b. UO will provide information on known asbestos containing materials and locations to design consultant for inclusion into construction contract documents
   c. Contract documents shall include requirements related to asbestos containing materials:
      • Shall not be disturbed
      • If disturbed, what actions are to be taken
      • Provide protection for asbestos containing materials to prevent disturbance

9. Tree and Plant Protection & Preservation:
   a. For ‘Tree Removal’ see Section 31 10 00.
   b. Project Arborist must be certified by the International Society of Arboriculture (ISA).
   c. No storage, stockpiling, parking, etc. is permitted within the zones of protection.
Section 01 50 00 – Temporary Facilities & Controls continued

d. Tree protection fencing:
   - Minimum protection will be a rigid 6-foot chain link or rigid 6ft plywood fence ONLY.
   - No snow fencing for tree protection.
   - Fencing sections are to be anchored into the ground.
   - Fencing to be set at predetermined locations to be shown on plans.
   - Fencing is to remain through the duration of the construction to final completion.
   - Fencing may not be moved or removed without prior Arborist, Landscape Architect, and FS Exterior Supervisor approvals.

e. In instances where there is approved tree removal or construction activity in the vicinity of a tree, the professional services of a certified Arborist shall be sought. Accepted recommendations of the arborist are to be included into the construction documents and management plan for the project.

f. Trees identified as ‘significant’ according to the Campus Tree Plan should be afforded extra care. In addition, trees within Designated Open Spaces (as defined in the Campus Plan) are to be afforded extra care.

g. All related construction drawings, including project site, landscape and demolition plans, shall be approved by the Landscape Architect in consultation with the project Arborist, and contain the information listed below. FS Exterior Supervisor has final approval in all matters.

h. The following requirements prevent damage to plant materials including trees, ground cover, root systems, soil, bark, foliage, branches, and limbs due to construction activities that include, but are not limited to:
   - Soil contamination, erosion and compaction.
   - Excessive wetting, ponding and construction run-off.
   - Alteration of grade, stockpiling of soil, debris and materials.
   - Damage to soil, roots, bark, trunk, limbs, branches and foliage.
   - Unauthorized cutting, breaking, skinning and abrasion of roots, branches and bark.

i. The Landscape Architect in consultation the project’s certified Arborist will:
   - Include a tree protection plan in construction documents.
   - Represent the university’s interest in protecting valuable trees/plants including dedicated trees and plaques.
   - Be consulted by the design team on all building, utility and landscape design issues related to the project affecting campus trees/plants. This involvement may start at conceptual design and will not terminate until project closeout.
   - Determine the boundaries for the Zones of Protection and Critical Root Zones and approve methods for protecting these areas during construction for all trees/plants to be saved.
   - Determine the boundaries of the Critical Root Zones within the Zones of Protection where the only soil disturbances allowed are trench-less boring at specified depths, ‘air spade’ trenching, or hand digging.
   - Approve methods for tree and root zone maintenance during construction, Zones of Protection posting and allowable construction activities within the Zones of Protection.
   - Monitor compliance and provide field reports, evaluate Zones of Protection violations and determine mitigation or monetary losses from violations and damages.
   - Identify all trees/plants to be relocated prior to demolition or construction.
   - Identify all trees/plants to be saved and protected.
Section 01 50 00 – Temporary Facilities & Controls continued

- Prior to any demolition, outline materials and procedures to be used in protecting Zones of Protection. These are to include scheduling of mulching and maintenance, procedures for obtaining variances, relative timing for removal of protective fencing and procedures for protecting Zones of Protection after fencing is removed. FS Exterior Supervisor must be notified and consulted before removal of protection fencing occurs.
- No trimming of tree canopies will be allowed without prior FS Exterior Supervisor approval.

j. Zones of Protection:

- Notices will be posted on Zones of Protection fencing listing prohibited activities without prior approval. These notices will remain in place until authorization is granted by the Landscape Architect, Arborist, and FS Exterior Supervisor.
- Contractor shall submit requests to work within the Zones of Protection following procedures established by the Landscape Architect and FS Exterior Supervisor must be notified and consulted before work occurs.
- The following activities are prohibited in the Zones of Protection without prior written approval from the Landscape Architect and FS Exterior Supervisor.
  i. Removal or moving of protective fencing
  ii. Parking and driving of vehicles
  iii. Storing of equipment
  iv. Excavations
  v. Flooding and cleanup of equipment, tools, etc.
  vi. Operation of equipment
  vii. Staging of materials
  viii. Trenching
  ix. Stockpiling
  x. Altering Drainage
  xi. Items may be added or removed for each individual project as needed.

- Tree trunks are to be protected as specified by the Landscape Architect and project’s Arborist.
- When fencing is removed all protection requirements still apply.
- During any excavation, NO roots larger than 1-inch in diameter will be cut without prior approvals from the Landscape Architect, Arborist and FS Exterior Supervisor.
- All cuts will be made with clean, sharp cutting tools only.
- No root tearing, ripping or abrasions are allowed.
- Exposed roots will be kept moist and protected from sun and frost at all times.
- Additional requirements shall be incorporated into the project specifications/drawings as necessary to ensure adequate tree/plant protection.
- Damages to any trees that are to remain and protected:
  i. Tree values will be assessed by the Landscape Architect and FS Exterior Supervisor per ISA standards and posted to the tree at start of construction. Compensation of any and all harm, damage, destruction, etc. to the tree will be assessed based on the tree value. OR
     Fines of five-hundred dollars ($500.00) per tree, per incident will be assessed for violation of these requirements.
  ii. Damages can be waived only by Landscape Architect and FS Exterior Supervisor if the tree is replaced with the like species and size and has a full one year unconditional guarantee.

End of Section
Section 01 60 00 – Product Requirements

1. All products and materials must be commercial grade at a minimum; no residential grade.

2. All construction deliveries must be made to the project site at attention of the Contractor; not to FS Receiving.

3. All products and materials must be protected by the Contractor from damage, weather, vandalism, etc. prior to installation. Replacement and replacement cost will be the responsibility of the Contractor.

4. All products and materials must be protected from damage, weather, vandalism, etc. after installation and prior to final completion. Replacement and replacement cost will be the responsibility of the Contractor.

5. Typical work by FS includes but not limited to: (OFCI, Owner Furnished Contractor Installed; OFOI Owner Furnished Owner Installed)
   a. Room numbering; See Appendix – Room Numbering Guide
   b. Specification of and providing of door hardware; OFCI.
   c. Exterior trash cans. Custom UO design and order, OFOI.
   d. Exterior benches; OFCI.
   e. Toilet dispenser accessories; OFCI.
   f. Exterior light poles, globes, lamps, and junction box; OFCI.
   g. Interior signage on small to medium projects only; OFOI.
   h. Exterior building marker signage; OFOI.
   i. Wall clocks; OFCI.
   j. Waste receptacles for all spaces; OFOI.
   k. Ash posts or smoking stations. OFOI; Custom UO fabrication.
   l. Walk off mats; OFOI.

End of Section

Section 01 70 00 – Execution & Closeout Requirements

1. Daily Cleaning Requirements:
   a. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
   b. After cutting and boring, contractor is required to clean the space of all debris, water and concrete.
   c. Keep the premises free from accumulation of debris.
   d. Remove all debris, equipment, surplus materials and leave the premises in a neat and orderly condition at the completion of the work day.
   e. Clean all walks, streets, etc. affected by the work.

2. Completion and/or Closeout Cleaning:
   a. See also Divisions 31 and 32 for landscape restoration requirements.
   b. Special cleaning for specific work may be noted in following sections of this document.
   c. Comply with manufacturer’s instructions for cleaning of all system components, equipment, and materials installed into the project.
   d. Prior to the time the Contractor requests Substantial Completion Inspection:
      - Remove labels that are not required as permanent labels.
      - Clean exposed hard-surfaced finishes including glass, metals, stone, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces, to a dirt free condition, free of dust, stains, films, and similar noticeable distracting substances.
Section 01 70 00 – Execution & Closeout Requirements continued

- Clean concrete floors in non-occupied spaces.
- Clean lighting fixtures and lamps of ALL dust and debris.
- Remove crates, cartons, and other flammable waste materials or trash from work areas. Building(s) shall be turned over free of concealed garbage, trash, and rodent infestation. If any of the preceding is revealed, or odors from them occur, they shall be removed by the Contractor at Contractor’s expense.
- Restore all surrounding property to its original condition.
- Elevator shafts, electric closets, pipe, and duct shafts, chases, furred spaces, and similar spaces which are generally unfurnished, shall be cleaned and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt, and dust.
- Rubbish and debris shall be lowered by way of chutes, hoists, or lowered in receptacles. Under no circumstances shall any rubbish or waste be dropped or thrown from one level to another within or outside the building(s).
- No marking, soiling, or other defacing of finished surfaces. In the event that finished surfaces become defaced, all costs for cleaning and restoring such surfaces to their originally intended condition shall be the responsibility and cost of the Contractor.
- Remove debris from and clean tops of all equipment, AHU, lights, etc. This includes mechanical rooms.

c. Prior to Contractor request of Final Acceptance Inspection:

- Clean transparent materials, including mirrors and window or door glass, to a polished condition, removing substances that are noticeable as vision-obscuring materials.
- Turn the work over in immaculate condition inside and outside including the premises.
- Clean all work on the premises including walks, drives, curbs, paving, fences, grounds, and walls. Slick surfaces shall be left with a clear shine. Cleanup shall include removal of smudges, marks, stains, fingerprints, soil, dirt, paint, dust, lint, labels, discolorations, and other foreign materials.
- Clean all finished surfaces on interior and exterior of project including floors, walls, ceilings, windows, glass, doors, fixtures, hardware, and equipment.
- Clean and apply finish (including ‘Anchor’ wax) to all floors as recommended by the manufacturer.
- Wash exterior glass using a window-cleaning contractor specializing in such work.
- Remove temporary buildings and structures, fences, scaffolding, surplus materials, and rubbish of every kind from the site of the work. Repair these areas to be compatible with the surrounding finished conditions.
- Clean tops of all equipment, AHU, lights, etc. This includes mechanical rooms.

3. Construction Waste Management:

a. Salvage and Recycling Requirements: Our goal is to salvage and recycle as much non-hazardous demolition and construction waste as possible including any demolition and/or construction waste.

b. Submittals:

- Recycling Plan: Prior to preparation of the Waste Management Plan, submit the recycling plan to the PM and Architect for approval.
- Waste Management Plan: Submit 3 copies of plan within 30 days of the Notice to Proceed.
- Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste in weight generated by the Work.

c. Record Keeping:

- Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether or not the organization is tax exempt.
Section 01 70 00 – Execution & Closeout Requirements continued

- Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Include documentation for back-charge fees (if any) for improperly segregated waste.
- Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

d. Provide recycling education and recycling information to Contractor and Subcontractor employees working on the project.

e. Waste Management Plan Implementation:
   - Provide containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   - Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
   - Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
      i. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
      ii. Comply with project requirements for controlling dust and dirt, environmental protection, and noise control.

4. Closeout delivery of any and all closeout and/or overstock items to the PM requires formal transmittals for project records; including O&M manuals, extra materials, custom finish knives, etc.

5. Design team Record Document requirements / deliverables at project closeout:
   a. 1 complete full size and reproducible drawing set on 4mil Mylar; all drawings and disciplines (not just floor plans) to include Civil, Landscape, Architectural, Mechanical, Electrical, etc.
   b. 1 complete reproducible CD set of all AutoCAD drawing files, Revit models, etc.; including egress maps.
   c. 1 complete reproducible CD set of each drawing sheet in ‘pdf’ file format.
   d. 1 complete index of AutoCAD files and drawing layers.
   e. 2 complete full-size, reproducible drawing and specification sets on bond paper.

6. General Contractor As-Built document requirements / deliverables at project closeout: With all the following listed items, give particular attention to concealed products and portions of the work that are not clearly identified in the original submittal or cannot otherwise be readily discerned at a later date by direct observation.
   a. Original permit set of documents with sign off of inspections. Contractor should make copies of these sign offs for their records.
   b. 1 complete full-size, reproducible drawing sets on bond paper.
   c. 1 complete set of as-built specifications.
   d. 1 complete reproducible CD of as-built drawings and specifications in ‘pdf’ file format.
   e. 1 complete full-size reproducible drawing & specification set of Contractor’s red-lines on bond paper.
   f. Complete digital set of all construction photographs by Contractor.

7. Operation and Maintenance Manuals:
   a. 2 complete physical hard copies of ALL listed items.
   b. 1 complete reproducible CD of ALL listed items in ‘pdf’ file format.
   c. ALL part numbers of manufacturers and suppliers.
   d. Total quantities installed under the contract.
   e. Manufacturer and supplier names and addresses.
   f. Complete manufacturer’s serial number(s) or other identity symbol(s).
Section 01 70 00 – Execution & Closeout Requirements continued

g. Parts lists that clearly identify every part in the item of equipment with the proper manufacturer’s name, part nomenclature and number, local source, and list price.
h. Draw-downs of all finish paint used.
i. Recommended Spare Parts:
   • Furnish a list of recommended spare parts for each equipment item that will be needed to support that item of equipment for a 12-month period.
   • The quantities of spare parts recommended shall be based upon the quantity of like equipment items installed under the contract.
   • Storage shelf life of part, in months, if the part has a limited life.
   • Recommended quantity of part(s) to inventory and support the installed quantity of equipment in which the part appears for a period of 12 months.
   • Name, address, and phone number of the nearest supplier for the part.
j. Normal Operating Instructions: Provide sufficient information that will permit a journeyman mechanic to adjust, startup, operate, and shutdown the equipment. Special startup precautions and other action items required before the equipment is put into service must be noted.
k. Emergency Operating Procedures: Detail description of the sequence of action to be taken in the event of a malfunction, either to permit a short period of continued operation or an emergency shutdown to prevent further damage to the unit and to the system.
l. Preventative Maintenance: Detail information to cover routine and special inspection requirements, including field adjustments, inspections for wear, adjustment changes, packing wear, lubrication points, frequency and specific lubrication type required, cleaning of the unit, type of solvent to use, and other measures applicable.
m. Calibration: Detailed data on what to calibrate, how to calibrate, when to calibrate, and procedures to enable checking the equipment for reliability; provide indications and data for test equipment, special tools and the location of test points.
n. Scale and Corrosion Control: Detailed information for prevention and removal of scale and corrosion.
o. Trouble Shooting Procedures: Detailed information and procedures for detecting and isolating malfunctions; provide detailed information concerning probable causes and applicable remedies.
p. Removal and Installation Instructions: Detailed information concerning the logical sequence of steps required to remove and install the item including instructions for the use of special tools and equipment.
q. Disassembly and Assembly Instructions: Detailed illustrations and text to show the logical procedure and provide the instructions necessary to disassemble and assemble the unit properly. The text shall include all checks and special precautions and list the use of special tools and equipment required to perform the assembly or disassembly.
r. Repair Instructions: Detailed repair procedures to bring the equipment up to the required operating standard including instruction for examining equipment and parts for needed repairs and adjustments, and tests or inspections required to determine whether old parts may be reused or must be replaced.
s. System Drawings: Detailed drawings, where applicable, that clearly show wiring diagrams, control diagrams, system schematics, pneumatic and fluid flow diagrams, etc., which pertain to the unit function. Drawings are required to show modifications to another manufacturer’s standard unit which is incorporated into the assembly or packaged unit.
   • The Contractor shall provide diagrammatic drawings for each installed system, which shall show the placement of the system in relation to the building, and the physical location of each item or equipment installed within the system. Each installed item of equipment shown on the drawing will be identified by the equipment item model and/or serial/part number.
Section 01 70 00 – Execution & Closeout Requirements continued

t. Special Tools and Test Equipment: Furnish a detailed list of the special tools and test equipment needed to perform repair and maintenance for each equipment item. The list shall contain the special tool and test equipment part number, size, quantity, price, manufacturer’s name and address, and local supplier’s name and address.

u. Warranties and Guarantees: Within each tabbed section of the O&M, include an executed copy of the specified warranty/guarantee covering the particular system, equipment item, or material.

- This is to include both the manufacturer’s warranty and the installing contractor’s guarantee for workmanship and system operation. This copy of the particular warranty/guarantee is in addition to the original signed copies that are to be bound together separately.
- Provide a separate binder containing all original project warranties and guarantees.

v. Field records on excavations, foundations, underground construction, wells, and similar work; if not already included in as-built drawings / documentation.

w. Accurate survey showing locations and elevations of underground lines, including invert elevations of drainage piping; if not already included in as-built drawings / documentation.

x. Surveys establishing lines and levels of buildings; if not already included in as-built drawings / documentation.

y. Load and/or performance testing.

z. Final inspection and deficiency corrections.

aa. Prior to date of substantial completion the Architect and PM shall determine which (if any) samples or mock-ups are to be transmitted to the PM for record purposes.

bb. With all the above listed items, give particular attention to concealed products and portions of the work that are not clearly identified in the original submittal or cannot otherwise be readily discerned at a later date by direct observation.

8. Contractor shall supply all commissioning and closeout documentation and/or verification not included in the O&M manuals or as-built documentation.

a. This information is intended to be a consolidation of documentation and verification for the project commissioning and closeout process.

b. Include documentation of training of FS personnel regarding operation of particular systems. Such documentation shall include identification of parties receiving training and date(s) of training.

9. Warranty Requirements:

a. Minimum warranty for all material and workmanship, building envelope & penetration components excluded per above noted ORS, for a minimum of 1-year after date of substantial completion OR for the extended period of time determined by manufacturer’s guarantee.

b. Extended warranties may be required for specific items as noted in the following document.

c. Correct immediately any failure caused by poor material or workmanship during warranty period; within 72 hours of notice.

d. If the PM or FS personnel are required to proceed with repairs, the responsible party of the warranty will be billed for costs and damages when failing to comply.

10. Demonstration and/or Training:

a. Training & demonstration session of overview for all trades and response groups.

b. In depth training & demonstration session for maintenance, technician, and service personnel. MUST be to a maintenance, technician, and/or service levels for ALL systems.

c. Required hours will be listed in following standards.

End of Section

END OF DIVISION 01
U of O CONSTRUCTION STANDARDS SUBSTITUTION REQUEST

TO: _____________________________________________________ (Campus Planning Project Planner)

PROJECT: ___________________________________________________________________________________

STANDARD ITEM: ___________________________________________________________________________

STANDARD SECTION NUMBER: _________________________ PAGE NUMBER __________________________

PROPOSED STANDARD SUBSTITUTION:

Attached data includes design or product description, specifications, drawings, photographs, performance and test data, product information, etc. adequate for evaluation of requested Standard substitution.

Attached data also includes description of changes to related and/or impacted building system(s) or component(s) that will result from the requested Standard substitution.

Proposing party certifies that the following items are correct unless noted & described in attachments:

1. Proposed Standard substitution does not affect U of O maintainability / serviceability.
2. Proposing party pays for changes to the building design and/or redesign caused by the Standard substitution.
3. Proposing party will supply appropriate detailing, specification, etc. for construction of the Standard substitution.
4. Proposed Standard substitution notes and describes all adverse effects on other trades, design schedule, drawing coordination, construction schedule, warranty requirements, project budget, etc.
5. Maintenance and service parts are available locally or readily obtainable for the proposed Standard substitution.

Proposing party further certifies function, appearance, and quality of proposed Standard substitution are equivalent or superior to the Standard.

Submitted by:

_____________________________________________________________________________________
Name (printed or typed)

_____________________________________________________________________________________
Signature

_____________________________________________________________________________________
Firm Name (printed or typed)

_____________________________________________________________________________________
Date (printed or typed) Phone Number (printed or typed)

For use by Designated U of O Representative / Owner of Standard in question:

APPROVED

APPROVED AS NOTED

NOT APPROVED

RECEIVED TOO LATE

By, Printed Name: ____________________________ Date: ____________________________

By, Signature: ____________________________

Remarks:
Section 02 20 00 – Assessment (Surveys; Existing Conditions; Existing Material)

1. FS Cartographer locates shall be initiated through ‘one-call’ to City of Eugene.
2. Tunnels and buried utilities must be located prior to jack-hammering, excavation, etc. If tunnel ceiling damage occurs this must be repaired at the contractor’s expense to FS satisfaction.

End of Section

Section 02 40 00 – Demolition & Structure Moving (Demolition)

1. See Section 09 00 00 for Cutting and Patching requirements.

End of Section

END OF DIVISION 02
Section 03 00 00 – Concrete (Maintenance; Common Work Results; Schedules)

1. See Section 32 10 00 for concrete sidewalk details.
2. All concrete is to be sealed unless concrete is polished or receives additional floor coverings.
3. Penetrating type graffiti sealing is required on all non-historic building envelopes to top of the second-level at a minimum. Application method of sealant must not come into contact with the ground or waste water systems.
4. Preferred construction of seating, planter box, retaining walls, etc. is brick with a concrete cap similar in design to those found in the central part of campus.

End of Section

Section 03 10 00 – Concrete Forming & Accessories (Forming; Accessories)

1. Saw-cut interior concrete joints only with every effort to layout saw-cuts in smaller/reasonable square proportions vs. rectangular.

End of Section

Section 03 30 00 – Cast-in-Place Concrete (Finishing; Post-Tensioned)

1. Acid-etched and/or sand-blasted finishes are not allowed on walking surfaces.
2. Post-tensioned concrete requires prior CPRE, FS, and CM/GC review and approval.

End of Section

Section 03 80 00 – Concrete Cutting & Boring (Cutting; Boring)

1. Cutting and Boring:
   a. Locate existing pipe, conduit, structure, etc. prior to any concrete cutting and/or boring; interior and exterior.
   b. Work in any part of the sciences complex or student housing, the building manager and users must be notified by Facilities PM a minimum of 48hrs prior to work beginning due to the sensitive nature of activities.
   c. All cutting is to be with vertical, straight-line joints.
   d. Replace surroundings to their original condition.

End of Section

END OF DIVISION 03
Section 04 00 00 – Masonry (Maintenance; Common Work Results; Schedules)

1. Penetrating type graffiti sealing is required on all non-historic building envelopes to top of the second-level at a minimum. Application method of sealant must not come into contact with the ground or waste water systems.

2. During installation of masonry systems, the open top of the cavity must be covered with a canopy to prevent water intrusion and future efflorescence.

3. Fully grout all structural walls.

4. Stainless steel accessories and flashing only for brick veneer systems.

5. Use of specialty masonry materials versus ‘off-the-shelf’ materials requires prior FS Maintenance and FS Exterior Supervisor approval.

6. Material overstock is required only when specialty masonry is approved and used; quantities TBD.

7. Preferred construction of seating, planter box, retaining walls, etc. is brick with a concrete cap similar in design to those found in the central part of campus.

8. Use of exposed aggregate requires prior FS personnel review and approval; interior and exterior applications.


10. NO masonry veneer below grade allowed.

11. Slotted weep holes only; no round weeps.

12. Use of any split-face units requires prior FS Maintenance and Exterior Supervisor approval; interior and exterior applications.

13. Masonry detailing shall avoid recesses or projections up to 12ft above grade that may be used to climb the façade of the building.

End of Section

END OF DIVISION 04
Section 05 00 00 – Metals (Maintenance; Common Work Results; Schedules)

1. Industrial standards are to be used rather than commercial.
2. Coat and/or seal all items prior to installation as much as able; special consideration must be given in occupied buildings.
3. All exterior fasteners are to be stainless steel or hot-dipped galvanized.
4. Any metal within or on walking surfaces must incorporate non-slip texture.

End of Section

Section 05 10 00 – Structural Metal Framing (Structural Steel)

1. If exposed structural steel is used grinding and finishing of the exposed steel shall be limited to a 10ft elevation above finish floor(s), or at reasonable ‘eye-level’ elevation for individual projects. Grinding and finishing of all exposed material is cost prohibitive.

End of Section

Section 05 40 00 – Cold-Formed Metal Framing (Structural Metal Stud Framing; Cold-Formed Metal Joist Framing; Slotted Channel Framing; Metal Support Assemblies)

1. Minimum of 20 gage metal stud material is to be used.

End of Section

Section 05 50 00 – Metal Fabrications (Stairs; Railings; Gratings; Metal Stair Treads & Nosings)

1. See Section 33 40 00 for Gratings.
2. See Stairs and Circulation Appendix.
3. Permanent Ladders:
   a. Required at roof hatches and exterior access to different roof elevations that are not provided with separate roof hatches.
   b. Must include an extension above opening, edge, etc. per OSHA requirements.
   c. Width, rise, and run must be adjusted to accommodate for the difficulty of traveling the steps with tools.
   d. NO offset step ladders.
   e. Must be at least the width of the door or hatch that accesses a space.
   f. Must have either 1-inch or 1-1/4-inch diameter rails at a minimum.
5. IF handrails are required at historic buildings the following is required. Design teams will be notified at the start of a project whether or not the building and/or the scope qualifies as ‘historic’.
   a. Comply with Campus Plan policies related to historic buildings.
   b. Meet applicable code requirements.
   c. Comply with the requirements of the Americans with Disabilities Act.
   d. Placement: Place one handrail down the middle of the stairs except where there is no top landing and where a center rail will affect the swing of a door. At that time, alternative options may be considered.
   e. Design: Refer to rail design and profiles as depicted in drawings and photos following. If the building has an existing rail design, continuity of the building rails supersedes that of the standard.
   f. Finish: Powder-coated color to match the historic metal finish. If the building has no existing metalwork, use the standard UO Green.
Section 05 50 00 – Metal Fabrications

g. Typical historic rail end profiles:

End of Section

Section 05 70 00 – Decorative Metal (Stairs; Railings; Castings; Formed Metal; Forged Metal)

1. Use of decorative metals requires prior FS review and approval.

End of Section

END OF DIVISION 05
Section 06 00 00 – Wood, Plastics, & Composites
(Maintenance; Common Work Results; Schedules)
1. Design teams will be notified at the start of a project whether or not the building and/or the scope qualifies as ‘historic’ and is exempt of any following item(s).
2. Manufacturer recommended and approved fasteners must be used in all pressure-treated wood applications.
3. Wood species, profiles, trims, etc. are to match throughout the building; new and existing construction.
4. Use of Teak and hardwoods is preferred for longer life and in appropriate applications.
5. Use of FSC wood is encouraged and in appropriate applications.
6. Formaldehyde free materials only.

End of Section

Section 06 10 00 – Rough Carpentry
(Wood Framing; Treated Wood Foundations; Wood Decking; Sheathing)
1. No particle board is to be used in underlayment or exterior applications.
2. Plywood sheathing only.
3. Interior dividing walls must continue to building structure.

End of Section

Section 06 40 00 – Architectural Woodwork
(Wood Casework; Wood Paneling; Stairs & Railings; Ornamental Woodwork; Wood Trim; Wood Frames; Wood Screens & Exterior Wood Shutters)
1. No wood is to be used on the exterior face of exterior doors and windows.
2. No wood window frames allowed but for historic preservation/restoration purposes only.
3. With the exception of ‘scribe-to-fit’ items, fabricate and finish all components off-site.
4. Casework and custom woodwork shall be to AWI Custom grade.
5. Casework for Recycling Collection:
   a. See Section 11 80 00 – Solid Waste Handling Equipment for Bagit System information and images
   b. Must be designed for use with collection inserts/receptacles but may vary in detail and aesthetics. Beyond those features, standardization is required in terms of the number of inserts and casework dimensions.
   c. A minimum 5-part sort for paper and bottles/cans is required. For high traffic areas requiring additional bottle/can capacity, a 6-part sort is preferred.
   d. Bagit System recycling collection bags and racks are as inserts are to be used. Casework inside dimensions should allow for the insertion, use, and removal of this rack system.
   e. Bagit System dimensions casework should allow are the following:
      - Single-Bag Freestanding Rack: 15 in. W x 16 in. D x 29 in. H
      - Double-Bag Freestanding Rack (shown): 22 in. W x 16 in. D x 29 in. H
      - Single-Bag Wall Mounted Rack (welded tubular steel) 15 in. W x 16 in. D
5. Where interior benches without backs are installed and the adjacent wall acts as the ‘seatback’, the wall must be detailed and/or reinforced so that frequent use, backpacks, etc. do not create damage to the wall.

7. Wood Trim:
   a. Standard ‘off-the-shelf’ trim types are preferred vs. specialty but for non-historic applications.
   b. Extra trim of specialty types are to be provided with overstock at the end of project.
   c. Any custom profiles, trims, etc. require delivery of a copy of the knife to the PM for future use; transmittal required with as-built requirements.

End of Section

END OF DIVISION 06
Section 07 00 00 – Thermal & Moisture Protection (Maintenance; Common Work Results; Schedules)

1. FS maintains a survey database of all roofs on campus that shall be utilized in all design efforts.
2. Coordination with FS is required for selections of roofing material and/or roofing strategies.
3. All selections of roofing material and/or strategy require FS review and consultation.
4. Cold joint locations require waterproofing to adequately cover and seal.
5. Exterior waterproofing requires special inspection at completion; includes below grade, roofing, etc. waterproofing systems.
6. No Dryvit systems shall be used.
7. Joints are to be sealed watertight.
8. Ice blocking is required over building entries and perimeter walkways when cover/canopy structure slopes towards entries or walks below.
9. Roof drainage must be located at the lowest point(s) and use a minimum 3-inch diameter pipe.
10. No internal downspouts or site drainage piping without review and approval.
11. Required Warranties:
   a. During warranty periods, water damage to any other building component and/or building contents due to product defect and/or incorrect installation requires correction at no cost to the UO.
   b. 30 year manufacturer warranty required for all roofing systems from date of Substantial Completion unless stated otherwise following.
   c. 2 year minimum installation warranty required for ALL moisture protection systems; from date of Substantial Completion.
12. Rain Screen Systems:
   a. Rain screen systems shall be fully detailed and specified; ‘design-build’ is not permitted.
   b. Rain screen systems shall be a component of all exterior masonry veneer systems.
   c. System specified and detailed shall be thoroughly designed, tested and detailed by the systems supplier prior to the start of work. Rain screen manufacturer shall provide on-site inspection and warranty on the installed system.
   d. Installer: personnel installing the products shall provide evidence of factory training and certification. Certification of individuals is required, not just certification of installing contactor.
   e. Product warranty of 25 years. Warranty to include replacement of rain screen system along with all other associated components/damage at no cost to Owner.
   f. Installation warranty of 10 years. Warranty to include repair of rain screen system along with all other associated components/damage at no cost to Owner.

End of Section

Section 07 10 00 – Dampproofing & Waterproofing (Built-Up Bituminous; Sheet; Fluid-Applied; Sheet Metal; Cementitious & Reactive; Bentonite; Water Repellents)

1. 20 year manufacturer and installation warranty required for all dampproofing and waterproofing; from date of Substantial Completion.
2. Dampproofing and/or Waterproofing at footing and foundation walls:
   a. Extend on outside faces of footings.
   b. Extend onto intersecting walls and footings, but do not extend onto surfaces expose to view at project completion.
   c. Install flashings and corner protection at all corners, changes in plane, construction joints, and cracks.
   d. Overlap and/or reinforce and seal material at joints and ends.
Section 07 10 00 – Dampproofing & Waterproofing continued

e. Install appropriate terminations at all edges with counter-flashings over all exposed edges.
f. Seal all penetrations through membrane, sheet, etc. watertight.

End of Section

Section 07 20 00 – Thermal Protection (Insulation; Roof & Deck Insulation; Exterior Insulation & Finish Systems; Weather Barriers; Vapor Retarders; Air Barriers)

1. No fiberglass batt insulation at removable ceilings.
2. No insulation below roof decks in new construction.

End of Section

Section 07 30 00 – Steep Slope Roofing (Shingles & Shakes; Roof Tiles; Natural Roof Coverings)

1. No wood shingles without prior CPRE and FS approval and for historic preservation only.
2. No roofing tiles without prior Cam CPRE and FS approval.
3. Green roofing strategies require prior CPRE and FS review and approval. If approved the following is required.
   a. No soil may be in contact with roofing membranes.
   b. Soil must be contained within moveable units to access the membrane and the deck. The weight of one unit must be safely removable and/or moveable by 1 individual.
   c. Contractor is required to perform removal and replacement of the green roof system in order to access and repair warranty items.

End of Section

Section 07 40 00 – Roofing & Siding Panels (Wall Panels; Faced Panels; Siding)

1. No vinyl siding.
2. Vertical panel systems require rubber gaskets and/or sealed fasteners within fastening methods and assembly.
3. Vertical panel systems shall not compromise the R value of building insulation.
4. Metal panel systems may be used over rain screen systems when Owner approved.

End of Section

Section 07 50 00 – Membrane Roofing (Built-Up Bituminous; Modified Bituminous Membrane; Elastomeric Membrane; Thermoplastic Membrane; Protected Membrane; Fluid-Applied; Coated Foamed; Roll)

1. 3-ply, built-up, bituminous, PVC, or cold-process roofing systems only.
2. Mechanically attached and/or fully adhered TPO single-ply membrane systems permitted.
3. No EPDM roofing.
4. Hot-mopping is not allowed on campus per EH&S.
5. Reflective materials are to be used when possible; white vs. black.
6. Replacement of existing roof membrane systems shall eliminate use of ballast style systems
7. Provide walk pads from point of roof access to all items requiring routine maintenance or access

End of Section
Section 07 60 00 – Flashing & Sheet Metal (Sheet Metal Roofing; Flashing & Trim; Roofing Specialties; Flexible Flashing)

1. Flashing must consist of a 2-piece system at a minimum.
2. NO painted metal flashing.
3. Flashing is required at all window lintels and sills.
4. Head flashing is required at all penetrations, openings, etc. through the exterior skin of the building.
5. 5 year manufacturer and installation warranty required for all flashing; from date of Substantial Completion. Warranty includes installation, leaks, displacement, failed joints, and damages to other building components impacted by failure.
6. Quality Requirements:
   b. Design, fabricate, and install flashings at edges of roof for 100mph wind uplift. Ensure that substrate specification and installation is in compliance.
   c. Design, fabricate, and install with allowance for thermal movements from the maximum change in ambient and surface temperatures.
   d. Provide clips that resist rotation and avoid shear stress as a result of thermal movement.

End of Section

Section 07 90 00 – Joint Protection (Preformed Seals; Sealants; Expansion Control)

1. Low VOC materials and products.
2. Sealants shall not be used as the primary weather barrier.

End of Section

END OF DIVISION 07
**Section 08 00 00 – Openings** (Maintenance; Common Work Results; Schedules)

1. See also Division 06 – Wood, Plastics, & Composites.
2. Design teams will be notified at the start of a project whether or not the building and/or the scope qualifies as ‘historic’ and is exempt of any following item(s).
3. Doors from frequently used spaces (not closets) with full swing into circulation require a visual warning; type and/or method will be determined by the project.
4. NO proprietary door or window systems are allowed regardless of extended warranties that may be offered.
5. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s Facilities personnel prior to specification and/or installation.

End of Section

**Section 08 10 00 – Doors & Frames** (Metal Doors & Frames; Wood Doors; Plastic Doors; Composite Doors; Integrated Opening Assemblies)

1. Aluminum doors are to be pivoting type only.
2. Door cores shall be lumber, Agrifiber-Plastic, or wood composite non-formaldehyde only products.
3. NO vinyl doors.
4. No plastic doors.

End of Section

**Section 08 30 00 – Specialty Doors & Frames** (Access Doors & Panels; Coiling Doors & Grilles; Special Function Doors; Folding Doors & Grilles; Panel Doors)

1. Access Doors and Access Panels:
   a. See mechanical, electrical, plumbing, etc. requirements in following divisions.
   b. Utility risers must be provided with a ‘man door’ (ex: 3ft x 7ft). Access panels are not allowed for riser access
   c. Access for entry of maintenance personnel must be a minimum of 24”x 30”.
   d. Valve access must be a minimum of 12”x 12”; 16”x 16” is preferred.
   e. Access to shut-offs must be labeled as such, ‘Emergency X Shut-Off’.
   f. NO plastic access doors and/or panels.
   g. For all system components requiring maintenance panel size must be sufficient to repair the equipment.
   h. NO key access unless requested by FS or required by code.
   i. Access must be possible by hand-actuated quarter turn hardware; removal of multiple screws is not acceptable.

   • The following are example images of acceptable access methods; FS review and approval is required of final chosen access method(s).

2. Security screens on tracks require prior FS Lock & Door and FS approval.
3. NO smoke control doors are allowed.
4. NO exterior doors shall open for make-up air in smoke control systems.
Section 08 30 00 – Specialty Doors & Frames continued

5. NO automatic entrance doors; like those at grocery stores.
6. Revolving entrance doors require prior FS Lock & Door approval.

End of Section

Section 08 40 00 – Entrances, Storefronts, & Curtain Walls (Curtain Wall & Glazed Assemblies; Windows; Special Function Windows)

1. Window screens are to be removable and maintainable from the interior of the building.

End of Section

Section 08 60 00 – Roof Windows & Skylights (Skylight Protection & Screens)

1. Skylights must meet OSHA fall-protection requirements.
2. 1-piece and gasketed skylight assemblies only.

End of Section

Section 08 70 00 – Hardware (Door Hardware; Access Control Hardware; Window Hardware; Special Function Hardware; Hardware Accessories)

1. 1996 Memorandum; George Hecht, Director of Campus Operations:

   “Facilities Services is charged with the maintenance and repair of campus building and grounds. Within that context, we are also responsible for the installation, service and repair of exterior and interior door locks. Over the years this service has grown to encompass an increasing number of sophisticated locking and alarm devices, going beyond basic lock services. We find that we are spending an increasing amount of time responding to requests from departments that have self-selected specialty lock/alarm systems, leaving us too little time to provide routine lock services to our remaining customers.

   To ensure the most effective use of a limited resource, I feel it’s necessary to clarify the scope of our lock and alarm services.

   a. Standard key locks will continue to be repaired, maintained and replaced if needed by Facilities Services Lock and Door Shop.
   b. Existing specialty locks and alarms will continue to be repaired and maintained by the lock shop for the life of the device. Replacement will be done at the expense of the department using the device.
   c. New specialty locks and alarms will be installed and maintained at the expense of the department requesting the device.
   d. Specialty lock and alarms include Locknetic locks, Simplex locks, Detex alarms (except for exterior fire exit doors), and stand-alone card access systems.

   Please direct any concerns or questions you may have to the Lock and Door Shop Operations Manager.”

2. 2007 Memorandum; Ken Straw, UO Facilities Lock & Door Supervisor:

   “The University of Oregon Facilities Services has developed campus standards that apply to hardware that is used on our buildings both for new construction and replacement hardware purposes. As for new capital construction projects that take place here at the University of Oregon the lock and door shop has entered into a non-binding verbal agreement with Ingersoll-Rand Technologies of the Northwest to provide additional hardware information that will assist the Facilities Lock & Door in providing hardware for large scale projects on campus. All architectural firms are to contract with a hardware consultant on large projects to develop door and hardware schedules. The lock and door shop here at the University of Oregon is requesting that all architectural firms please contact I.R. Technologies for the purpose of developing those schedules.
Section 08 70 00 – Hardware continued

Rick Jermain and Joe Cross both have many years of experience in the hardware field and will serve the campus well. Please contact them at 1-360-546-2613 or by email at joe_cross@irco.com or rick_jermain@irco.com

Address:
10000 NE 7th Ave. Suite 125
Vancouver, WA 98685”

3. Allowable Variations: Only when approved by FS Lock & Door.
   a. Finishes matching existing/historic conditions.
   b. Special use items such as high security lock/alarm systems.
   c. Decorative trims for specific design features.

4. Mandatory Requirements:
   a. Construction keying and final keying is by FS Lock & Door.
   b. Aluminum storefront doors are to have Rixon 180 top, 195 bottom and Mi9 intermediate offset pivot hinges, VD exit devices and LCN closers, NOT factory standards. Other hardware may be factory standard.
   c. Preliminary hardware schedules are to be prepared, by the Architect & Ingersoll-Rand Co., and then submitted to FS Lock & Door for review and approval within a minimum of 30 days prior to completion of final Contract Documents.
   d. A minimum of one building entry requires a power door operator.
   e. Finishes shall be 626 Satin Chrome.
   f. Magnetic holders must be tied into the fire alarm system.
   g. NO narrow style hardware is allowed; medium or wide styles only.
   h. Over sized doors are to use wide-style hardware only.
   i. NO electrified panic devices.
   j. Mullions with electric strikes allowed only with access control systems.

5. Operable ground level windows opening out are to have 6-inch limiters to avoid entry or injury from the exterior.

6. Items listed in the following table are:
   a. FS Lock & Door Provided and Contractor Installed, OFCI.
   b. Currently approved by FS Lock & Door for use in appropriate applications.
   c. Shall be specified to maintain the campus standards.

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<thead>
<tr>
<th>Product:</th>
<th>Manufacturer:</th>
<th>Model:</th>
<th>Finish:</th>
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<tbody>
<tr>
<td>Automatic Flush Bolt</td>
<td>Glynn Johnson</td>
<td>GJ-FB31p</td>
<td>626 Satin Chrome</td>
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<tr>
<td>Butts (3 Butts per leaf for 3070, add 1 butt for each foot in height.)</td>
<td>Ives</td>
<td>5BB1 4 ½ x 4 ½ (36” or less leaf)</td>
<td>626 (632 at exterior wet, or corrosive locations)</td>
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<tr>
<td></td>
<td>Ives</td>
<td>5BB1 HW 4 ½ x 4 ½ (over 36” leaf)</td>
<td>626 (632 at exterior)</td>
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<td></td>
<td>IVES</td>
<td>Comparable Model</td>
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<tr>
<td></td>
<td>Stanley</td>
<td>Comparable Model</td>
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<td>LCN</td>
<td>4041 REG Duty Arm</td>
<td>Standard Paint</td>
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<td>Locknetics</td>
<td>CM or KC device</td>
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### Section 08 70 00 – Hardware continued

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<td>Lockset / Latchset</td>
<td>Schlage</td>
<td>ND Series “Rhodes” with Interchangeable Core Function</td>
<td>626 Satin Chrome</td>
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<td>Exit Lock ND25D</td>
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<td>Privacy Lock ND40S</td>
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<td>Office Lock ND53JD</td>
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<td>Vestibule Lock ND60JD (verify appropriate application)</td>
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<td>Classroom Lock ND70JD (verify appropriate application)</td>
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<td>Schlage</td>
<td>Storeroom Lock ND80JD</td>
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<td>Schlage</td>
<td>Institutional Lock ND82JD</td>
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<td>Schlage</td>
<td>Privacy Lock Indicator L9496 (Single occupant public access)</td>
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<td>Rim Devices (Non-rated)</td>
<td>VonDuprin</td>
<td>98 x Hex Key Dogging</td>
<td>632 Stainless Steel</td>
</tr>
<tr>
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<td>VonDuprin</td>
<td>996 (vandal resistant where appropriate)</td>
<td>632 Stainless Steel</td>
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<tr>
<td>Rim Device (Rated)</td>
<td>VonDuprin</td>
<td>98F</td>
<td>632 Stainless Steel</td>
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<td></td>
<td>VonDuprin</td>
<td>996 (vandal resistant where appropriate)</td>
<td>632 Stainless Steel</td>
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<td>Surface Vertical Rod, Electrified (Non-rated)</td>
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<td>Concealed Vertical Rod (Not Preferred)</td>
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<td>9847 Hex Key Dogging</td>
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<td>Overhead Stop</td>
<td>Glynn Johnson</td>
<td>To be approved</td>
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<tr>
<td>Auto Door Operator</td>
<td>LCN Benchmark</td>
<td>9142 REG (Hard wired ONLY with keyed switch at interior beside push button.)</td>
<td>626 Satin Chrome</td>
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<tr>
<td>Reader / Operator / Intercom Posts</td>
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<td>-</td>
<td>6-inch square aluminum posts provided by FS Lock &amp; Door Shop, Contractor installed.</td>
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<tr>
<td>Mullions with Electric Strikes (Keyed &amp; Removable ONLY)</td>
<td>VonDuprin</td>
<td>Part No. KR 4954; KR4854 (Elect. RHR)</td>
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<td>Mullions – Removable ONLY</td>
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<tr>
<td>Cylinder Body</td>
<td>Schlage</td>
<td>IC core housing (Exit Devices) or IC core mortise body 20-090 (Mortise applications)</td>
<td>626 Satin Chrome</td>
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Section 08 70 00 – Hardware continued

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Finish</th>
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<tr>
<td>Removable Core Cylinders</td>
<td>Facilities Lock &amp; Door Furnished &amp; Installed</td>
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<tr>
<td>Electromagnetic Holder</td>
<td>LCN</td>
<td>7850 (24VDC)</td>
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<td>Manual Flush Bolts</td>
<td>IVES</td>
<td>458</td>
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<tr>
<td>Meeting Stiles</td>
<td>Pemko</td>
<td>303DV</td>
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<td>Smoke seals</td>
<td>Pemko</td>
<td>S88D</td>
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<tr>
<td>Threshold</td>
<td>Pemko</td>
<td>Style to suit need (ADA compliant)</td>
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<tr>
<td>Wall Stop (Provide wall backing)</td>
<td>IVES</td>
<td>407-1/2</td>
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<tr>
<td>Electrified Strikes</td>
<td>VonDuprin</td>
<td>6000 series</td>
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<td>HES</td>
<td>9600 series (rim device)</td>
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</tbody>
</table>

End of Section

Section 08 80 00 – Glazing (Glass Glazing; Mirrors; Glazing Accessories; Glazing Surface Films; Special Function Glazing)

1. See Toilet Room Appendix for mirror requirements.
2. No reflective glazing or reflective window film shall be used.
3. Glazed units must be serviceable from the interior of the building.
   a. Glazing systems that require access from the exterior to complete the removal and installation of insulated glazing units are not permitted.
   b. Breaking of existing insulated glazing units to accommodate unit removal and/or access to glazing sealant/tape systems is not permitted.
4. Interior Wet/Dry Method (Tape and Sealant) or Interior Dry Method (Tape and Tape) are permitted.
5. West facing glazing requires shading strategies. Strategies are to be reviewed and approved by CPRE and the FS Utilities & Energy PM.
6. Provide minimum manufacturer’s warranty period of ten (10) years from the date of manufacture for dual seal units vertically glazed. Insulating units in sloped glazing applications shall be warranted for a period of five (5) years from date of manufacture. Warranty to include all costs associated with unit replacement.

End of Section

Section 08 90 00 – Louvers & Vents (Louvered Equipment Enclosures; Vents)

1. See various mechanical, electrical, plumbing, etc. requirements within following divisions.

End of Section

END OF DIVISION 08
Section 09 00 00 – Finishes (Maintenance; Common Work Results; Schedules)

1. See appendices for various space type requirements.

2. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent FS personnel prior to specification and/or installation.

3. Finish choices MUST NOT jeopardize, or be made at the expense of, essential building systems.

4. Coat/seal all items prior to installation as much as able; special consideration(s) required in occupied buildings.

5. Water based finishes only for interior and onsite applications.

6. Low VOC materials are to be used; zero VOC when available.

7. Follow finish manufacturer’s recommendations for acceptable moisture ranges prior to application / installation. Moisture testing on concrete, substrate, etc. is required prior to installation of finishes and results must be submitted to the PM.

8. Cutting and Patching:
   a. Patch areas in a manner that eliminates evidence of patching and refinishing.
   b. Refinishing should provide an even surface of uniform finish, color, texture, and appearance of all finish surfaces including as much of the surrounding wall as practical. (I.e. Corner to corner most adjacent to the patch.)
   c. Patch, repair, and/or re-hang ceilings to provide an even-plane surface of uniform appearance.
   d. Restore exterior building enclosures to a weather-tight condition.
   e. Clean all areas and spaces removing debris immediately after work has been completed.

End of Section

Section 09 20 00 – Plaster & Gypsum Board (Assemblies; Supports; Gypsum Plastering; Portland Cement Plastering; Other Plastering; Veneer Plastering; Backing Board & Underlayment)

1. Smooth or sand-finish textures are to be used.

End of Section

Section 09 30 00 – Tiling (Thin-Set; Mortar-Bed; Conductive; Waterproofing-Membrane; Chemical-Resistant)

1. Use of any exterior ceramic tile requires prior FS review and approval.

2. Tile MUST be non-porous and/or sealed.

3. Sanded grout is to be used.

4. Overstock Materials: 10% of each type of tile installed.

End of Section

Section 09 50 00 – Ceilings (Acoustical; Acoustical Ceiling Suspension Assemblies; Specialty; Textured Ceilings; Special Function; Integrated Ceiling Assemblies)

1. See Section 06 10 00 requirement that interior dividing walls must continue to structure as opposed to stopping at ceiling height.

2. Overstock Materials: 5% of each type of acoustic tile and/or panel installed.

3. NO spline ceilings.

4. Mechanical and electrical access to equipment above a hard-lid ceiling require a minimum of 24” x 24” access panel with clear path to the equipment.

5. Porous ceilings (tiles and/or systems) are not to be used in ‘wet’, clean, or sterile applications.
Section 09 50 00 – Ceilings continued

6. Suspended acoustical ceiling systems:
   a. NO tegular ceiling tile.
   b. No fiberglass batt insulation at removable ceilings.
   c. Ceiling grid must be either 2ft x 2ft or 2ft x 4ft.
   d. T-bar grid to be standard of 1” in width.

7. Ceilings and mechanical/electrical equipment coordination:
   a. Coordination with mechanical, electrical, and plumbing equipment is required when laying out ceiling grids and supports; no mechanical, electrical, or plumbing access should be blocked.
   b. A ‘Maintenance Access’ zone (vertically & horizontally) is to be defined and called out on drawings and maintained through final construction.
   c. Lighting shall not be located in the ‘Maintenance Access’ zones or access points.
   d. Removal of ceiling tiles may not be blocked by equipment locations.
      • 6-inches from the suspended ceiling to the bottom of equipment & ductwork is required for ceiling tile removal.

End of Section

Section 09 60 00 – Flooring (Treatment; Specialty; Masonry; Wood Flooring; Resilient; Terrazzo; Fluid-Applied; Carpeting; Access Flooring)

1. Interior stone floors require prior FS review and approval.
2. Flooring choices must take into consideration traction and slip-resistant properties to minimize incidents.
3. Flooring MUST be sealed per product requirements and/or manufacturer recommendations.
4. Carpet must **not** require dry cleaning methods.
5. Rubber flooring and base is preferred over vinyl.
6. Resilient Flooring
   a. Also see Laboratories Appendix.
   b. Manufacturers known to be acceptable: Noraplan, Marmoleum.
   c. Manufacturer recommendations for initial cleaning shall be followed and performed.

7. Appropriate underlayment materials for finish floor are to be specified and installed.
8. Polished or stained concrete in public areas is preferred.
9. The number of transitions from hard to soft flooring is to be minimized.
10. NO wood flooring. FS review and approval is required for use of any wood flooring.
11. Concrete slabs must be tested for moisture prior to start of flooring installation. Moisture levels in slabs shall be less than the maximum permitted level specified by the flooring manufacturer. Documentation of acceptable moisture levels to be provide to PM.
12. Flooring Material Overstock Requirements:
   a. Broad Loom Carpet: 5% of installed yardage for each type installed; delivered, wrapped, and labeled.
   b. Carpet Tile: 3% of installed yardage for each type installed; delivered, wrapped, and labeled.
   c. Rubber Base: 2% of installed linear feet for each product type; delivered, wrapped, and labeled.
   d. Resilient Flooring: 10% of installed yardage for each type installed; delivered, wrapped, and labeled.
   e. Sheet Goods, Treads, Risers, Skirts: 5 yards of each type, color, and pattern installed; delivered, wrapped, and labeled.
   f. All overstock material shall be from the same manufacturer, lot and/or run as installed in the facility.
Section 09 60 00 – Flooring continued

g. Provide 6 months supply of specified maintenance products including pads, brushes, and similar application products.  

h. Contractor shall provide an inventory of all overstock items in accordance with Division 1.

End of Section

Section 09 90 00 – Painting & Coating (Staining & Transparent Finishing; Decorative Finishing; High-Performance Coatings; Special Coatings)

1. Graffiti sealing is required on all building envelopes to top of second-level at a minimum. Application method of sealant must not come into contact with the ground or waste water systems.

2. NO application of varnish within occupied buildings.

3. Clean pipe, conduit, and similar features before applying paint or other finishing materials.

4. 1 coat of primer and 2 coats of finish are required on all applications, at minimum.

5. NO painted galvanized.

6. NO ‘cold’ or spray-on galvanizing.

7. Overstock Materials: 1 gallon of each type and/or color of finish paint used.

8. Do not cover or paint any signs, labels, identification, etc. If covered or painted, the contractor is required to replace items.

9. Draw-downs and final list/matrix of all finish paint are required at project completion within O&M Manuals.

10. Application of Finishes and Paints:

   a. In accordance with manufacturer’s instructions.
   b. Protect all surfaces not to be coated.
   c. Provide adequate fresh air and ventilation during application.
   d. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface.
   e. Minimum of three paint coats required:
      - Primer coat may be tinted up to 50% of final color.
      - Finish coats: 2 minimum or as required to properly cover.
   f. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
   g. Inspect each coat before applying next coat; touch-up surface imperfections with coating material, feathering, and sanding if required; touch-up areas to achieve flat, uniform surface without surface defects visible from 5 feet.
   h. Remove dust and other foreign materials from substrate immediately prior to applying each coat.
   i. Where coating application abuts other materials or other coating color, terminate coating with a clean sharp termination line without coating overlap.
   j. Contractor must redo unsatisfactory finishes; refinish entire area to corners or other natural terminations.

11. Campus Colors:

   a. Powder Coating; Tiger Dry Lac RAL colors:
      - Green:  RAL 6005; 49/50670 and 38/50002.
      - Yellow:  RAL 1023; 49/22490 and 38/20023.
      - Off-White for radiators: RAL 9010; 49/11500. Powder coat radiators if removable; paint otherwise.
      - Alternate colors to be approved by Owner.
Section 09 90 00 – Painting & Coating continued

b. UO Green Paint: Miller Paint Co., Sil-Shield 95-5000, color no. 06E1292.

12. Exterior metal accessories and/or furnishings shall be galvanized or powder coated; no painted finish.
   a. Galvanized when accessories are poured in place and/or not removable for refinishing.
   b. Powder coated when accessories are removable for refinishing.

13. Finishing of Mechanical and Electrical Equipment:
   a. Prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports, except where items are shop finished or insulated.
   b. Paint interior exposed conduit and electrical equipment except in mechanical rooms.
      • Galvanized conduit must be pickled, primed, and receive 2 finish coats.
   c. When painting ventilation grills, access panels, etc. remove item(s) and paint separately.

End of Section

END OF DIVISION 09
Section 10 10 00 – Information Specialties (Visual Display Surfaces; Display Cases; Directories; Signage; Telephone Specialties)

1. See also Classrooms Appendix.

2. Provide permanent interior and exterior signage at all utilities, shut-offs, equipment, etc. locations; including ceiling locations.

3. Exterior Signage:
   a. See Campus Outdoor Sign Plan.
   b. Traffic signs are to be designed and installed in accordance with the appropriate convention and located within site plans.
   c. Building identification signs at primary building entrances are OFOI; location of installation(s) should be included in site plans. The following is for information only.

   Primary Building Entrance Sign:

   Construction: Aluminum channel supports with embedded polycarbonate sign face, filled with rigid insulation.
   Symbol: All signs must contain The Great Seal
   Text: Building name in uppercase (when possible), Palatino font, centered on sign face, below seal. Lettering and sign faces sized according to requirements of each location.
   Color: Background (PMS 342)
   Seal and lettering (white, unless lettering is brass or bronze)
   Supports (Tiger Drylac RAL 6005 PowderCoat 49/50670)

4. Interior signage:
   a. Complete room number assignment is required at 100% DD for approval and/or revision by UO. These room numbers are then to be final with only minor revision during the CD phase as MEP schedules will use these designations. See Room Numbering Guide Appendix
   b. Interior room signage on large projects is to be provided and installed by the GC. Design of signage is either by the design team or by design-build with the GC.
   c. Building Directories are to be included within the signage package and installation.
      • Plotter output only with easy access for ease of replacement.
      • To be located near main entrances and/or major circulation spaces and located within floor plans.
   d. Egress maps are to be included within the signage package and installation.
      • Egress routes shall be reviewed and approved by U of O EH&S and/or the AHJ.
      • Map media shall be designed and installed for easy future revision.
      • Modifiable electronic files (AutoCAD) for all maps shall be provided with record documents for future use.
Section 10 10 00 – Information Specialties continued

e. Interior room signage on small to medium remodel projects only can be OFOI. Signage images below are for information and reference only.

- Raised room number, brail, white lettering on black.

- Raised room number, brail, sliding insert, brushed aluminum, choice of accent color. Standard dimensions are as seen below.

- Cork board extension option for signage.

End of Section

Section 10 20 00 – Interior Specialties (Compartments & Cubicles; Partitions; Service Walls; Wall & Door Protection; Toilet, Bath, & Laundry Accessories)

1. See also Toilet Rooms Appendix.

2. Within public & circulation spaces stainless steel & mechanically fastened wall corner guards are required.

End of Section

Section 10 40 00 – Safety Specialties (Fire Protection Specialties; Emergency Aid Specialties)

1. Fire Extinguishers:
   a. 2A10BC for all applications minus kitchen spaces.
   b. K for kitchen applications with either grease or fryers.
   c. 20BC for all other kitchen applications.
   d. Contractor Furnished and Contractor Installed, CFCI.
Section 10 40 00 – Safety Specialties continued
  e. Slide type extinguisher hangers only that are Amrex compatible; no pin hangers.
  f. Extinguishers in public areas, recreation areas, and residence halls are to be housed in cabinets.
  g. Recessed extinguisher cabinets are allowed in corridors only and only with prior Owner approval.

2. Automated External Defibrillator (AED) Cabinets:
   a. Quantity, placement, and alarming requirements of AED cabinets is project specific and must be
certain with EH&S.
   b. Standard EH&S purchased AED is the HeartStart FRx Defibrillator with the following specifications:
      • Carry Case, Plastic Waterproof Shell.
      • 2 HeartStart SMART Pads II (1 Set).
      • 1 68-PCHAT Fast Response Kit.
      • 2 M5070A Battery for HeartStart Defibrillator.
      • 1 Infant/Child Key.

End of Section

Section 10 50 00 – Lockers (Storage Specialties; Storage Assemblies; Wardrobe & Closet Specialties)
1. All shelving is to be secured to building, wall, office system, etc. structure to prevent tipping.
2. All shelving standards and brackets are to be double-slotted with standards installed at a minimum of every
16 inches on-center.

End of Section

Section 10 70 00 – Exterior Specialties (Exterior Protection; Protective Covers; Manufactured Exterior
Specialties)
1. West facing glazing shall incorporate shading strategies.

End of Section

Section 10 80 00 – Other Specialties (Pest Control Devices)
1. Boric acid pest control:
   a. In wall voids for the following spaces at a minimum:
      • Bathrooms
      • Kitchens
      • Animal and Fish facilities.
      • Additional spaces may be added at Facilities EH&S discretion.
   b. Product:
      • Powder form only.
      • ‘BorActin’ as supplied by Rockwell Labs Ltd. or Owner approved equal.
      • Apply at rate recommended by manufacturer on base plates between all stud walls just prior to
enclosure.

End of Section

END OF DIVISION 10
Section 11 40 00 – Foodservice Equipment (Food Storage; Food Preparation; Food Delivery Carts & Conveyors; Food Cooking; Food Dispensing; Ice Machines)

1. See also Division 21 for Fire Suppression.  

End of Section

Section 11 52 00 – Audio-Visual Equipment

1. See also Classrooms Appendix.  

End of Section

Section 11 53 00 – Laboratory Equipment

1. See also Laboratories Appendix.  

End of Section

Section 11 80 00 – Collection & Disposal Equipment (Solid Waste Handling)

1. See also Loading Docks Appendix.

2. Design of facilities that involve storage and/or disposal of industrial and/or special materials, chemicals, waste, etc. will require a report and recommendation from Facilities EH&S.

3. Exterior Recycling & Equipment:

   a. All recycling stations are to be determined and located with Campus Recycling by 100% DD.
   b. Collection shall be sited alongside building garbage collection whenever possible and applicable.
   c. Additional loading dock requirements may be applied based upon project program, scope, etc.
   d. Office and Academic Buildings require the following at a minimum:
      - Concrete or asphalt pad for siting of a 3 yard cardboard dumpster and a 3-yard garbage dumpster.
      - Recycling collection/staging area in the form of a weather-protected loading dock, an enclosed shed, or a covered enclosure.
      - Service vehicle parking or dock space sufficient for a large step-van.
   e. Athletic Facilities require the following at a minimum:
      - PDO (Public Drop-Off’s) and/or recycling shed at all major entrances and exits for collection of bottles, cans, and paper.
      - Concrete or asphalt pads for cardboard and garbage dumpsters. Number to be determined by the size and nature of the athletic facility.
   f. Residence Halls require the following at a minimum:
      - Recycling staging area in the form of a weather-protected loading dock or a covered enclosure. Size must be sufficient to hold twelve 45-gallon barrels.
      - Service vehicle parking or dock space sufficient for a large step-van.
      - The following collection areas are required only in the event interior collection sites are not provided.
         i. Exterior resident recycling collection areas for each major wing of a residence hall in the form of a covered enclosure or sufficient to hold eight 45-gallon barrels.
         ii. One 3-yard cardboard dumpster.
         iii. One 3-yard garbage dumpster.
      - Concrete or asphalt pad for siting of any additional 3 yard cardboard dumpster and 3-yard garbage dumpsters.
      - Any kitchen area operating within a Residence Hall complex requires an additional recycling staging area separate from recycling collection sites used by Residence Hall residents. Site must be sufficient to hold twelve 45-gallon barrels and a 3-yard cardboard dumpster.
Section 11 80 00 – Collection & Disposal Equipment continued

g. Off-campus Apartment Units/Family Housing Complexes:
   • Shall be equipped with full-service, self-contained recycling sites in covered enclosures.
   • One recycling site for each 15-20 apartments; units or apartments configured in a sprawling layout could require a greater number of sites per unit.
   • Each site consists of the following:
     i. One 4-part PDO with 14-gallon curbside inserts
     ii. One 4-part Recycling Shed with 45-gallon barrels
     iii. One 3-yard cardboard dumpster
     iv. One 3-yard garbage dumpster

h. Campus Public Exterior Areas:
   • Require a PDO on high traffic areas and gathering spots.
   • One or more PDO shall be sited at the following locations:
     i. Established entries to and exits from campus.
     ii. Major pedestrian intersections throughout campus.
     iii. Well-used pedestrian walkways and traffic pattern locations
     iv. Athletic facilities
     v. The Erb Memorial Union exterior.
     vi. Each PDO site shall have at least one garbage receptacle

i. OFOI Exterior Recycling Equipment: Containers listed below are for information and standards for the purposes of fire-safety, life-safety, maintenance, serviceability and public usability.

   • Public Drop Off (PDO) recycling shed – 4-part
     i. Mfg./Supplier: DeWald Northwest, Albany, OR
     ii. Part No: as per U of O drawing dated 4-17-98
     iii. Holds four 14-gallon inserts (see item below)
     iv. Siting/applications: Campus-wide public, high-traffic pedestrian areas.
     v. Signage by Campus Recycling.
     vi. Finish, UO Green.

   • 14-gallon Curbside Recycling Bins
     i. Inserts for 4-part DeWald PDO-style units (see item above)
     ii. Mfg./Supplier: Busch Systems International, Barrie, Ontario, Canada
     iii. Part Number: BC2000, color Kelly Green, stamped ‘We Recycle’
     iv. Siting/applications: Inserts for 4-part PDO-style DeWald units, above. (Units used are ordered in kelly green)
     v. Signage by supplier.
Section 11 80 00 – Collection & Disposal Equipment continued

- Recycling Shed – Combo 4-part and 2-barrel
  i. Mfg./Supplier: DeWald Northwest, Albany, OR
  ii. Part No: C2-4
  iii. Holds four 14-gallon inserts and two 45-gallon Barrels.
  iv. Siting/applications: Off-campus housing recycling stations and other campus special-applications areas.
  v. Signage by Campus Recycling.
  vi. Finish, UO Green.

- Recycling Shed – 4 barrel
  i. Mfg./Supplier: DeWald Northwest, Albany, OR
  ii. Part No: Special Model (custom sized) C-4
  iii. Holds four 45-gallon barrels.
  iv. Siting/applications: Off-campus housing recycling stations and other campus special-applications areas.
     (Similar to the adjacent picture 2-section unit, but with 4 sections.)
  v. Signage by Campus Recycling.
  vi. Finish, UO Green.

- Cardboard Recycling Dumpster
  i. *These units are provided by International Paper Company as part of its cardboard recycling contract with the University. Sizes vary by building size, from 1-yard to 3-yard capacity.
  ii. Siting/applications: All campus buildings and residential areas.
  iii. Signage by Campus Recycling.
Section 11 80 00 – Collection & Disposal Equipment continued

4. Interior Recycling & Equipment:
   a. All needed recycling stations are to be determined and located with Campus Recycling by 100% DD.
   b. Collection shall be sited alongside garbage collection whenever possible and applicable.
   c. Office and Academic Buildings: The following represent general guidelines.
      • A public recycling site will consist of a 5-part collection system for 2 paper grades and (combined) bottles/cans.
      • One 5-part, fire-rated, public recycling collection site plus garbage can for each major wing of each floor of a building.
      • One 5-part, fire-rated, public recycling collection site plus garbage can for each 4 to 6 classrooms.
      • One 5-part, fire-rated, public recycling collection site plus garbage can for each 5 to 10 offices or for each office suite.
      • One 3- to 5-part, non-fire-rated non-public recycling collection site plus garbage can for each copy room and/or mail room.
      • Additional receptacles for mailroom junk mail collections.
      • Additional sites as dictated by occupant needs.
      • For fire-rated sites, preference is given to Bagit Steel Enclosures.
   d. Residence Halls: The following represent general guidelines.
      • One full service site plus garbage receptacle per major wing of each residence hall located in basements, or exterior covered enclosures. Site capacities will vary from 6 to 12 barrels.
      • One in-room dorm bin per resident room.
      • Paper and bottle/can recycling for each area desk.
      • Receptacles for mail area collection of junk mail.
      • The use of DeWald 2- and 4-part sheds in interior Residence Hall locations is preferred.
      • A secure room or space for the storage of Campus Recycling service equipment (hand trucks, PPE, barrels, etc.) and a small crew office with telephone and data hook-ups.
   e. Special-Use Buildings, such as the Erb Memorial Union, Recreation Center, café areas, etc. require area-specific recycling collections equipment and staging areas. These types of buildings have low permanent occupancy and high transient occupancy. At a minimum the following recycling will generally be required in these areas:
      • A generous allotment of collection equipment per occupant or user.
      • A greater variety of recyclables.
      • Extensive staging and/or loading dock recycling equipment storage areas.
      • More aesthetically-pleasing collection equipment
      • Garbage collection at all public recycling areas
      • Generous cardboard collection sited with garbage dumpsters.
      • Allowances for the collection of special materials (junk mail, CD’s, arts and crafts recycling, etc.)
      • A secure room or space for the storage of Campus Recycling service equipment (handtrucks, PPE, barrels, etc.) and a small crew office with telephone and data hook-ups.
Section 11 80 00 – Collection & Disposal Equipment continued

f. OFOI Interior Recycling Equipment: Containers listed below are for information and standards for the purposes of fire-safety, life-safety, maintenance, serviceability and public usability.

- Bagit Original Hanging Bag Recycling System
  i. Mfg./supplier: The Bag Connection, Dundee, OR
  ii. Part numbers:
      o 05BP – Blue 14-gallon paper recycling bag
      o 05WP – White 14-gallon paper recycling bag
      o 05GP – Green 14-gallon paper recycling bag
      o 05L – 14-gallon leak-proof bottle/can recycling bag (blue)
      o 06P – Single bag free-standing rack
      o 07P – Double bag freestanding rack
  iii. Custom-made 20-gallon leak-proof bottle/can recycling bag - green. (14- and 20-gallon leak-proof bags not shown)
  iv. Siting applications: Non-fire-rated sites for paper & bottle/can collections; office suites, copy rooms, etc.

- 3-tiered Deskside Paper Sorting Boxes
  i. Mfg./supplier: Columbia Corrugated Box Co., Tualatin, OR
  ii. Part number: Tiered boxes – Printed rotary bin with inserts #1, #2 and #3.
  iii. Siting/applications: Deskside, as requested. User-serviced container.

- 20-gallon Galvanized Garbage Cans
  i. Mfg./supplier: Behrends
  ii. Part Number: 1211
  iii. Siting/applications: Fire-rated areas for paper and bottle/can collections where funding for Steel Bagit Enclosures is not possible. For bottle/can collections, these use the Bag Connection custom-made 20-gallon leakproof recycling bags.
  iv. Signage by Campus Recycling.

- Dorm Bins
  i. Individual bins for residence hall occupants.
  ii. Manufacturer/Supplier: Busch Systems International, Barrie, Ontario, Canada
  iii. Part Number: BC1000 6-gallon Deskslider, color Kelly Green, stamped ‘We Recycle’
  iv. Siting/applications: One per each residence hall Room.
  v. Signage by supplier.
Section 11 80 00 – Collection & Disposal Equipment continued

g. CFCI Interior Recycling Equipment: The following represent preferences for building/project funded, furnished, and installed interior recycling equipment.

- Bagit Steel Enclosures
  i. Mfg./supplier: The Bag Connection, Dundee, OR
  ii. Part Number: Special order, no part number
  iii. Installed in 2-, 4-, 5- and 6-unit blocks – requires Bagit Original bag inserts (above).
  iv. Siting/Applications: Fire-rated areas. Purchase and siting are contingent upon and determined by construction project budgets and departmental funding.
  v. Signage by Campus Recycling.
  vi. Finish: either UO Green or black

- Casework
  i. Mfg./supplier: Various contractors
  ii. Part number: N/A
  iii. Siting/applications: Fire-rated areas. Purchase and siting are contingent upon and determined by construction project budgets and departmental funding.
  iv. Signage by Campus Recycling
  v. Finish: Woodgrain and/or various
  vi. Sizing: To accept Rubbermaid inserts

- Casework Inserts
  i. Mfg./supplier: Rubbermaid
  ii. Part Number: 3569
  iii. Installed in built-to-size casework
  iv. Siting/Applications: Fire-rated areas.
  v. Purchase and siting are contingent upon and determined by construction project budgets and departmental funding.
  vi. Signage by Campus Recycling.

5. OFOI Shared Equipment Containers; Interior and Exterior: Containers listed below are for information and standards for the purposes of fire-safety, life-safety, maintenance, serviceability and public usability.

a. 50-gallon plastic barrels
  - Inserts for DeWald recycling sheds for non-paper materials. Barrels are also used for interior collections in residence hall resident sites and in residence hall kitchen areas.
  - Manufacturer/Supplier: Provided by Forrest Paint of Eugene, OR for no charge.
  - Part Number: Various.
  - Siting: Various, as per DeWald unit siting and residence hall needs.
  - Signage by Facilities Recycling.
Section 11 80 00 – Collection & Disposal Equipment continued

b. 50-gallon plastic barrels
   - Inserts for DeWald recycling sheds for non-paper materials. Barrels are also used for interior collections in residence hall resident sites and in residence hall kitchen areas.
   - Manufacturer/Supplier: Provided by Forrest Paint of Eugene, OR for no charge.
   - Part Number: Various.
   - Siting: Various, as per DeWald unit siting and residence hall needs.
   - Signage by Campus Recycling.

c. 50-gallon fiber barrels
   - Inserts for DeWald recycling sheds for paper.
   - Manufacturer/Supplier: Provided by Forrest Paint of Eugene, OR for no charge.
   - Part Number: Various.
   - Siting: Various, as per DeWald unit siting and residence hall needs.
   - Signage by Campus Recycling.

6. Compost Collection and Equipment:
   a. Office and Academic Buildings: Should include the minimum allowances for composting.
      - All equipment should be co-located with recycling and garbage receptacles:
      - Minimum one 96-gallon or up to three 32-gallon roll carts sited in the same exterior location as garbage and cardboard dumpsters; interior room with direct access to building egress and service vehicle parking.
      - One individual compost unit per building occupant requesting voluntary participation in the compost program.
      - One paper towel compost collection receptacle per restroom.
   b. Residence Halls:
      - Exteriors: Up to three 96-gallon roll carts sited in the same exterior location as garbage and cardboard dumpsters.
      - Interior room with direct access to building egress and service vehicle parking.
   c. Dining Facilities:
      - Public Sites: Post-consumer collection sites based upon dining hall service levels. Casework inserts or 32-gallon roll carts are standard. May be tailored to interior décor and established collection containers. All equipment should be co-located with recycling and garbage receptacles.
      - Kitchen Interior Sites: Kitchen equipment for pre-consumer food composting as needed by staff and as dictated by space considerations. Ideally, a combination of 35-gallon roll carts and 5-gallon buckets co-located with garbage and recycling receptacles.
      - Kitchen Exterior Sites: Will utilize 96-gallon roll carts as detailed above; and/or will contribute loads in 35-gallon roll carts as needed.
Section 11 80 00 – Collection & Disposal Equipment continued

d. Interior Common Spaces:
   - Post-consumer collection sites based upon area usage and proximity to food consumption areas.
   - Casework inserts or 32-gallon roll carts are standard.
   - Equipment should be co-located with garbage and recycling receptacles.

e. Satellite Cafes:
   - Interior Post-consumer Sites: For café clientele located in or near cafe. Casework inserts or 32-gallon roll carts are standard. May be tailored to interior décor and established collection containers. Equipment should be co-located with garbage and recycling receptacles.
   - Interior Pre-consumer Sites: For pre-consumer food composting as needed by staff and as dictated by space considerations. Ideally, a combination of 35-gallon roll carts and 5-gallon buckets. Equipment should be co-located with garbage and recycling receptacles.
   - Exterior Sites: Utilization of a combination of building 96-gallon roll carts and/or café 32-gallon roll carts.

f. Multi-purpose and Non-standard Building Types and Usages: Need(s) will be determined on a case-by-case basis in keeping with similar determinations for recycling and garbage service and equipment provisions. Equipment should be co-located with garbage and recycling receptacles.

g. OFOI Compost Containers: Containers listed below are for information and standards for the purposes of fire-safety, life-safety, maintenance, serviceability and public usability.

- 96-gallon & 32 gallon roll carts
   - i. For centralized building collections and pick-ups plastic barrels.
   - ii. Manufacturer: Toter Inc.
   - iii. Part Number: EVR® II
   - iv. Siting/applications: For use in interior Residence Hall locations where space allows. These are particularly suitable for large, open areas such as basement hallways and trash rooms where enclosure of barrels is desirable or required for fire rating purposes.
   - v. Signage by Campus Recycling.
   - vi. Finish: Brown

- Collection Buckets
   - i. For food service work stations and small café-style food outlets.
   - ii. Multi-purpose 4- or 5-gallon buckets as shown.
   - iii. Signage by Campus Recycling.
Section 11 80 00 – Collection & Disposal Equipment continued

- Event Compost Collection Cans
  i. Manufacturer: Rubbermaid
  ii. Siting/applications: For attendee use at events.
  iii. Signage by Campus Recycling.
  iv. Finish: Yellow

- Paper Towel Collection Containers
  i. For collections of compostable paper towels in all restrooms.
  ii. Size and specifications may vary by restroom dimensions and aesthetics.
  iii. Comparable to Rubbermaid Slim Jim (shown) with distinctive coloring.

- Individual Compost Units
  i. For individual compost collection for faculty and staff.
  ii. Busch Systems 1.45-gallon Mini Kitchen Compost Carrier #KC-1000 as shown or comparable.
  iii. Signage by Campus Recycling.

- Compost Bags & Liners
  i. BioBag brand 39-gallon shown or comparable.

End of Section

END OF DIVISION 11
Section 12 00 00 – Furnishings (Maintenance; Common Work Results; Schedules)

1. See also Appendices for various space types and requirements.
2. All items are to be commercial grade; NO residential grade.
3. All items taller than 6ft must be secured to building structure to prevent tipping.
4. Clear or natural wood finishes are preferred.
5. No furniture may cover radiators, valves, environmental controls, equipment, data and electrical outlets, etc.
   a. Facilities review of furniture and/or partition layout is required prior to any purchase or installation of such furniture.
   b. If building system and mechanical equipment items are covered by furniture, the department shall be responsible for the cost to remove and/or disassemble furniture to access equipment.

End of Section

Section 12 20 00 – Window Treatments (Blinds; Curtains & Drapery; Window Shades; Window Treatment Operating Hardware)

1. Window Treatments:
   a. Solar roller-shades with 10% open weaves are preferred for exterior windows.
   b. Manual shade control is preferred, with continuous bead cord; locate cord on most convenient side for user operation.
   c. Electric controls and motorized shades are acceptable with FS Maintenance review and approval of the motor to be specified. Sivoia motors are known to be acceptable.
   d. Draperies require FS Maintenance approval.
   e. Metal and plastic Venetian or ‘mini’ blinds are allowed if UO Department agrees to accept cost of proper cleaning at regularly scheduled intervals; NO paper, fabric, or wood blinds.

End of Section

Section 12 30 00 – Casework (Manufactured Metal; Manufactured Wood; Manufactured Plastic; Specialty; Countertops)

1. See also Section 06 40 00 for built-in casework requirements.
2. Countertops:
   a. Commercial grade countertops only.
   b. Wood and/or plastic laminate countertops with sinks require a sealed edge at sink cutout.
   c. No pre-molded or residential style plastic laminate counter tops.
   d. All counter penetrations must be sealed.
   e. No open backs or gaps where a countertop meets a wall.

End of Section

Section 12 40 00 – Furnishings & Accessories (Office; Table; Furnishing Accessories; Rugs & Mats)

1. OFOI interior walk-off mats: 3-M; Nomad series; high traffic; 8850.
   a. Walk-off mats integral to a recessed floor require Owner approval. If approved, the walk-off mats are to be CFCl.
2. Wall clocks are OFCI.
3. Waste receptacles for all spaces are OFOI.
Section 12 40 00 – Furnishings & Accessories continued

4. Keyboard & Mouse Ergonomics:
   a. Shall be easily adjustable in height and angle while being stable in use.
   b. Shall provide adequate space for the keyboard and mouse.
   c. Shall not impede or impact the users legs while under the tray platform.

End of Section

Section 12 50 00 – Furniture (Office; Seating; Institutional; Industrial; Systems Furniture)

1. Freestanding furniture and Systems Furniture should be evaluated for height and weight to determine if they are to be secured to the wall using common earthquake restraint practices; 6ft or taller shall be secured to structure.

2. Wood furniture construction should utilize lap joints, dove-tails, etc. vs. inadequate glue and dowel only methods.

3. Powered-panel systems furniture is to be avoided. Components without built-in wiring are preferred for ease of reconfiguration.
   a. If powered-panel systems are approved and installed, the department making the purchase is required to cover costs for any future reconfiguration that requires electricians.

4. Spaces designed to accommodate partition/component office systems must provide adequate power in perimeter walls, ceiling fed power poles, and/or floor-boxes to accommodate components without built-in wiring.

5. Seating Ergonomics:
   a. Minimum adjustability shall include seat height, back height & angle, seat pan angle, and arm rest height & width.
   b. Seat pans should be adjustable in depth, available in various sizes, and wider than the hip breadth of the user.
   c. Seat backs should provide for a proper fitting lumbar support.
   d. Arm rests must be detachable.
   e. Casters should be appropriate for the floor surface; hard or carpet.
   f. Chair bases must have a 5 star caster configuration.
   g. Chairs must swivel 360°
   h. Weight capacity must be specified by the manufacturer and followed.
   i. Fabrics are to be durable, water resistant, and easy to clean.
   j. Vendors should allow for trial use of a prospective chair for a minimum of use of 5 working days prior to purchase.

6. Desk Ergonomics: Desks that are not height adjustable or have limited desk space shall have the option of attaching an adjustable keyboard and mouse tray or platform.

7. Systems Furniture Ergonomics:
   a. Shall be height adjustable in maximum of 1 inch increments.
   b. Work surface height shall range from 24inches to 36inches from floor to top of the work surface for seated work.
   c. Shall provide for attachment of a keyboard and mouse tray / platform as an option.

End of Section
Section 12 90 00 – Other Furnishings (Site Furnishings)

1. Exterior Furniture:
   a. The following exterior furnishings are Campus Plan approved standard designs. All installations / placements are subject to CPRE and FS review; and possibly CPC.
      • All non-approved exterior furnishings proposed for publicly viewed areas on campus require CPRE, FS, and CPC review and approval.
   b. Outdoor furnishings within building courtyards or private outdoor spaces, not seen by the public, are at the discretion of the building occupants and departments. Notification to CPC and FS review is recommended prior to purchase.
   c. Removable Bollards, OFCI: VISCO #VI-BO-14/30, aluminum construction, powder-coated UO Green.
   d. Permanent Bollards, OFCI: VISCO #VI-BO-14, powder-coated UO Green.
Section 12 90 00 – Other Furnishings continued

e. Ash Posts, OFOI custom fabrication.

f. Exterior Benches:
   - Where possible, exterior seating is to be incorporated into site walls and ledges.
   - Benches are OFCI.
   - Gardenside teak bench. 5ft length is preferred, but 6ft length is available.

![Gardenside, LTD]

\[ T \text{ - TRADE PRICE} \quad R \text{ - RETAIL PRICE} \]

- **BENCHES AND ARMCHAIRS**
  - #2604 PARKSIDE BENCH 5’
    - $650 T / $815 R - 76 LBS.
  - #2606 PARKSIDE BENCH 6’
    - $715 T / $895 R - 81 LBS.
  - #2608 PARKSIDE BENCH 8’
    - $985 T / $1225 R - 109 LBS.

![Gardenside, LTD]

No photo

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![Trash Can, OFCI: Wausau Tile with Oregon ‘O’ logo]

g. Trash Cans, OFCI: Wausau Tile with Oregon ‘O’ logo.
Section 12 90 00 – Other Furnishings continued

h. Bicycle Parking:
   - See the ‘Bicycle Plan and Bicycle Management Program’.
   - CPRE and FS Exterior Supervisor oversee the placement of bicycle parking and the development of circulation systems.
   - All bike parking must be located within site plans.
   - Hanging bicycle parking can be used for up to 50% of the required spaces with Owner approval.
   - Each residence hall or apartment complex shall provide short term parking and secure long term parking in lockers, enclosed cages, secure rooms, etc.
   - Removable racks are preferred and are to be powder coated only.
   - Poured in place racks are to be galvanized only.
   - Bicycle Parking System(s) Details following:
     i. Figure 1: Rib bicycle parking, OFCI
     ii. Figure 2: Hoop & Diagonal-hoop bicycle parking, OFCI
     iii. Figure 3: Wave rack, OFCI
     iv. Figure 4: Bicycle lockers, CFCI
     v. Figure 5: Bicycle lockers, CFCI

Figure 1: Rib bicycle parking, OFCI
Section 12 90 00 – Other Furnishings continued

Figure 2: Hoop & Diagonal-hoop bicycle parking, OFCI

![Diagonal-Hoop](image)

**WEDE SERIES RACK**

<table>
<thead>
<tr>
<th>Model</th>
<th>Mount Finish</th>
<th># of Loops</th>
<th>Bike Capacity</th>
<th>Length</th>
<th>Front View</th>
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<td>-SF Surface Flange</td>
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<td>-KG Inground</td>
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</tbody>
</table>
Section 12 90 00 – Other Furnishings continued

Figure 3: Wave rack, OFCI
Section 12 90 00 – Other Furnishings continued

Figure 4: Bicycle lockers, CFCI

- Cycle-Safe, model M/6: (http://www.cycle-safe.com/): UO Green available with custom order; CFCI.
- Minimum aisle dimension is 5ft.
Section 12 90 00 – Other Furnishings continued

Figure 5: Bicycle lockers, CFCI

End of Section

END OF DIVISION 12
Section 13 00 00 – Special Construction (Maintenance; Common Work Results; Schedules)

1. See also Appendices for various space types and requirements.
2. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s FS personnel prior to specification and/or installation.

End of Section

Section 13 10 00 – Special Facility Components (Swimming Pools; Fountains)

1. Inclusion of pools within a project scope requires FS Maintenance and EH&S review with special attention to building codes.

End of Section

Section 13 20 00 – Special Purpose Rooms (Controlled Environment; Fabricated; Vaults)

1. Minimum personnel access opening size allowed is the either 24in x 30in or the minimum emergency access required by fire rescue standards; which ever is greater.
2. No mixing storage tanks.
3. No acid treatment tanks.

End of Section

Section 13 40 00 – Integrated Construction (Building Modules; Sound, Vibration, & Seismic Control; Radiation Protection)

1. Fall protection:
   a. In design request a voluntary consultation with OSHA via EH&S to review fall protection requirements/needs.
   b. OSHA fall protection requirements are to be followed.
   c. Safety railings as required by OSHA at roof perimeters.
   d. Fall protection systems are required on every new roof and every re-roofing project if not already present.
   e. Preferred locations of tie-off mounts are on vertical walls or parapets vs. horizontal locations that require additional deck / roofing penetrations.

End of Section

END OF DIVISION 13
Section 14 00 00 – Conveying Equipment (Maintenance; Common Work Results; Schedules)

1. See also Division 22 piping and pump requirements.
2. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s FS personnel prior to specification and/or installation.
3. Training is to be provided to FS Elevator Maintenance personnel to a technician & service level.
4. Elevator access is required to rooftops and penthouses where major mechanical equipment is located.
5. Elevator Consultant to be used by the design team is Elevator Consulting Services, Inc.

   Elevator Consulting Services, Inc
   15600 NE 8th Street
   Suite B1, PMB 148
   Bellevue, WA 98008
   Phone: (425) 957-4641

End of Section

Section 14 20 00 – Elevators (Electric Traction; Hydraulic; Limited-Use / Limited-Application; Custom Cabs; Equipment & Controls)

1. The approved and listed equipment is non-proprietary and MUST remain non-proprietary. Replaceable parts must be available from all elevator equipment suppliers.
2. If there is a building security system, mini-dome cameras are to be used at elevator cab ceilings.
   a. Elevator Subcontractor will install coax cable in elevator traveling cable.
   b. Closed Circuit TV (CCTV) Contractor shall run cable from elevator machine rooms to DVR and monitor.
   c. Coordinate camera installation in elevators with elevator installer.
3. Elevator Finishes:
   a. Wall finishes can be either stainless steel and/or plastic-laminate; a combination is preferred.
   b. Smooth and flat rubber flooring only; NO raised round sections.
4. All fixtures shall be vandal resistant.
5. No clarity oil shall be used; ISO 32 only.
6. Wiring of elevator shunt shall trip heat detectors; NOT activation of elevator shunt only when the heat detector is activated.
7. Elevator sump pumps and pits are to be alarmed to the DDC.
8. Provide preferred Siemens brand solid-state starter rated for the project.
9. Controls: Motion Control Engineering, Inc; or Owner approved equal.
11. Car Door Detector: Janus Elevator Products, Inc; or Owner approved equal.
12. Roller / Slide Guides: Elevator Safety Company (ELSCO); or Owner approved equal.
13. Operating Fixtures – Car, Hall Station/Lanterns: Innovation Industries, Inc; or Owner approved equal.
14. Car Top Inspection Station: Elevator Products Corporation; or Owner approved equal.
15. Car and Hall Position Indicators: C.E. Electronics, Inc; or Owner approved equal.
16. Hydraulic Pump Unit: Canton Elevator, Inc; or Owner approved equal.
Section 14 20 00 – Elevators continued

17. Hydraulic Cylinder / Plunger: Canton Elevator, Inc; or Owner approved equal.
18. Hydraulic Valve: Maxton Manufacturing Company; or Owner approved equal.
19. Seismic Switch: Seismic Switch, Inc; or Owner approved equal.
20. Rope Gripper: Hollister – Whitney Elevator Corporation; or Owner approved equal.
22. Overspeed Governor: Hollister – Whitney Elevator Company; or Owner approved equal.
23. Intercoms & Emergency ADA Phones: Electronic Micro Systems (EMS); or Owner approved equal.
24. Hoistway Door Safety Plugs: Tri-Lock Mfg. and Maintenance Corporation; or Owner approved equal.
25. Car Exhaust Fan: Elevator Products, Inc; or Owner approved equal.
26. Freight Doors / Controller: The Peelle Co. LTD; or Owner approved equal.

End of Section

Section 14 80 00 – Scaffolding

1. Use qualified and certified erectors following OSHA 1910.28 guidelines.

End of Section

END OF DIVISION 14
Section 21 00 00 – Fire Suppression (Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control)

1. See also Section 08 30 00 – Specialty Doors & Frames.
2. See also Section 09 50 00 – Ceilings.
3. See also Section 09 90 00 – Painting & Coating.
4. See also Division 33 for Utility Standards.
5. Fire Suppression system design requires review and approval by EH&S.
6. NO demolition of one item shall occur in order to repair and/or replace another item.
7. ALL deleted items must be removed and not just abandoned.
8. Systems and system components in new construction, remodels, and retrofits are to be compatible with existing systems and system components to the extent possible
9. New building projects must be 100% sprinkler protected.
10. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s FS personnel prior to specification and/or installation.
11. Accessibility of Fire Suppression Equipment:
   a. Refer to and abide by all OSHA requirements, as appropriate.
   b. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
   c. Access to standpipe and riser rooms must be via a corridor or mechanical room only.
   d. All necessary access points for maintenance must be provided and coordinated. Minimum of 12” clearance at access points are to be maintained
   e. Utility risers must be provided with a door (3ft x 7ft). Access panels are not allowed for riser access.
   f. Fire Suppression Access Panels:
      • Sprinkler valves and/or equipment shall be provided with an access panel large enough to readily pass equipment/manpower through to make repairs.
      • Panel location is subject to review by the Architect, Engineer, and FS EH&S.
      • Panel shall be rated the same as wall or ceiling in which it is located.
      • Labeling of what component(s) is behind an access panel. Red label with 1” white lettering.
      • Doors less than 24” shall be provided with a concealed pivoting rod hinge. Doors 24” or larger shall be provided with a continuous piano hinge. The door shall contain latch screws for securing the door.
      • Panel door shall have rounded safety corners, be fabricated from 16 gage galvanized steel, and shall have a factory prime coat finish suitable for painting.
      • Panel frame shall be one piece construction and provide concealment of the rough wall opening without visible miters or welds on the face.
      • The wall frame shall be provided with 1/4” mounting hose for fastening with the furred space.
      • Manufacturers: ELMDOOR Manufacturing Co.; or approved.
   g. Inaccessible Equipment:
      • If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
Section 21 00 00 – Fire Suppression continued

- ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.

12. Minimum Identification:
   a. Hydraulic information signs required at main riser.
   b. Re-label units when labels begin to fade or fall off.
   c. During finish construction, labeling is to be reviewed and approved by FS PM and Maintenance.
   d. Provide permanent signage, interior and exterior, at all utility boxes, vaults, manholes, main valves, etc.
   e. Zoned systems must have clearly defined valves.
   f. Label equipment, piping, etc. with description or verbiage and direction of flow. No color banding.
   g. Label all valves with numbers and what they serve.
   h. Covering or painting of any sign/label requires replacement.
   i. Label piping to fire hose cabinets as such and not ‘Fire’. (Existing conditions only.)
   j. Label ceilings or ceiling grid (not the tile) at key access points, valves, equipment, etc. with a clear adhesive label and bold black lettering with equipment, etc. ID information.

13. Design Criteria and Tests / Approvals of Sprinkler System:
   a. Contractor shall conduct a pretest of wet system with air pressure at 50 psi for 1 hour minimum.
   b. Hydrostatic Test: Test pipe of sprinkler systems with not less than 200 psig or 50 psi above normal static pressure for 2 hours in presence of Architect, Engineer, FS EH&S, or authorized representatives of Fire Department. No exceptions will be made.

14. Training:
   a. The vendor shall provide FS EH&S training of maintenance and operational aspects, both described and demonstrated.
   b. Training shall be conducted by a manufacturer’s representative thoroughly familiar with the characteristics of the installed system.
   c. A minimum of 6hrs of total training is to be provided.

15. Service: The system vendor must employ factory trained technicians and maintain a service organization within 125 miles of the project and be capable of responding to service calls within 4 hours.

16. 1-Year Warranty Inspection: Contractor to conduct a 1 year inspection with FS EH&S of system equipment and system operational functions prior to expiration of 1 year warranty and correct any found items at the cost of the Contractor. Provide report to FS PM and EH&S.

17. Overstock, tools and supplies to be included in each sprinkler head cabinet:
   a. Sprinkler heads: minimum six (6) per head type.
   b. Sprinkler head wrenches: minimum two (2) per sprinkler head cabinet plus two (2) spares to be delivered to Over Stock Room.
   c. Sprinkler head cabinet: one (1) per sprinkler riser.

18. In the Operations and Maintenance Data, provide the following information on each type of fire suppression system:
   a. Name and 24/7/365 contact information for system installer and General Contractor.
   b. Floor plans showing the layout and location of all sprinkler heads, valves, flow sensors, risers, service entry, standpipes, fire department connections, etc. for each floor.
   c. Separate floor plans graphically depicting system zoning for each floor.
Section 21 00 00 – Fire Suppression continued

d. Reduced scale copy of system zoning plans to permanently mount in riser room.
e. Parts and material specifications for specialized system components that require routine maintenance or replacement in the event of activation.

End of Section

Section 21 10 00 – Water-Based Fire Suppression Systems (Facility Water-Service Piping; Standpipes; Sprinkler Systems)

1. Systems and system component locations should be designed and located in areas that are not exposed to the weather therefore requiring additional insulation, heat tape, etc. measures.

2. All kitchen spaces / applications must reference UL 300 compliance and the City of Eugene Fire Suppression Requirements regarding kitchen hoods and ventilation. The City of Eugene is more stringent than the IFC.

3. Furnish and install tamper switches, flow switches and weatherproof exterior bell. Electrical connection to be by building monitor contractor. Coordinate connection to ensure proper function of alarm and supervisory devices.

4. Fire Suppression Piping:
   a. Interior Pipe Shall Be:
      • Steel Pipe: black steel; Schedule 40 or 10; ASTM A-53 or ASTM A-135; Type E; Grade A or B.
      • Steel pipe 1in to 2in is to be Schedule 40, or UL listed proprietary pipe similar to Allied Dyna-Thread for UL listed Threaded Corrosion Resistance Ratio (CRR) greater than or equal to 1.0.
      • Steel pipe 2-1/2” and larger is to be Schedule 40 or 10 and shall be verified to have a CRR of 1.0 or greater.
   b. Do not impede or limit access of doors, windows, openings, or head room; piping shall be configured to provide maximum amount of access for equipment maintenance.
   c. Pipe openings shall be closed with caps and/or plugged after installation to prevent entrance of foreign materials before final connection.
   d. Maintenance and Protection Requirements:
      • Flushing locations shall be provided per IBC Standard in accessible locations; reviewed and approved location by the Architect / Engineer and the Facilities EH&S.
      • Flushing Connections: 1-1/4in nipples with caps at extreme ends of all cross mains.
   e. Drains and Drips:
      • Piping shall drain back to the express drain located beside the standpipe/riser. Where this is not possible auxiliary drains must be provided and discharge location to be reviewed and approved by FS EH&S.
      • Install auxiliary drains at low points in system.
      • Five or fewer trapped heads will not require a drain valve, but may be drained through plugged tee.
      • Drains are to have a 3/4in hose line connection.
      • If discharge of main drains, auxiliary drains, or inspector’s test connections will cause exterior landscape or property damage a concrete splash block is to be provided to deflect flow and minimize damage.

5. Fire Suppression Interior Joints/Fittings:
   a. Schedule 40, Black Steel Pipe Requires:
      • Screwed joints ANSI B2.1 or welded joints ANSI B31.10, B31.10a, B31.20b.
Section 21 10 00 – Water-Based Fire Suppression Systems continued

- Mechanical grooved couplings joined by an UL and FM approved combination of bolted couplings, gaskets and grooves. Grooves may be rolled or cut and be dimensionally compatible with the coupling.

b. Schedule 10, Black Steel Pipe Requires:
- Welded joints, ANSI B31.10, B31.10b
- UL and FM approved mechanical couplings. Couplings may be of the bolted rolled grooved type or the mechanical locking type. Grooves for the rolled grooved type shall be rolled only.

d. Cast Iron Flanged: ANSI B16.1 or AWWA C207.
e. Fittings not allowed:
  - Lock screw plain end joints/fittings.
  - Snap-Let outlet.
  - F.I.T. fittings.
  - Gasket plain-end joints/fittings.

f. Mechanical pipe coupling housings shall be of malleable iron conforming to ASTM A 47, Grade 32510 or ductile iron conforming to ASTM A 536, Grade 65-45-12. Coupling nuts and bolts shall be of steel and conform to ASTM A 183.
g. Flange Gaskets: Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain arimid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR).
i. Saddle type mechanical tees are acceptable for tapping into existing supply mains.
j. Reductions in pipe sizes shall be made with one piece reducing fittings.
k. Provide listed and approved flexible couplings on sprinkler mains per UBC.
l. Install UL approved hangers and earthquake bracing in place of supporting sprinkler piping.
m. Provide loops or victaulic couplings where piping crosses seismic joints in construction.
n. Provide dielectric unions wherever dissimilar piping materials are connected.

6. Wall and Floor Penetrations:
   a. Holes for pipe passing through rated walls shall be filled to the manufacturer’s recommended thickness with fire resistant caulk.
   b. Wall and hard ceiling penetrations shall be fire stopped.
   c. Provide escutcheons for pipe penetrations through finished areas.
   d. Escutcheons shall be chromium plated iron or chromium plated brass, either one piece or spit pattern, held in place by internal spring tension or set-screw.

7. Hangers, Inserts, and Support:
   a. Hangers shall be in accordance with IBC Standard 9-1.
   b. Manufacturers known to be acceptable: Michigan, Tolco.
   c. Hangers, brackets, supports, anchors, and related appurtenances are to be UL listed for pipe size(s) being suspended.
   d. Pipe may be anchored to corridor walls using unistrut and pipe clamp.
   e. Hanging of pipes from ductwork is prohibited.

8. Fire Suppression Interior Control Auxiliary/Utility Valves:
   a. NO Milwaukee Butterball Ball Valves.
Section 21 10 00 – Water-Based Fire Suppression Systems continued

b. Auxiliary/Utility Valves:
   • Manufacturers known to be acceptable: United Brass Works; Central; Gem; Kennedy; Victaulic.
   • Location and quantity of auxiliary drain valves are to be reviewed and approved by FS EH&S.
   • Globe and Angle Valve Manufacturers known to be acceptable: United Brass Works, Inc. 45S and 46S; Central F15 and F16.
   • Ball Valves Manufacturers known to be acceptable: Central; United Brass Works.

9. Sprinkler Heads & Associated Equipment:
   a. Appropriately rated heads in all locations; especially skylights.
   b. Concealed heads are required in recreation centers, childcare centers, and any other location deemed appropriate by the FS EH&S office.
   c. Quick Response Pendent Heads:
      • Finish is to be white in white recessed escutcheon.
      • Heads typically to be 165°F rated, K=5.6, NPT= 1/2”. Fusing element to be metal link.
      • Manufacturers known to be acceptable: Viking; Reliable; Globe; Tyco.
      • Sprinklers being replaced shall be replaced with quick response heads of same temperature and orifice sizes. Original and replaced sprinkler heads shall be turned over to the FS EH&S.
   d. Quick Response Upright Heads:
      • Finish shall be brass.
      • Heads typically to be 165°F rated, K=5.6, NPT= 1/2”. Fusing element to be metal link.
      • Manufacturers known to be acceptable: Viking; Reliable; Globe; Tyco.
      • Sprinklers being replaced shall be replaced with quick response heads of same temperature and orifice sizes. Original and replaced sprinkler heads shall be turned over to the FS EH&S.
   e. Quick Response Sidewall Heads:
      • Finish is to be white escutcheons and white coated sprinklers.
      • Heads typically to be 165°F rated, K=5.6, NPT= 1/2”. Fusing element to be metal link.
      • Manufacturers known to be acceptable: Viking; Reliable; Globe; Tyco.
   f. Sprinkler Head Cabinet:
      • Contractor shall furnish extra sprinklers of each type installed; no less than 4 of each type.
      • Contractor shall furnish no less than two special sprinkler head wrenches or one head wrench for each sprinkler head box, whichever is greater.
      • Cabinet is to be located in near main riser.
      • Manufacturer: Same as sprinkler head manufacturer.

10. Fire-Stopping:
   a. Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and items penetrating the fire-stopping as demonstrated by fire-stopping manufacturer based on testing and field experience.
   b. Intumescent Latex Seal Manufacturers known to be acceptable: The RectorSeal Corporation; 3M Fire Protection Products.
Section 21 10 00 – Water-Based Fire Suppression Systems continued

11. Joints:
   a. Shop welded joints will be permitted.
   b. Flanged joints or mechanical grooved couplings shall be provided where indicated or required by IBC Standard.
   c. Mechanical grooved pipe joints shall conform to AWWA C 606.
   d. Mechanical couplings and fittings shall be from the same manufacturer.
   e. Joints shall be in accordance with ANSI B1.20.
   f. Joints shall be made using UL-04 listed or FM-P7825 approved combination of fittings, gaskets, and grooves.
   g. Mechanical pipe couplings shall be of the bolted type and consist of a housing fabricated with a synthetic rubber gasket, nuts, and bolts to secure the unit together.
   h. Gaskets shall be of molded synthetic rubber with central cavity, pressure responsive configuration and shall conform to ASTM D 2000.

End of Section

END OF DIVISION 21
Section 22 00 00 – Plumbing (domestic waters; waste; sewer) (Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control)

1. See also Section 08 30 00 – Specialty Doors & Frames.
2. See also Section 09 50 00 – Ceilings.
3. See also Section 09 90 00 – Painting & Coating.
4. See also Division 21 for Fire Suppression piping.
5. See also Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment for ‘Motors’ Standard.
6. See also Division 23 - Heating, Ventilating, & Air-Conditioning (HVAC) for steam, condensate, heating water, and chilled water piping.
7. See also Division 33 for Utility Standards.
8. See also Appendices for various space type requirements.
9. UO goals of sustainability, life-cycle costs, maintainability, serviceability, high performance, quality equipment, and efficient campus inventory must be maintained. First costs may be impacted slightly as a result, but a better product will follow.
10. Exterior placement of any and all equipment requires CPRE and FS Maintenance approval to ensure compliance with the UO Campus Plan. If approved, all University policies shall be followed.
11. Building system zoning requires FS Maintenance and Utilities & Energy Management PM review and approval.
12. NO demolition of one item shall occur in order to repair and/or replace another item.
13. ALL deleted items must be removed and not just abandoned.
14. Systems and system components in new construction, remodels, and retrofits are to be compatible with existing systems and system components to the extent possible.
15. Use of tempered water requires FS EH&S and Maintenance review and approval. IF tempering water used, install soft seat checks and y strainers are to be used.
16. If utility piping is approved by FS CPS & Maintenance to leave the tunnel and continue underground ALL piping must be sleeved / cased with a direct-buried piping system and ALL sleeves must continue into the building a minimum of 12inches.
   a. Provide a minimum of 1inch air space between pipe insulation and casing.
17. Training of piping systems and major system components MUST be provided to a maintenance, technician and/or service levels for ALL systems.
18. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s FS personnel prior to specification and/or installation.
19. Accessibility of Equipment & Components:
   a. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
   b. Refer to and abide by all OSHA requirements, as appropriate.
   c. OSHA 1910 Subpart D - Walking-Working Surfaces standards for working platforms must be followed. Provisions to meet these standards must be incorporated into the building design.
   d. Utility risers must be provided with a door (3ft x 7ft). Access panels are not allowed for riser access.
   e. All necessary access points for maintenance must be provided and coordinated. Minimum of 12” clearance at access points are to be maintained.
Section 22 00 00 – Plumbing continued

f. No equipment shall be accessed via restrooms.
g. Equipment above ceilings shall be located within corridors or above doorways with 36inch clearance for accessibility.
h. In mechanical and electrical rooms any components requiring routine service/maintenance must be installed / mounted below 7ft in height. Prior to installation of any component above 7ft requires onsite review and explanation with FS Maintenance and/or FS Electrical Supervisor.
i. Inaccessible Equipment:
   • If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
   • ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.

20. Minimum Identification for Building Systems:
   a. During finish construction, labeling is to be reviewed and approved by the FS PM and Maintenance.
   b. Provide permanent signage, interior and exterior, at all utility boxes, vaults, manholes, main valves, etc.
   c. Label ceilings or ceiling grid (not the tile) at key access points, valves, equipment, etc. with a clear adhesive label and bold black lettering with equipment, etc. ID information.
   d. Zoned systems must have clearly defined valves.
   e. Re-label units when labels begin to fade or fall off.
   f. Covering or painting of any sign/label requires replacement.
   g. No color banding.
h. Label all valves with brass valve tags that include the following information:
   • Valve number (number to include piping system descriptor)
   • What area of the building the valve serves (main, floor, area, room, etc).
   • Valve status: normally open (OPEN) or normally closed (CLOSED)
   • What piping system the valve serves as follows.
   i. ANSI / ASME 13.1 (2007) shall be used and followed for all piping.
      • Pipe markers should be positioned so that they can be easily seen from the normal angle of approach.
      • Labels shall include direction of flow.
      • Piping labels are required at the following locations:
         i. Adjacent to all valves and flanges.
         ii. Adjacent to all changes of direction.
         iii. On both sides of wall or floor penetrations.
         iv. At regular 20ft intervals on straight runs or increments required by code if less than 20ft.
Section 22 00 00 – Plumbing continued

- Pipe diameter determines the appropriate label and text sizes as follows: Pipes too small to be directly labeled should be marked with a hanging tag.

<table>
<thead>
<tr>
<th>Outside Pipe Diameter (including insulation):</th>
<th>Minimum Length of Label Color Field:</th>
<th>Minimum Letter Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches:</td>
<td>mm:</td>
<td>Inches:</td>
</tr>
<tr>
<td>.75 – 1.25</td>
<td>19 – 32</td>
<td>8</td>
</tr>
<tr>
<td>1.5 – 2</td>
<td>38 – 51</td>
<td>8</td>
</tr>
<tr>
<td>2.5 – 6</td>
<td>64 – 152</td>
<td>12</td>
</tr>
<tr>
<td>8 – 10</td>
<td>203 – 254</td>
<td>24</td>
</tr>
<tr>
<td>&gt;10</td>
<td>&gt;254</td>
<td>32</td>
</tr>
</tbody>
</table>

j. Building Systems Labeling Standard for Piping and Valves:

<table>
<thead>
<tr>
<th>Piping Labeling Standards</th>
<th>Valve Tag Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20# Steam</td>
<td>20#S</td>
</tr>
<tr>
<td>60# Steam</td>
<td>60#S</td>
</tr>
<tr>
<td>Air</td>
<td>AIR</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>CWS</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>CWR</td>
</tr>
<tr>
<td>Clean Steam</td>
<td>CS</td>
</tr>
<tr>
<td>Cold Water</td>
<td>CW</td>
</tr>
<tr>
<td>Condensate</td>
<td>C</td>
</tr>
<tr>
<td>Condensate Return</td>
<td>CR</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>DW</td>
</tr>
<tr>
<td>Heat Recovery Supply</td>
<td>HRS</td>
</tr>
<tr>
<td>Heat Recovery Return</td>
<td>HRR</td>
</tr>
<tr>
<td>Hot Water Supply</td>
<td>HWS</td>
</tr>
<tr>
<td>Hot Water Recirculated</td>
<td>HWR</td>
</tr>
<tr>
<td>Hot Water Heating Supply</td>
<td>HWHS</td>
</tr>
<tr>
<td>Hot Water Heating Return</td>
<td>HWHR</td>
</tr>
<tr>
<td>Industrial Cold Water</td>
<td>ICW</td>
</tr>
<tr>
<td>Industrial Hot Water</td>
<td>IHW</td>
</tr>
<tr>
<td>Industrial Hot Water Recirculation</td>
<td>IHWRRecirc</td>
</tr>
<tr>
<td>Lab Vent</td>
<td>Lab Vent</td>
</tr>
<tr>
<td>Lab Waste</td>
<td>Lab Waste</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>GAS</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N2</td>
</tr>
<tr>
<td>Refrigeration Compressor Discharge</td>
<td>RCD</td>
</tr>
<tr>
<td>Refrigeration Compressor Suction</td>
<td>RCS</td>
</tr>
<tr>
<td>RO Water</td>
<td>RO</td>
</tr>
<tr>
<td>RO Water Reject</td>
<td>ROR</td>
</tr>
<tr>
<td>Roof Drain</td>
<td>RD</td>
</tr>
<tr>
<td>Sea Water, Gravity</td>
<td>SEAWG</td>
</tr>
<tr>
<td>Sea Water, Pumped</td>
<td>SEAWP</td>
</tr>
</tbody>
</table>
Section 22 00 00 – Plumbing continued

<table>
<thead>
<tr>
<th>Piping Labeling Standards</th>
<th>Valve Tag Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Water Heating Supply</td>
<td>SWHS</td>
</tr>
<tr>
<td>Solar Water Heating Return</td>
<td>SWHR</td>
</tr>
<tr>
<td>Vent</td>
<td>VENT</td>
</tr>
<tr>
<td>Waste, Gravity</td>
<td>WASTE</td>
</tr>
<tr>
<td>Waste, Pumped</td>
<td>WASTE - PUMPED</td>
</tr>
</tbody>
</table>

21. Insulation:
   a. Restore damaged pipe covering to its original condition.
   b. Insulation must continue through all penetrations. Domestic cold water is the only exception.
   c. IF rain drains on interior of buildings are approved via Construction Standard Substitution Request, they are to be insulated with removable blankets at all roof and/or floor penetrations.
   d. Valve and expansion joint blankets are to be easily removable and reusable. No Velcro fastening.
      • Manufacturers known to be acceptable: Lewco mat glass fiber insulation, covered with alpha-maritex silicone coated fiberglass cloth.
   e. Domestic Water:
      • Hot water and hot water re-circulation piping shall be insulated.
      • Cold water piping above grade shall be insulated.
      • Piping passing through concrete or masonry block walls or floors shall be insulated to prevent damage to the piping system.

22. All piped systems with supply and return piping require the following:
   a. Dividing supply system into zones, areas of service or by floor
   b. Isolation of each zone, area of service, or floor level from the main distribution lines.
   c. Drain down valves shall be provided at the low point in each zone, area of service, or floor level.

23. Valves:
   a. Applicable services for the following valve requirements include hot water, cold water, compressed air, HVAC hydronic chilled and hot water.
   b. General Valve Requirements:
      • No sweat valve connections. Threaded connections only.
      • Allow for repair and replacement of valves.
      • No plastic lab valves for RO / DI water; valves must be tin lined and spring closed.
      • Square head shut-off valves required at exterior locations.
      • All steam valves are to be 300lb.
      • Isolation indicating valves required at the following locations.
         i. Each floor level, major branches, and remote fixtures for all supply and return systems.
         ii. Adjacent to emergency showers.
         iii. Point of entry into individual laboratories for all piping systems; gas, compressed air, Nitrogen, vacuum, water, etc.
         iv. Suction and discharge of all pumps.
         v. Both sides of hydronic control valves.
         vi. Isolation of serviceable equipment.
         vii. On branch connections from mains into the tunnel system; chilled water, steam, condensate, domestic water, compressed air, etc.
   c. Unions or compression coupling is required on discharge of all relief valves.
   d. All drain valves are to be capped by a brass cap with an EPDM gasket.
Section 22 00 00 – Plumbing continued

e. No triple duty valves on pumps. 3 different and separate valves are required for check valves, flow or balancing valves, and stop valves.

f. Steam Pressure Reducing Valve (PRV) manufacturer known to be acceptable: Spirax Sarco pilot operated PRV.

g. Med gas type laboratory valves:
   - For Nitrogen, compressed air, carbon dioxide, and oxygen systems.
   - Clean gas applications; factory cleaned and packaged.
   - Three piece construction.
   - Factory installed K type copper pipe stubs.
   - Brazed connections.
   - Manufacturers known to be acceptable: Beacon Medaes.

h. Ball valve requirements for sizes 2 inches or less:
   - Minimum of 150lb SWP.
   - Minimum of 600 psig rated working pressure for WOG.
   - Two piece construction only.
   - Bronze bodies only.
   - Reinforced Teflon seats.
   - Adjustable packing.
   - Full port.
   - Stainless steel ball only.
   - Must comply with MSS SP-110
   - Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

h. Butterfly valve requirements for sizes 2 1/2 inches or larger:
   - Minimum of 150lb SWP.
   - Ductile iron bodies only.
   - Stainless steel stems only.
   - Adjustable packing.
   - EPDM seats and liners.
   - Body and stem seals.
   - Lever-lock operators.
   - Lug style only.
   - Bronze discs only.
   - Neck: Clearances for up to 2 inches of insulation.
   - Must comply with MSS SP-110.
   - Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

c. Check valves requirements for sizes 2 1/2 inches or less:
   - Minimum 125 psig rated working pressure for steam
   - Minimum 200 psig rated working pressure for WOG.
   - Y-pattern or swing types with renewable seats and discs.
   - Bronze bodies only.
   - Bronze discs only.
Section 22 00 00 – Plumbing continued

- Must comply with MSS SP-110.
- Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

d. Check valve requirement for sizes 3 inches or larger:
- Minimum 125 psig rated working pressure for steam
- Minimum 200 psig rated working pressure for WOG.
- Swing type with renewable seats and disks.
- Iron bodies only.
- Flanged ends only.
- Bronze trim only.
- Iron discs only.
- Bolted bonnets only.
- Must comply with MSS SP-110.
- Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

e. Drain valve requirements:
- Minimum of 150lb SWP.
- Minimum of 600 psig rated working pressure for WOG.
- Bronze bodies only.
- Two piece construction only.
- Reinforced Teflon seats.
- Adjustable packing.
- One threaded end with a 3/4 inch male hose connection on the other end.
- Brass caps with rubber gaskets and brass chains.
- Full port.
- Stainless steel balls only.
- Must comply with MSS SP-110.
- Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

c. Gate valve requirements for sizes 2 1/2 inches or less:
- Minimum of 150lb SWP.
- Bronze bodies only.
- Union bonnets.
- Rising stem.
- Stuffing box must be re-packable under pressure.
- Must comply with MSS SP-80.
- Manufacturers known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

c. Gate valve requirements for sizes 2 1/2 inches or larger:
- Minimum of 150lb SWP.
- Iron bodies only.
- Flanged ends.
- Bolted bonnets.
- Solid wedge, bronze mounted
Section 22 00 00 – Plumbing continued

• Stuffing box must be re-packable under pressure.
• Must comply with MSS SP-70.
• Manufactures known to be acceptable: Crane; Jenkins; Stockham; Hammond; Conbraco (Apollo); Milwaukee; NIBCO.

End of Section

Section 22 10 00 – Plumbing Piping & Pumps (Water Distribution; Sanitary Sewerage; Storm Drainage; General Service Compressed-Air Systems)

1. No plastic piping is allowed within tunnels.
2. All steel piping must be domestic; no foreign steel piping.
3. Piping, materials, assemblies, locations, equipment, etc. shall address and/or consider acoustics at all times.
4. ANY below grade area and/or tunnel must be provided with a sump pump, sump pit, high water alarm, and loss of power alarm.
5. Roof drainage must be located at the lowest point(s) and use a minimum 3-inch diameter pipe.
6. NO drains and/or sump pumps are to be located in transformer rooms.
7. Domestic Water Piping:
   a. Y-strainers are to have a valve with a brass cap located on the cleanout port of the strainer.
   b. Domestic water re-circulation strategies are to be used unless FS Maintenance and Utilities & Energy PM approval or direction otherwise.
   c. In addition to applicable codes, all backflows at or below 5-feet off finish floor.
   d. Strainers are required on ALL backflow devices.
   e. Interior piping is to be Type L Copper.
   f. Inspector’s test cocks required on all backflow valves.
   g. Water hammer arrestors shall be of the permanently sealed shock absorber type. Every arrestor shall be accessible, and provided with an isolation valve to facilitate replacement.
   h. Gate or full port ball valves.
   i. No flexible reheat piping allowed; only hard pipe with unions on the coils.
   j. Provide all brass dielectric unions wherever dissimilar piping materials are connected.
      • Manufacturers known to be acceptable: Ward; Lee.
   k. Drain valves with brass caps, hose threads, and EPDM gaskets shall be installed at all low points of system piping to facilitate draining of system for repair and maintenance.
   l. Water piping shall not be installed below slabs on grade except for trap priming lines.
8. Sanitary Waste and Vent Piping:
   a. Floor drains must be located at the lowest point, within reason of construction methods, and grates are to be attached with screws.
   b. Provide self-priming traps.
   c. Accessible sanitary sewer sampling point required at new buildings for EH&S reporting.
   d. Gang all trap primers with solenoid/timer arrangement.
   e. Provide fully accessible cleanouts for waste lines in each restroom.
   f. All trap primers are to be fully accessible.
9. Backflow Protection:
   a. All OSHA access requirements must be followed.
   b. Manufacturers known to be acceptable: Febco; Conbraco/Apollo.
   c. A protected bypass may be required on domestic water based on building and program types.
Section 22 10 00 – Plumbing Piping & Pumps continued

d. Test ports must be accessible.
e. Backflow devices for irrigation system require 12” clear under the assembly.
f. If above ground installation is approved:
   - Provide heated hot boxes for exterior backflow devices. Boxes need to have 2 doors, side opening and fully accessible when opened.
   - Any privacy screen must be placed with enough clearance to access all sides.
g. Underground backflow installations:
   - Must have a sump pit and sump pump with an audible alarm and DDC notification.
   - Underground installations of backflow units require prior FS Maintenance approval.
h. Pressure regulator is required prior to the backflow device.
i. All unions must be screwed.
j. Backflow prevention piping diagram:

![Backflow Diagram]

10. Pumps General:

a. All pumps must alarm to the DDC system in the event of pump failure, high water (sumps), and/or loss of power.
b. All pump(s) status, operation, start, and stop must be monitored and controlled via the DDC system.
c. Alarm reports need to be sent to FS CPS operators from the DDC in the event of both high water and loss of power.
d. All pumps to have maximum speed of 1750 RPM for heating, chilled, and industrial water systems.
e. Locate pumps in mechanical rooms as often as possible.
f. Provide VFD controlled building pumps without bypass lines.
g. Select pump impellers such that impellers shall not be greater than minimum impeller size plus 90% of the difference between the maximum and minimum impeller size for the pump selected; hydronic brass or stainless-steel impellers only.
h. Select a motor to be non-overloading under all operating conditions.
i. Stacked pumps in mechanical rooms must have a drain pan above the lower pump and the lower pump must be serviceable without removal of the drain pan.
j. Design B motor efficiency.
k. Provide totally enclosed motors for pumps located in any ceiling.
l. Required Submittals for all pumps:
   - Product data for each pump including performance curves, motor data, operating weights, and pressure ratings.
   - Control information and wiring diagrams for packaged equipment.
   - Operating and maintenance data for each product.
Section 22 10 00 – Plumbing Piping & Pumps continued

11. Sump Pumps, Ejector Pumps, Duplex Pumps, Effluent Pumps, Drain Pumps, etc:
   a. ‘Sump Pumps’, etc. defined as a pump and/or pump system that remove accumulations of liquid or waste from a pit and/or collection area.
   b. Manufacturers known to be acceptable for pumps up to a 2” discharge that is also not a duplex system include: Peerless; Paco; Weil; Peabody Barnes; Aurora; Hydromatics.
   c. Manufacturers known to be acceptable for duplex pumps over a 2” discharge are Peerless; Paco; Weil; Peabody Barnes; Aurora.
   d. Below grade areas must provide a sump pump and sump pit to avoid any standing water.
   e. If elevator, electrical, and/or communication rooms are located below grade, they must be equipped with a sump pump system powered by the standby power source. These rooms shall not be located under locations that would introduce water (kitchens, restrooms, etc.).
   f. Pumps are to be installed on rail systems for access and removal unless they are less than 50GPM or 40lb pump weight.
   g. Pumps in areas that might eject hot water the pumps and associated piping must be rated for high temperatures.
   h. All pumps, other than elevator pit sump pumps, must be duplex systems.
   i. Packaged pumps must be complete including pump and controls.
   j. Furnish complete control unit, including starter, float and alarm control.
   k. Pumps are to have cast iron body and motor housing, cast iron impeller, mechanical seals, stainless steel shaft, strainer.
   l. Provide ball and rod operated controls arranged to allow pump operation and alarm bell initiation to report to the DDC system.

End of Section

Section 22 30 00 – Plumbing Equipment (Water Filtration Equipment; Electric Water Heaters; Fuel-Fired Water Heaters; Water Heat Exchangers)

1. Domestic Water Heaters:
   a. Steam control valves to domestic hot water heaters are to be normally closed.
   b. Thermostatic mixing valves shall be used to provide 110˚F or lower tempered water where necessary.
   c. Hot water supply temperatures at fixtures shall be maintained by the use of pumped circulating systems.
   d. Booster heaters shall be used for dishwashers and other equipment requiring hot water in excess of 120˚F. Raising the temperature of the building hot water system is not allowed.
   e. If located outside of a mechanical room, then installation must include a metal pan and drain under the unit.

End of Section

Section 22 40 00 – Plumbing Fixtures (Commercial; Emergency Fixtures; Security Fixtures; Drinking Fountains & Water Coolers)

1. Wall Hydrants:
   a. Manufacturers known to be acceptable: Smith; Jay R Smith; Josam; Zurn.
   b. SS box type with concealed hose connection.
   c. ¼ turn non-freeze; with integral vacuum breaker.

2. Hose Bibs:
   a. Required locations:
      • Building exteriors every 150ft
      • 1 at the loading dock
      • Minimum of 25ft from any exterior equipment
Section 22 30 00 – Plumbing Equipment continued

• 1 roof top location.
• 1 in each mechanical and/or plumbing room.
• Each restroom at lavatories
• Custodial closets

b. Inside sill fitting.
c. Vacuum breaker spout.
d. 1/2-inch NPT female thread inlet.
e. Slow compression cartridge.
f. Control must be via a hose bib key.
g. Isolation valves for hose bibs are to be accessible; located on the building interior for exterior locations.
h. Manufacturers known to be acceptable: Chicago; Josam; Smith; Zurn.
i. For roof top location ONLY a freeze-less roof hydrant is acceptable. Manufacturers known to be acceptable: Woodford.

3. Floor Drains:
   a. Required in all restrooms, janitor closets, and mechanical rooms.
   b. Use rated floor drain; No PVC material.
   c. Adjustable strainer heads.

4. Mop Sink:
   a. One piece and floor mounted.
   b. Typically 28 inch x 28 inch x 13 inches.
   c. Material: enamel or cast iron.
   d. Color: White
   e. Drain: factory installed type 302 stainless steel bodies with combination dome strainer and lint basket.
   f. Manufacturers known to be acceptable: Kohler; Commercial Enamel.

5. Drinking fountains & bottle fillers:
   a. Refrigerated fountains are not to be used.
   b. Fountains are not to contain additional filtering of potable water.
   c. One drinking fountain per building at a minimum shall include integral bottle fillers.
   d. Manufacturers known to be acceptable: Eklay; Halsey Taylor; Haws; American Standard.
   e. Manufacturers known to be acceptable for drinking fountain retrofits: T&S Brass and Bronze.

6. Lavatory & Sink Drains:
   a. Grid type strainers only.
   b. 17 gauge traps and strainers.
   c. ADA Lavatories: Slip type trap
   d. Underside mounted lavatories without rims are preferred.
   e. Manufacturers known to be acceptable: Kohler; American Standard.
   f. Color: White
   g. Lavatory pipe insulation is to be accessible.

7. Water Closet Fixtures:
   a. Wall mounted toilets with a heavy duty carrier.
   b. Manufacturers known to be acceptable: Kohler; American Standard.
   c. NO floor supported toilet fixtures in new construction.
   d. Color: White
Section 22 40 00 – Plumbing Fixtures continued

8. Urinals:
   a. Jet flush urinals are preferred
   b. Wall hung only.
   c. Manufacturers known to be acceptable: Kohler; American Standard.
   d. Color: White
   e. No waterless urinals.

9. Faucets:
   a. Manufacturers known to be acceptable for industrial use include: Chicago.
   b. Manufacturers known to be acceptable for general use include: Chicago; Moen.
   c. Auto-sensor and solar auto-sensor style faucets are permitted in public restrooms.

10. Flush Valves:
    a. Manufacturers known to be acceptable: Sloan; American Standard; Moen.
    b. Sensors must have manual override buttons; urinals & water closets.

End of Section

END OF DIVISION 22
**Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC)** (Maintenance; Common Work Results; Schedules; Insulation; Instrumentation & Control)

1. See also Section 08 30 00 – Specialty Doors & Frames.
2. See also Section 08 90 00 – Louvers & Vents.
3. See also Section 09 50 00 – Ceilings.
4. See also Section 09 90 00 – Painting & Coating.
5. See also Division 22 for Plumbing Standards.
   a. Section 22 00 00 for Labeling and Identification requirements.
   b. Section 22 10 00 for general valve and pump requirements.
6. See also Section 26 20 00 for Variable Frequency Drives (VFD) for HVAC Equipment.
7. See also Division 27 for Communications Standards.
8. See also Division 33 for Utilities and Monitoring & Verification Standards.
9. See also Appendices for various space type requirements.
10. UO goals of sustainability, life-cycle costs, maintainability, serviceability, high performance, quality equipment, and efficient campus inventory must be maintained. First costs may be impacted slightly as a result, but a better product will follow.
11. All steel piping must be domestic; no foreign steel piping.
12. Piping, materials, assemblies, locations, equipment, etc. shall address acoustics at all times.
13. Exterior placement of any and all equipment requires CPRE and FS Maintenance approval to ensure compliance with the UO Campus Plan. If approved, all University policies shall be followed.
14. IF rooftop equipment is approved and used, it is required to be raised from the deck a minimum of 24-inches clear with removable stanchions / supports.
15. Building system zoning requires FS Maintenance and Utilities & Energy Management PM review and approval.
16. NO demolition of one item shall occur in order to repair and/or replace another item.
17. ALL deleted items **must** be removed and not just abandoned.
18. Systems and system components in new construction, remolds, and retrofits are to be compatible with existing systems and system components to the extent possible.
19. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner FS personnel prior to specification and/or installation.
20. **Accessibility of Equipment & Components:**
   a. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
   b. Elevator access to rooftops and penthouses is required in new construction where mechanical equipment is located.
   c. Refer to and abide by all OSHA requirements, as appropriate.
   d. OSHA 1910 Subpart D - Walking-Working Surfaces standards for working platforms must be followed. Provisions to meet these standards must be incorporated into the building design.
   e. All necessary access points for maintenance must be provided and coordinated; clearance at access points is to be maintained.
Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC) continued

f. All Variable Air Volume (VAV) and Terminal Unit (TU) boxes require 36” clearance on all sides possible with a clear approach from below. At a minimum 36” clearance is required on the control side of the TU with a clear approach from below.
g. No equipment shall be accessed via restrooms.
h. Equipment above ceilings shall be located within corridors or above doorways; except for exhaust fan equipment serving a single room and exhausting directly outside.
i. All equipment must be accessible for removal, replacement, and serviceability.
j. Service access shall not include and/or require any disassembly. This includes all surrounding components including, but not limited to, ceiling grids, piping, ducts, conduits, equipment and other installed items.
k. Access panels and clearance is required to ALL coils for replacement and cleaning.
l. Access panels are required at all dampers.
m. ALL equipment MUST allow for access of personnel and equipment required for future removal and replacement of such equipment.
n. Access must be provided to read gages, manometers, meters, etc.
o. ALL intakes require access to properly maintain and clean.
p. In mechanical and electrical rooms any components requiring routine service/maintenance must be installed / mounted below 7ft in height. Prior to installation of any component above 7ft requires onsite review and explanation with FS Maintenance and/or FS Electrical Supervisor.
q. Inaccessible Equipment:
   • If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
   • ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.

21. All piped systems with supply and return piping require the following:
   a. Dividing supply system into zones, areas of service or by floor
   b. Isolation of each zone, area of service, or floor level from the main distribution lines.
   c. Drain down valves shall be provided at the low point in each zone, area of service, or floor level.

22. Minimum Identification:
   a. Re-label units when labels begin to fade or fall off.
   b. Covering or painting of any sign/label requires replacement.
   c. During finish construction, labeling is to be reviewed and approved by the PM and FS Maintenance.
   d. Provide permanent signage (interior and exterior) on all equipment, motors, pumps, etc.
   e. Label ceilings or ceiling grid (not the tile) at key access points, valves, equipment, dampers, etc. with a clear adhesive label and bold black lettering with equipment, etc. ID information.

23. Insulation:
   a. Insulation must continue through all penetrations.
   b. Valve and expansion joint blankets are to be easily removable and reusable. No Velcro fastening.
      • Manufacturers known to be acceptable: Lewco mat glass fiber insulation, covered with alpha-maritex silicone coated fiberglass cloth.
   c. Chilled Water:
      • Vapor barrier is required and all ends, cuts, etc. at exposed insulation must be sealed.
Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC) continued

- Styrofoam pipe covering with Mylar vapor barrier.
- Lagging: Zeston 2000 PVC pre-molded fitting covers or equivalent jacketing.

d. Tunnel Steam and Condensate Piping:
- Vapor barrier is required and all ends, cuts, etc. at exposed insulation must be sealed.
- Fiberglass: Johns Mansville, Zeston 2000 PVC; Owens Corning with vapor barrier jacketing; Calcium Silicate (IIG, Industrial Insulation Systems) pipe insulation.
- Lagging: 0.016” stucco embossed Childers aluminum elbow insulation covers, secured with No.8 x 1/2” sheet metal screws. Childers pre-molded aluminum fitting covers.
- Removable Insulation Blankets: Lewco mat glass fiber insulation, covered with alpha-maritex silicone coated fiberglass cloth.

24. Mechanical Penthouses:
   a. Penthouses are to be insulated or with an air space with vapor barrier.
   b. Penthouse construction is to be water tight, not air tight.
   c. If system(s) within a penthouse is hydronic and has drainage, then epoxy or water proofed floor is required in the penthouse. Epoxy or waterproofing is to extend up walls 6inches at a minimum.
   d. Space shall be provided for storage of 1 full change of filters at a minimum. Storage may be located on top of a unit IF space is water tight and dry.

25. Gauges and Thermostats: Pneumatic controlled devices are to have a 0-30# pressure gauge mounted on the device to monitor branch pressure.

26. Instrumentation & Controls for HVAC – DDC:
   a. Siemens is the UO campus controls vendor.
   b. HVAC controls and warranty must be accompanied by software, software updates, and access tools.
   c. Each building or building complex shall be equipped with an independent, programmable, logical computerized control system that will allow monitoring, logical control of HVAC systems, scheduling, and programming of all energy systems, including lighting with local overrides in the building or building complex. FS HVAC Personnel are to be consulted in the selection of systems or system components to be installed.
   d. The central system is a domain model vs. peer to peer.
   e. Individual control is required for each digital input.
   f. ‘Incidents’ must be picked-up and report within a maximum time period of X; time period X to be determined in consultation with FS HVAC Personnel during design.
   g. DDC and Fire Alarm low-voltage can share voice/data j-hooks or cable trays IF fully coordinated and EH&S, FS, and FS HVAC Personnel approved.
   h. The installing Control Contractor must monitor equipment. NOT the supplier of the equipment if different.
   i. Control devices are to be compatible with, and connected to, the FS trunk network.
   j. When buildings are stand-alone (not connected to adjacent buildings), the building’s differential pressure shall control the building exhaust.
   k. All reheat or re-cool coils are to have DDC discharge temperature sensors down stream of coils to monitor performance of the HVAC system.
   l. CO sensors are required to control minimum outside air settings.
   m. No filter alarm points.
   n. IF hydronic boilers are Owner approved and used, temperature reset shall be controlled by DDC or a dedicated time clock in the absence of DDC.
   o. DDC point provisions need to be made for future/potential floor sensors in mechanical rooms and/or basement spaces. Related electrical wiring provisions will be required as well.
Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC) continued

p. Terminal equipment devices shall provide all required software for setup, maintenance, and service.
q. ALL sump pumps alarms MUST occur for both high water and loss of power/signal.
r. Temperature maintenance shall be controlled by DDC where available or a dedicated time clock in the absence of DDC.
s. HVAC systems and controls shall automatically reset after the event of a fire alarm.
t. Freeze-stats are to have a manual reset with two switch circuits. The first stage will be hard wired to disable the fan. The second stage will be a DI point to the DDC control system.
u. Any room with mechanical or electrical equipment below grade must have a water alarm connected to the DDC system.
v. Coil Freeze Protection:
   • Install the freeze-stat just downstream of the heating coil (before the cooling coil) and not downstream of the cooling coil.
   • The freeze-stat is to alarm the DDC: A low temperature detector, with manual reset and hardwired interlock; located downstream of each heating coil and upstream of associated cooling coil, stops (AHU-XX) below 38°F (adjustable) air temperature and sends critical alarm to DDC.
   i. Note: This requires that either a plenum is called for between the heating coil and cooling coil, or that the heating coil is installed in a large enough section to allow installation of the tubing. Back to back coils on modular type units typically do not allow sufficient space between the two coils to allow the control contractor to install the sensor tubing.
w. Operation Code:
   • Submittal of operation code must be reviewed and approved by FS HVAC Controls Technician prior to programming.
   • FS will supply a point naming convention to the project team. All points used must comply with the provided list.
x. DDC Graphics Requirements:
   • Provide schematic diagrams depicting each system. The diagrams are to show all major components such as fans, dampers, heating and cooling coils, pumps, boilers, heat exchangers, chillers and other related equipment HVAC equipment.
   • Provide diagrams per floor showing the location of all major HVAC equipment and areas served. The diagram should also show the location of DDC components. This diagram is not to be used for monitoring the operation of the systems it is designed to be a “road map” for locating equipment.
y. DDC work stations:
   • If the building does not contain an onsite work station, the DDC Siemens front end must be compatible for monitoring and control.
   • Connected to one central server and DDC, Siemens.
   • Shall allow for programming; modification of points; generation of points; command; monitoring.
   • Install 2 network ports (1 for the automation panel and 1 for Insight work station) to the Facilities trunk at each automation panel location.
   • At each main building controller install a spare FS trunk communications port so a portable computer can monitor the system.
   • Required license(s) to operate software is to be provided by the project.
   • Must be compatible with Siemens Insight software.

27. Water and Air Balancing & Testing:
   a. Installation of fixed sheaves will be by the balancing contractor only; variable sheaves required by installing contractors.
Section 23 00 00 – Heating, Ventilating, & Air-Conditioning (HVAC) continued

b. All air and water testing and balancing is to be performed by a third party hired by the FS PM and requires contractor coordination efforts.
c. If balancing of the system is not able to be performed due to a construction error the contractor is obligated to correct item(s) for complete and satisfactory balancing and testing.
d. Contractor, or sub-contractor, is to be onsite during balancing efforts for assistance to balancing agent as well as for any on-the-spot modifications that are needed.

28. Commissioning:
   a. Shall include point to point operation verification by the controls contractor. Required presence of FS Maintenance and/or Utility & Energy PM will be determined at the scheduling of this verification test.
   b. Commissioning of energy efficiency shall compare model to actual conditions under occupancy.

29. Owner Training:
   a. Training provided MUST be to a maintenance, technician and/or service levels for ALL systems.
   b. Provide 16 to 32 hours of FS Maintenance training upon completion of the project. Required hours will be determined by individual project complexities.

End of Section

Section 23 20 00 – HVAC Piping & Pumps (Hydronic; Chilled Water; Steam & Condensate)

1. If utility piping is approved by CPS & FS to leave the tunnel and continue underground all the piping must be sleeved / cased with a direct-buried piping system: condensate, steam, chilled water, etc. All sleeves must continue into the building a minimum of 12inches.
   a. Do not locate condensate pipes in conduit casings with steam pipes.
   b. Provide a minimum of 1inch air space between pipe insulation and casing.

2. No plastic piping allowed within tunnels.

3. Plastic pipe is permitted under-slab to 6” above slab to allow for transitions to alternate materials.

4. All steel piping must be domestic; no foreign steel piping.

5. Piping, materials, assemblies, locations, equipment, etc. shall address and/or consider acoustics at all times.

6. Provide welded couplings for 3-inch and larger pipe.

7. The speed of the buildings heating and chilled water pumps is to be controlled through a Variable Frequency Drive (VFD) and differential pressure control.

8. All valves for automatic air vents are to be mounted below the device.
   a. Manufacturers known to be acceptable for automatic air vents: Spirotherm Spiro Top; Honeywell

9. Condensate and overflow pans are to be stainless steel and insulated.

10. Hydronic pumps are to have brass impellers.

11. Install a dirt separator on all hydronic main distribution systems.
    a. Manufacturers known to be acceptable for dirt separators: Spirotherm.

12. Valves:
    a. See also Section 22 10 00 for general plumbing valve requirements.
    b. Automatic flow balancing valves are preferred in 3-way control valve applications for hydronic balancing.
    c. A flow metering station (circuit setter) in 2-way control valve applications for hydronic balancing.
    d. A check valve is to be installed to isolate compressor air from the tunnel air supply.
Section 23 20 00 – HVAC Piping & Pumps continued

e. Gate valves and unions on steam are to be 300lb style. Valves and unions located after a PRV (Pressure Reducing Valve) may be 150lb style. No 125lb valves.
f. On all hydronic control valves install unions or couplings next to each side of the control valve and stop valves connected to each side of the unions or couplings.

13. Heating Piping, Valves, Pumps, etc:

a. NO galvanized piping.
b. No flexible piping is allowed on reheat coils, only hard pipe with unions on the coils.
c. No dielectric unions on hot water hydronic piping.
d. Use screwed brass unions or screwed brass valves where dissimilar metals meet.
e. Hydronic reheat piping is to be copper or steel.
f. Gate valves only and 150lb minimum.
g. Pressure temperature relief valve required at heat exchangers and piped to a floor drain.
h. No dielectric unions are allowed at reheat.
i. Three-way heating water control valve piping diagram:
Section 23 20 00 – HVAC Piping & Pumps continued

i. Two-way heating water control valve piping diagram:

14. Cooling & Chilled Water Piping, Valves, Pumps, etc:
   a. NO galvanized piping.
   b. No steel pipe for chilled water except within the tunnel without prior FS Maintenance approval.
   c. Piping 3 inches and smaller to be copper.
   d. Piping larger than 3 inches is to be schedule 80 PVC.
   e. Supply valve at the point of entry is to be remotely controlled via the DDC system.
   f. Supply valve is to be modulating and not 2-position.
   g. Air conditioning condensate drain piping is to be schedule 40 PVC.
   h. Use screwed brass unions or screwed brass valves where dissimilar metals meet.
   i. Coils are to be sized for 20 to 15 degree delta T.
   j. Provide VFD controlled building pumps without bypass lines.
   k. Include building flow meter and building flow limiting valve.
   l. EPDM on chilled water flange gaskets.
   m. Gate valves only and 150lb minimum.
   n. No dielectric unions are allowed on chilled water.
   o. No 3-way valves on chilled water. One or two 3-way valves at the end of a line are acceptable to provide enough bypass for the variable speed drives to maintain minimum speed.
   p. A modulating control valve is to be installed on the building chilled water supply main to isolate the building from the CPS chilled water. The valve is to be located in the building not the tunnel.
Section 23 20 00 – HVAC Piping & Pumps continued

q. Install a ball valve down stream of the hydronic Make-up feeder pressure gauge. The valve is used to test the outlet pressure of the make-up feeder while isolating the feeder from the hydronic system.

WATER MAKEUP FEEDER:
1. The makeup water to a heat exchangers is to be connected to the campus chilled water supply main.
2. All piping and fittings related to the makeup feeder and expansion tank to be copper or brass.
3. Gallon meter to monitor makeup water usage.
4. All piping shall be copper.

15. Steam Piping, Valves, Pumps, etc:
   a. Campus steam shall be regulated down to a maximum of 7 lb steam at the building entry with weighted arm regulators.
   b. Install spiral wound style gaskets in all steam joint applications.
      • Manufacturers known to be acceptable: Metalbestos or Flextaulic.
   c. Main steam valves are to be normally closed and fail closed.
   d. With the installation of steam trap systems in tunnels, the monitors are to be located on a tunnel wall at the tunnel entry.
   e. A check valve is to be located on the main steam condensate line before it is connected to the tunnel condensate main.
   f. Steam control valves are to have stainless steel seats and disks.
   g. Steam control valves to hydronic heat exchanger are to be normally open.
   h. Steam supply valve at the point of entry is to be remotely controlled via the DDC system. Valve is to be modulating and not 2-position.
   i. Gate valves only and 150lb minimum. No ball valves on steam or condensate.
   j. Schedule 40 steel piping for steam supply.
   k. Install a temperature probe down stream from steam traps to monitor temperature and report to DDC. Use of steam trap monitors requires prior FS and Utility & Energy PM approval.
      • This is not required for drip steam traps.
   l. Steam fittings to be cast iron only.
   m. No bypass allowed around pressure regulators.
n. **Float & Thermostatic (F & T) Steam Trap piping diagram:**

![F & T Steam Trap Diagram](image)

1. The unions are to be on a vertical and parallel plane.
2. If a four-port trap is used the test valve can be located on the lower unused port.

16. **Steam Condensate Piping, Valves, Pumps, etc:**

   a. Projects with existing steam systems shall include the replacement of condensate piping and removal of abandoned piping. Extent of replacement to be determined by FS Maintenance.
   
   b. Schedule 80 steel piping for all steam condensate return piping.
   
   c. Gate valves only and 150lb minimum. No ball valves on condensate.
   
   d. Condensate fittings to be cast iron only.
   
   e. All steam condensate must go to 1 location / 1 line that are then pumped to the condensate main in the tunnel. This line back to the tunnel main must be metered.
   
   f. Condensate sets will have a valve between the pump and the tank and a duplex pump system.
   
   g. Overflows on condensate sets shall not be higher that the lowest point of a heat exchanger tube bundle and the vent must dump to a floor drain in a safe location; safe locations are outside of circulation or egress areas.
   
   h. Vents shall extend through the roof.
   
   i. No bypass allowed around pressure regulators.
   
   j. The steam condensate receiver minimum size is 30 gallons.
   
   k. All condensate pumps are to have the optional isolation valve between the condensate tank and the pump.

17. **In-Line Circulating Pumps for Heating and Chilled Water Pumps:** From Division 22

   a. Manufacturers known to be acceptable: Paco; Peerless; Grundfos; Aurora; Taco; Thrush.
   
   b. Manufacturers known to be acceptable for booster domestic hot water re-circulating pumps: Thrush; Paco; Peerless; Grundfos; Aurora.
   
   c. Pipe mounted, integral centrifugal pump and resiliently mounted motors required.
   
   d. Flexible coupling between pump and motor required.
   
   e. Mechanical shaft seals required.
   
   f. Monitor status, operation, and start/stop via the DDC system.
   
   g. Bronze fitted construction required.
   
   h. Rising head characteristics with decrease in volume required.
   
   i. Drip-proof construction required.
   
   j. Bearings and impellers must be removable without disturbing piping.
   
   k. Coupling drive with suitable guard required.
   
   l. Installation:

   - Adequate access must be provided for access, serviceability, and removal.
   - Motor in horizontal or vertical depending on normal design of pump.
   - Provide for convenient access to oil cups as required by the manufacturer.
   - Provide flexible connections, strainers, check valves and shut-off valves on suction and discharge of pumps.
Section 23 20 00 – HVAC Piping & Pumps continued

- Lubricate in accordance with manufacturer’s instructions before operation.
- Support and isolate circulators.

End of Section

Section 23 30 00 – HVAC Air Distribution (Ducts & Casings; Air Plenums & Chases; Air Duct Accessories; Fans; Special Exhaust Systems; Air Terminal Units; Air Outlets & Inlets; Ventilation Hoods)

1. SMACNA standards to be followed for metal ducts, fittings, etc.

2. Clear separation and isolation of systems and HVAC strategies is required. For example, adjacencies of naturally ventilated spaces and conditioned spaces must be designed and controlled properly.

3. 3 year warranty is to be provided on all dampers for rattling and noise. Written specifications are to specify a damper that holds a 3 year life/warranty.
   a. Manufacturer known to be acceptable: Ruskin; Tamco series 1500; Greenheck.
   b. ALL damper components are to be installed per manufacturer, no exceptions.

4. Fans during construction:
   a. Building fans may **not** run until final completion of all construction. Pre-Functional Checklist (PFC), startup, and commissioning schedules / activities that require running fans will be negotiated.
   b. IF construction debris, dust, dirt, contamination, etc. is found in system, the contractor is responsible for cleaning of all duct, fans, coil, units, equipment, etc. and/or replacement as needed.

5. Air Intakes:
   a. Air intake locations must be determined with consultation of FS and EH&S.
   b. Penthouse and/or mechanical enclosures must have an exterior entry or access for cleaning at the air intake.
   c. Provide bird screens on air and/or make-up air intakes. NO insect screening on air and/or make-up air intakes.

6. Flexible connections on all inlet and discharge duct connection.
   a. This is not required if AHU has internal vibration isolation.

7. Flexible connection for vane axial fans to be barium loaded vinyl.

8. Use of conditioning equipment requires FS Electrician and Utility & Energy PM review and approval.

9. Install a refrigerated air dryer to the control air system.

10. Install a Motor guard model 30 style air filter for the control air.

11. Return fans are required in systems when economizing is included.

12. No non-ducted returns; return grilles are to be connected with duct work back to HVAC unit.

13. Back draft dampers allowed ONLY on exhaust fan or roof vent discharges.

14. NO auxiliary mechanical equipment is to be mounted inside of an HVAC system air side compartment other than dampers, damper actuators, fan assemblies, coils, and filters.

15. All duct work must be inside penthouses or building structure. IF exposed rooftop ductwork is reviewed and approved then it **must** be constructed of welded stainless steel.

16. All VAV boxes are to be located above doorways or in corridors for maintenance and accessibility.

17. Mechanical rooms are not to be used as air plenums.

18. No duct-board or fiberglass duct work.
**Section 23 30 00 – HVAC Air Distribution continued**

19. No lined return ducts unless specific acoustic reasons exist and FS and EH&S approval is received.

20. **Flexible duct:**
   a. Allowed and preferred in low-pressure systems.
   b. Flex connections are to be to hard 90-degree elbows off boxes.
   c. Connections and air flows are to be verified by third party air balancing.

21. **Fire/smoke dampers:**
   a. A disconnect switch is required at each actuator.
   b. Electric actuators.
   c. Access panels or doors for fire-dampers/smoke-dampers to be of sufficient size to access and repair.
   d. The damper shafts and linkage shall be compatible.
   e. Control damper drive shaft is to be secured to the damper blade.
   f. No jack shafts or socket style mounts to blades.
   g. Manufacturers known to be acceptable: Tamco; Ruskin; Greenheck.
   h. ALL damper components are to be installed per manufacturer, no exceptions.

22. **Fans:**
   a. No axial fans allowed.
   b. Fan coil units must be mounted at walls or ceilings; no floor mounted units.
   c. 1000 RPM **maximum** shaft speed for all v-belt driven fans - supply, return, relief, transfer and exhaust.
      - This does mean larger mechanical space and ducts. The tradeoff is less motor replacement, less noise, less belt/sheave/bearings/bearings replacement and more sustainable.
   d. No Joy fans.
   e. Fan bearings and shafts must be accessible for replacement.
   f. Construction submittals require a concurrent FS review and shall include the following:
      - Shop Drawings including dimensions and details.
      - Product data including performance data.
      - Operation and Maintenance data.
      - Sound power ratings for each fan type.
   g. **Centrifugal Fans:**
      - Manufacturers known to be acceptable: Pace; Trane; Barry Twin City; Peerless; Aerovent; Acme; Greenheck; Cook.
      - Standard factory finish and AMCA rated.
      - Single width, single inlet, double width, double inlet, forward curved, backward inclined, or air foil blades as scheduled.
      - Welded steel housing with sloped cut-off plates, spun steel or die formed inlet cone and welded steel supports.
      - Statically and dynamically balanced within its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001” at 1200 RPM, grease packed pillow block sealed bearings with not less than two pillow blocks per fan assembly.
      - L-10 bearing life of 80,000 hours minimum per AFBMA standards.
      - Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings, Design B motors.
Section 23 30 00 – HVAC Air Distribution continued

- Drive:
  i. Sized for 150% of motor horsepower, cast iron adjustable sheaves, V-belt type, sheaves statically and dynamically balanced, multiple belt drives on all units over 2 HP.
  ii. Provide metal guard over drive.
  iii. Provide fixed sheave units over 5 HP.
  iv. Replace fan sheaves as necessary to obtain desired results.
  v. Include allowance for one sheave change for fans with fixed sheaves.

- Provide vibration isolation.
- Fan outlets with removable angles and bolts for attaching flexible connections or discharge dampers.
- Provide motor operated discharge dampers.
- Provide fans with AMCA Type B spark proof construction.
- Extend scroll drain to over floor drain with pipe size the same as outlet size.
- Suspend from structure with isolating hanger rods or mount on isolator base.

h. Roof Exhaust Fans:

- Manufacturers known to be acceptable: Carnes; Penn; Greenheck; Cook; Acme; Barry; Strobic.
- Provide curb mounted centrifugal roof exhauster.
- Single width, single inlet, airfoil blades.
- One piece gauge spun aluminum construction or louvered type with heavy gauge extruded aluminum louvers, steel inlet bell, arranged for curb mounting.
- Statically and dynamically balanced within its own bearings, grease packed pillow block sealed bearings with not less than two pillow blocks per fan assembly.
- Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings, Design B motors.
- Drive: Sized for 150% of motor horsepower, cast iron adjustable sheaves, V-belt type, sheaves statically and dynamically balanced, multiple belt drives on all units over 2 HP.
- Fan wheel and motor mounted on integral double deflection neoprene isolators.
- Account for roof slope to provide level mounting service for equipment.
- Provide electric motor operated back draft damper, aluminum blades with felt edges.
- Back draft dampers must be accessible without dismantling of components. I.e. a hinged curb mount with flex power is acceptable.
- Mount fan on roof curb in accordance with the manufacturer’s recommendations, anchoring fan to curb and curb to roof.
- Accessories: bird screen; disconnect switch under enclosure; acoustical curb with removable baffles for access to dampers.

i. Roof Vents:

- Manufacturers known to be acceptable: Carnes; Penn; Greenheck; Acme; Cook; Strobic.
- Provide low profile, louvered penthouse, constructed of heavy gauge extruded aluminum blades with mitered corners, welded, suitable for curb mounting, with bird screen and electric motor operated back draft damper.
- Account for roof slope to provide level mounting service for equipment.
- Mount roof vent on roof curb in accordance with the manufacturer’s recommendations. Anchor roof vent to curb and curb to roof.

j. Small Cabinet Fans:

- Manufacturers known to be acceptable: Pace; Acme; Greenheck; Penn; Cook.
- Low-sones sound criteria.
Section 23 30 00 – HVAC Air Distribution continued

- Centrifugal direct drive cabinet fan, AMCA rated.
- Fan: Double width, double inlet forward curved stamped aluminum, spun inlet cones, integral back-draft damper.
- Casing: Fabricated acoustically insulated steel casing, steel scroll and base, factory standard finish. Provide bottom or side access.
- Motor: Integrally mounted, 1050 RPM nominal lubricated sleeve bearing.
- Vibration Isolation: Factory mount motor and fan scroll on double deflection neoprene mounts.
- Ducted inlet and outlet.
- Mount in ductwork suspended from structure with threaded rod.
- Unobstructed access to components.

k. Inline Fans:
- Manufacturers known to be acceptable: Greenheck; Penn; Cook; Acme; Carnes.
- Inline, belt driven, cabinet fan, AMCA rated, backward inclined wheel, externally mounted 1800 RPM motor, hinged access doors.
- The housing shall be constructed of continuously welded heavy gauge steel to assure no air leakage.
- Housing shall have inlet and outlet collars for slip fit duct connections.
- Housing and bearing support shall be constructed of structural steel members to prevent vibration and rigidly support the shaft and bearings.
- Units shall incorporate a universal mounting system that allows the fan to be mounted in either vertical or horizontal configurations and field rotation of the motor position in 90 degree increments.
- Mount in ductwork using vibration isolation.
- Connect ductwork using flexible connections.
- Unobstructed access to access door and motor.

23. Thermo expansion tanks; Air:
   a. Compression style only; no bladder style.
   b. Install gauge glass with stop valves.
   c. Install a drain valve on the bottom of the tank.
   d. Install a pressure gauge with valve to the tank.
   e. Install tunnel compressed air to the top of the expansion tank. If tunnel air isn’t connected to the building then the air tap can be removed from the expansion tank.
   f. Install a locking style ball valve on tank to secure the air line.
   g. All piping connected to the compression tank shall be copper.
   h. Detail: Expansion Tank for compressed air.

![Expansion Tank Detail Diagram]

End of Section
Section 23 40 00 – HVAC Air Cleaning Devices (Particulate Air Filtration)

1. New and clean filters are to be installed at project completion
2. A full replacement set is to be provided at project completion.
3. No bag filters.
4. Air Dryers: Replacement media must be readily available and accessible within the United States.

End of Section

Section 23 50 00 – Central Heating Equipment (Stacks; Heating Boilers; Heating Boiler Feedwater; Fuel-Fired Heaters; Solar Energy Heating; Heat Exchangers)

1. Use of boiler(s) requires prior FS and Utility & Energy PM review and approval.
2. Generator stacks are to terminate above air intakes.
3. Solar water heat:
   a. Typical starting point for design unless prior FS and Utilities & Energy PM approval or direction otherwise.
   b. Use of a drain back system is preferred.
   c. Water storage is to be centralized near the solar storage/collector.
   d. Water storage tank system shall include effective means of preventing development of Legionella.
4. Heat Exchangers:
   a. Tube-bundle shall be removable without requiring the removal of other equipment, piping, etc. to gain access. Minimum of 3ft clear on all sides for material and personnel.
   b. To be installed readily accessible without a ladder.
   c. Steam heat exchangers and steam control valves are to be normally open for building heat

End of Section

Section 23 70 00 – Central HVAC Equipment (Air-to-Air Energy Recovery; Indoor Central-Station Air-Handling Units; Packaged Outdoor HVAC; Custom-Packaged Outdoor HVAC)

1. Makeup air or supply air for smoke evacuation systems shall not include the use of automatic opening doors for security reasons.
2. Air Handling Unit (AHU):
   a. AHU are to be located within a penthouse and NOT exposed on a rooftop.
   b. Filters to be used are 24"x24"x2" and 40% filtration.
   c. Filter racks are to be designed accordingly and are to be accessible for filter replacement.
   d. Install a filter gage; either liquid-filled manometer or Magnehelic.
   e. Provide a clear path and access for the removal and replacement of the fan shaft.
   f. Accessible control dampers and damper blade linkage required.
   g. Steam coils for fans are to be horizontal steam distribution type coils.
   h. Access and clearance required to ALL coils for replacement and cleaning.
   i. Provide lighting within unit for verification and serviceability in reasonable locations.
   j. No radial inlet dampers or vane dampers to control fan static; VFD is to be used.
   k. Manufacturer known to be acceptable for motor-bases: Overly Hautz, steel adjustable motor bases with double adjusting bolts. No exceptions.
3. Heat and Energy Recovery:
   a. Heat pipes are to be used; no air to air heat exchangers;
   b. If water to water exchangers are used, the heat recovery system is to include glycol.
   c. Filters are to be installed on both sides of heat and energy recovery units.
Section 23 70 00 – Central HVAC Equipment continued

d. Heat recovery MUST include access doors to clean coils on exhausts.
e. Energy recovery devices are to have a bypass mode and are to be controlled by DDC.

End of Section

Section 23 80 00 – Decentralized HVAC Equipment (Decentralized Unitary HVAC; Convection Heating & Cooling Units; Radiant Heating Units; Humidity Control)

1. No window mounted AC units without prior CPRE and FS approval.
2. Reheat coils must be placed so access to the valve(s) is serviceable.
3. Localized cooling via fan coils. Multiple or many local cooling areas shall utilize a system such as a ‘chilled beam’ (example only) vs. many fan coil units at each location.
4. Humidification control requires prior FS and Utility & Energy PM approval.
5. Convection units (fin tube, baseboard) are to have an accessible service panel or door so the control valves and balancing valves can be accessed without the removal of the convection unit cover or cabinet.
6. Floor Heating:
   a. Use of floor heating requires FS review and approval.
   b. Floor heating manifold(s) must be accessible for removal and replacement.
   c. Floor heating water is to be on a dedicated heating circuit.
   d. Do not tie into the general building heating system.
   e. Floor cooling must use a water to water heat exchanger to separate building and campus chilled water.
7. Air Conditioning (AC) Equipment:
   a. Manufacturers known to be acceptable for split system units: Mitsubishi; Liebert.
   b. Thermostats must be hardwired to the unit; no remote style thermostats.
   c. Packaged AC units require prior FS and Utility & Energy PM approval: IF approved and used the following is required.
      - Commercial grade must be used.
      - No exposed rooftop ductwork is allowed.
      - 2” wide filter racks are to be used.

End of Section

END OF DIVISION 23
Section 25 00 00 – Integrated Automation (Maintenance; Common Work Results; Schedules)

1. See also Division 23 for Instrumentation & Control for HVAC (DDC) Standards.
2. See also Division 26 for Variable Frequency Drive (VFD) for HVAC Standards.
3. See also Section 33 09 00 – Monitoring & Verification Instrumentation.
4. See also Laboratory Appendix for environmental controls, alarming, notification, signage, etc.
5. See also Appendices for various space type requirements.

End of Section

END OF DIVISION 25
Section 26 00 00 – Electrical (Maintenance; Common Work Results; Schedules; Instrumentation & Control)

1. See also Section 08 30 00 – Specialty Doors & Frames.
2. See also Section 09 50 00 – Ceilings.
3. See also Section 09 90 00 – Painting & Coating.
4. See also Division 23 for Instrumentation & Control for HVAC (DDC) Standards.
5. See also Division 27 for Communications
6. See also Division 28 for Electronic Safety & Security
7. See also Division 33 for Utility Standards.
8. See also Appendices for various space type requirements.
9. NEC and IEEE definitions will apply to all standards that follow.
10. NEC and IEEE working clearance required and to be maintained.
11. UO goals of sustainability, life-cycle costs, maintainability, serviceability, high performance, quality equipment, and efficient campus inventory must be maintained. First costs may be impacted slightly as a result, but a better product will follow.
12. Exterior placement of any and all equipment requires CPRE and FS approval to ensure compliance with the UO Campus Plan. If approved, all University policies shall be followed.
13. Building system zoning requires FS and Utilities & Energy Management PM review and approval.
14. NO demolition of one item shall occur in order to repair and/or replace another item.
15. ALL deleted items must be removed and not just abandoned; fixtures and devices shall be physically removed, conduits, pull boxes and outlet boxes small remain.
16. Systems and system components in new construction, remodels, and retrofits are to be compatible with existing systems and system components to the extent possible
17. Spaces designed to accommodate partition/component office systems must provide adequate power in perimeter walls and/or floor-boxes. This will accommodate the use of components without built-in wiring.
18. Dedicated electrical rooms are required vs. in combination with data/telecom.
19. Boxes, panels, equipment gutters, etc. are to be cleaned inside and out upon completion and prior to acceptance of work.
20. Convenience outlets for laptops are to be located within public spaces at reasonable locations.
21. Receptacles for convenience and FS Custodial should be located near building entrances, on exterior balconies, proper, and in elevators.
22. No electric equipment or pathways allowed in chlorinated air or water spaces.
23. Training provided MUST be to a maintenance/technician level for ALL systems.
24. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent FS personnel prior to specification and/or installation.
25. Commissioning of energy efficiency shall compare model to actual conditions under occupancy.
26. All power feeds to mechanical equipment must have a means for locking out power feeds via a service switch and any and all service switches must be lockable no matter what size equipment it serves.
27. All components, enclosures, cabinets, panels, etc. require vacuum cleaning prior to final completion; no blowing cleaning methods.
28. Accessibility of Equipment:
   a. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
   b. Refer to and abide by all OSHA requirements, as appropriate.
   c. OSHA 1910 Subpart D - Walking-Working Surfaces standards for working platforms must be followed. Provisions to meet these standards must be incorporated into the building design.
   d. Design and installation of all equipment shall be accessible for operation, maintenance, repair, and replacement as required by NEC and OSHA General Requirements. - 1910.303.
   e. All necessary access points for maintenance must be provided and coordinated.
   f. No equipment shall be accessed via restrooms.
   g. Equipment above ceilings shall be located within corridors or above doorways.
   h. Thorough coordination of ceiling access(s) with electrical equipment above.
   i. Cabinet, enclosure, panel doors, etc. shall open unobstructed 180°.
   j. Cabinet, enclosure, panel doors, etc. in main electrical rooms opposite and/or beside another shall open unobstructed and clear each other.
   k. In mechanical and electrical rooms any components requiring routine service/maintenance must be installed / mounted below 7ft in height. Prior to installation of any component above 7ft requires onsite review and explanation with FS Maintenance and/or FS Electrical Supervisor.
   l. Inaccessible Equipment:
      • If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
      • ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.

29. Grounding:
   a. No.6 or smaller grounding conductors shall have green insulation.
   b. No.6 and larger are to be identified at accessible points per NEC 250.19A1.A2.
   c. All connections/terminations are to be cad welded, crimped, or compression type. Connections may NOT be mechanically reversible.
   d. All pig-tales are to use stranded wire.
   e. Standoff copper buss bar exposed for building grounding and all common grounding.
   f. No reduction in size of grounding conductor allowed.

30. Hangers and Supports:
   a. Seismic bracing must be provided for equipment and piping per SMACNA and N.E.C. requirements.
   b. Prohibited Materials: nails; wires; perforated tape; no anchor drives of any kind; J-nails.
   c. J-hooks, trays, etc. are acceptable only if wire/cable is properly bundled and/or gathered.
   d. Conduit Support Materials:
      • Manufacturers known to be acceptable for one or two-hole push-on strap: Appleton; Raco; Thomas & Betts.
      • Manufacturers known to be acceptable for one or two-hole pipe strap manufacturers: Kindorf.
      • Manufacturers known to be acceptable for lay-in pipe adjustable hanger manufacturers: Kindorf; Steel City; Pline.
Section 26 00 00 – Electrical continued

- Manufacturers known to be acceptable for trapeze or wall surface supports: Kindorf “bolt-hole” base galvanized steel channels with C105 and C106 single bolt pipe straps.
- Galvanized steel channels and associated support rods shall be selected to accommodate weight of associated raceway and wire.

31. Electrical Identification:
   b. Labeling is to be reviewed and approved by the PM & FS Electrical Supervisor.
   c. Provide permanent signage, interior and exterior, at all utility boxes, vaults, manholes, etc.
   d. Zoned systems must be clearly defined and labeled.
   e. Covering or painting of any sign/label requires replacement.
   f. Mark and label new wiring and place in trays.
   g. Tag lighting feeds with circuit number and panel ID.
   h. If banks of switching are installed that control various systems (i.e. lighting, AV, and projection screen, etc.) or various spaces (i.e. classroom and corridor, etc.) labeling with 1/8” black letters indicating function of each switch is required.
   i. Panels require labeling of necessary PPE with potential hazards as a result of Arc Flash Hazard Analysis.
   j. Any item, component, equipment, etc. with a dual feed requires labeling at the device make-up box identifying each feed type and location.
   k. Electrical Panels in new construction are to be labeled as follows…

<table>
<thead>
<tr>
<th>First Character – Floor Level</th>
<th>Second Character – Type of Power</th>
<th>Third Character – Panel Number</th>
<th>Required Dash</th>
<th>Fourth Character – Voltage</th>
<th>Resulting Panel Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>B – Basement</td>
<td>N – Normal</td>
<td>1 – 1st Panel on Floor Level</td>
<td>-</td>
<td>2 – 120/208v</td>
<td>BN1-2</td>
</tr>
<tr>
<td>1 – 1st Floor</td>
<td>S – Standby</td>
<td>2 – 2nd Panel on Floor Level</td>
<td>-</td>
<td>4 – 277/480v</td>
<td>1S2-4</td>
</tr>
<tr>
<td>2 – 2nd Floor</td>
<td>E – Emergency</td>
<td>3 – 3rd Panel on Floor Level</td>
<td>-</td>
<td>2 – 120/208v</td>
<td>2E3-2</td>
</tr>
<tr>
<td>3 – 3rd Floor</td>
<td>V – Voltaic</td>
<td>4 – 4th Panel on Floor Level</td>
<td>-</td>
<td>4 – 277/480v</td>
<td>3V4-4</td>
</tr>
<tr>
<td>4 – 4th Floor</td>
<td>I – Inverter or UPS</td>
<td>5 – 5th Panel on Floor Level</td>
<td>-</td>
<td>2 – 120/208v</td>
<td>4I5-2</td>
</tr>
<tr>
<td>P – Penthouse</td>
<td>N – Normal</td>
<td>6 – 6th Panel on Floor Level</td>
<td>-</td>
<td>4 – 277/280v</td>
<td>PN6-4</td>
</tr>
</tbody>
</table>

l. Remodel construction that adds electrical panels fed from an existing panel are to be labeled as follows…

<table>
<thead>
<tr>
<th>Existing Panel Name (Example)</th>
<th>Required Dash</th>
<th>Added Character</th>
<th>Resulting Name for New Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN1-2</td>
<td>-</td>
<td>A – 1st new panel fed from existing</td>
<td>BN1-2-A</td>
</tr>
<tr>
<td>BN1-2</td>
<td>-</td>
<td>B – 2nd new panel fed from existing</td>
<td>BN1-2-B</td>
</tr>
</tbody>
</table>

m. All switches and receptacles are to be labeled with the panel and circuit number that it is fed from. The labels are to be white or clear tape with 1/4” black lettering; lettering must provide legible contrast.

n. All disconnects and panels are to be labeled with 1/2” black lettering on Phenolic nameplates of white or the color specified below and must be fastened with sheet metal screws.
Section 26 00 00 – Electrical continued

o. Fire Alarm: All circuit breakers, junction boxes, covers, etc. are to be labeled ‘Fire Alarm’ and red in color from the manufacturer. Except for circuit breakers, painted red is not acceptable.
p. Emergency and/or Standby Power: Within occupied spaces all switches and receptacles shall have red devices, covers, plates, etc.
q. Solar Power: Phenolic nameplates shall be yellow.
r. UPS Power: Phenolic nameplates shall be blue.
s. Grounded or Isolated Power:
   • Receptacles shall have orange covers, plates, etc.
   • Phenolic nameplates shall be orange.
t. Wire & Cable Identification:
   • Colors and identification MUST be maintained through the entire length of the wire or cable.
   • 120 volt systems can have white neutrals.
   • 208Y/120V System:
     i. Phase A - Black
     ii. Phase B - Red
     iii. Phase C - Blue
     iv. Neutral - White
     v. Equipment Ground - Green
     vi. Isolated Grounds:
        ◊ Green w/ Yellow stripe #12 and #10
        ◊ Green and Yellow bands #8 and up
     vii. Travelers - Purple
     viii. Switch Leg - Pink
   • 480Y/277V System:
     i. Phase A - Brown
     ii. Phase B - Orange
     iii. Phase C - Yellow
     iv. Neutral – Grey or White with an identifying stripe
     v. Equipment Ground - Green
     vi. Travelers - Purple
     vii. Switch Leg - Pink
u. Wiring Devices – Labeling:
   • Taped label circuit numbers on conductors and neutrals at receptacles.
   • Plastic stick-on labels:
     i. Identify device plates as indicated on drawings.
     ii. Identify switch and receptacle plates with panel designation and circuit number.
     iii. Identify disconnects to indicate equipment or device controlled.

32. Torque logs are required at each service and/or distribution location to ensure good connections.
Section 26 00 00 – Electrical continued


   a. The below references refer to Copyrighted 2009 ANSI/NETA Standard for Maintenance Testing
      Specifications
      InterNational Electrical Testing Association
      3050 Old Centre Ave., Suite 102 Portage, MI 49024
      Phone: 269-488-6382 | Fax: 269-488-6383
      www.netaworld.org
      • Transfer switch testing: Chapter 7.22.3
      • Arc flash hazard analysis: Chapter 6, Power System Studies.
      • Arc flash labeling: Chapter 6, Power System Studies
      • Torque testing and logging of electrical connections: Chapter 7.1 and table 100.12
      • Fault current coordination study: Chapter 6, Power System Studies
      • Ground electrode impedance testing: Chapter 7.13

34. Electrical Testing, Arc Flash Hazard Analysis Requirements:

   a. In closeout documents provide Owner with a CD of SKM Systems Analysis Power*Tools for Windows
      (PTW) format files. This CD shall include all files required to edit and evaluate the electronic model,
      including libraries, one-lines, scenarios, TCC curves, and all reports. Systems shall be modeled using no
      more than 300 busses. Electronic files using a format not compatible with SKM Power Tools for
      Windows are not acceptable.
   b. Perform an arc flash hazard analysis after the short-circuit and protective device coordination study have
      been completed.
   c. ALWAYS refer to and abide by OSHA requirements, as appropriate.
   d. Arc flash hazard analysis shall be performed to identify the shock hazard and appropriate PPE required at
      each switchboard, switchgear, distribution board, motor control center, panelboard, UPS, transformer, etc.
      in accordance with the following standards.
      • IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial
        and Commercial Power Systems.
      • IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial
        Power Systems.
      • IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
      • IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial
        and Commercial Power Systems.
      • IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations.
      • ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and
        Regulating Transformers.
      • ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
      • ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a
        Symmetrical Current Basis.
      • ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole
        Air Switches, Fuse Disconnecting Switches and Accessories.
      • NFPA 70E – Standard for Electrical Safety in the Workplace.
   e. Studies shall use computer programs that are distributed nationally and are in wide use. Software
      algorithms shall comply with requirements of standards and guides listed in the following. Manual
      calculations are not acceptable.
Section 26 00 00 – Electrical continued

f. The arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies:

- The Registered Professional Electrical Engineer shall be an employee of the approved engineering firm, licensed in the state where Project is located, with a minimum of five (5) years of experience in performing power system studies.
- The engineering firm shall have a minimum of twenty-five (25) years experience in performing power system studies.
- The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.
- An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

g. The results of the arc flash hazard analysis study shall be summarized in a final report. The report shall include the following at a minimum:

- Executive Summary including Introduction, Scope of Work and Results/Recommendations. Note any equipment that causes a high incident energy level. Propose corrective measures to reduce the energy levels.
- Pertinent data, rational employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
- Table summarizing the incident energy exposure available at every faulted bus.
- Protective Device Coordination Methodology Analysis Results and Recommendations.
- Protective Device Settings Table.
- Time-Current Coordination Graphs and Recommendations.
- Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
- Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
- One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

h. Data Collection:

- The Owner shall provide qualified personnel to show technician the equipment location and to open all equipment doors, locks, etc. necessary to collect nameplate data.
- Verify the owner’s one-line drawings and provide marked corrections where discrepancies are found.
- Data collection shall begin downstream from the utility service and continue down through the Owner’s electrical distribution system as defined under scope of work. The study shall not include any single phase AC circuits or DC distribution systems as these types of circuits and systems are excluded from IEEE 1584-2002 Arc Flash calculation guidelines. The study will not include equipment rated 240 volts or less per NFPA 70E, when supplied by a single transformer rated less than 125kVA.
- Obtain from the utility the minimum, normal, and maximum operating service voltage levels, three-phase short circuit MVA and X/R ratio, as well as line-to-ground short circuit MVA and X/R ratio at the point of connection as shown on the drawings.
Section 26 00 00 – Electrical continued

i. Arc Flash Hazard Analysis:

- The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04).
- The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.
- Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
- When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.
- The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
  i. Fault contribution from induction motors should not be considered beyond 5 cycles.
- For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment’s main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
Section 26 00 00 – Electrical continued

- Provide the following:
  1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
  2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
  3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

j. Field Adjustment:
- The Owner shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- Owner shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- The Manufacture shall notify Owner in writing of any required major equipment modifications.

k. If the upstream protective device does not contain an adjustable setting or settings, refer to PPE label identification for minimum arc flash hazard warning label requirements. If the upstream protective device does contain an adjustable setting or settings, add the following to the label in addition to what is required under PPE label identification:
  1. Manufacturer, model, and device settings of upstream protective device.
  2. Include both a ‘Coordination’ setting and an ‘Arc Flash Reduction’ setting for the upstream protective device.
  3. The ‘Coordination’ setting is to be the setting used for the device during normal conditions.
  4. The ‘Arc Flash Reduction’ setting is to be used during energized work at the bus. The ‘Arc Flash Reduction’ setting shall set any provided long-time delay, short-time pickup, short-time delay, and instantaneous settings to minimum.

l. Provide arc flash warning labels for all the equipment evaluated.
  1. Thermal transfer type labels of high adhesion polyester.
  2. Shall be printed by a thermal transfer type printer, with no field markings.
  3. Shall be UV resistant material and smudge proof.
  4. Shall be designed according to the following standards:
     1. UL969 – Standard for Marking and Labeling Systems
     2. ANSI Z535.4 – Product Safety Signs and Labels
     3. NFPA 70 (National Electric Code) – Article 110.16
  5. Floor Standing Equipment: Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
  6. Wall Mounted Equipment: Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
  7. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash Labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.
Section 26 00 00 – Electrical continued

- The overall color of the arc flash hazard label shall be 4 inches by 4 inches, orange for PPE levels 0 thru 4, and red for a dangerous hazard risk category. The portion of the arc flash hazard label that contains the hazard risk category information shall be color coded as follows: (Refer to the following sample arc flash hazard labels where the upstream over current protective device has no adjustable settings.)

  i. Hazard risk category 0: Green.

  ![Arc Flash and Shock Hazard]

  **Appropriate PPE Required**

  6 inches Flash Hazard Boundary
  0.21 cal/cm² Flash Hazard at 18 inches

  **Category 0** Untreated Cotton

  **Bus: CATEGORY 0**

  PROTECTIVE DEVICE: PD-0000

  ![Arc Flash and Shock Hazard]

  **Appropriate PPE Required**

  480 VAC 00
  42 inches Limited Approach
  12 inches Restricted Approach
  1 inches Prohibited Approach

  **Bus: CATEGORY 0**

  PROTECTIVE DEVICE: PD-0001

  ![Arc Flash and Shock Hazard]

  **Appropriate PPE Required**

  66 inches Flash Hazard Boundary
  10 cal/cm² Flash Hazard at 18 inches

  **Category 2** Cotton Underwear + FR Shirt & Pants

  **Bus: CATEGORY 2**

  PROTECTIVE DEVICE: PD-0002

  ![Arc Flash and Shock Hazard]

  **Appropriate PPE Required**

  480 VAC 00
  42 inches Limited Approach
  12 inches Restricted Approach
  1 inches Prohibited Approach

  **Bus: CATEGORY 2**

  PROTECTIVE DEVICE: PD-0002

ii. Hazard risk category 1: Yellow.


![WARNING]

**Arc Flash and Shock Hazard**
**Appropriate PPE Required**

<table>
<thead>
<tr>
<th>Category 3</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>480 VAC 00</td>
<td>Shock Hazard when cover is removed</td>
</tr>
<tr>
<td>42 inches</td>
<td>Limited Approach</td>
</tr>
<tr>
<td>12 inches</td>
<td>Restricted Approach</td>
</tr>
<tr>
<td>1 inches</td>
<td>Prohibited Approach</td>
</tr>
</tbody>
</table>

**Bus:** CATEGORY 3

**PROTECTIVE DEVICE:** PD-0003

v. Hazard risk category 4: Pink.

![WARNING]

**Arc Flash and Shock Hazard**
**Appropriate PPE Required**

<table>
<thead>
<tr>
<th>Category 4</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 VAC 00</td>
<td>Shock Hazard when cover is removed</td>
</tr>
<tr>
<td>42 inches</td>
<td>Limited Approach</td>
</tr>
<tr>
<td>Avoid Contact</td>
<td>Restricted Approach</td>
</tr>
</tbody>
</table>

**Bus:** CATEGORY 4

**PROTECTIVE DEVICE:** PD-0004

vi. Dangerous: Red.

![DANGER]

**NO SAFE PPE EXISTS**
**ENERGIZED WORK PROHIBITED**

<table>
<thead>
<tr>
<th>Dangerous! No FR Category Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 VAC 00</td>
</tr>
<tr>
<td>42 inches</td>
</tr>
</tbody>
</table>

**Bus:** CATEGORY DANGEROUS

**PROTECTIVE DEVICE:** PD-000D
Section 26 00 00 – Electrical continued

- Refer to the following sample arc flash hazard labels where the upstream over current protective device has adjustable settings: (This label and the ‘Note’ verbiage on the label assumes proper engineering has occurred and all required studies have been completed; not an appropriate Note to be included if these items have not occurred.)

### WARNING - Arc Flash Hazard

**Client:** UO OF

**Location:** HUESTIS MAIN ELECTRICAL ROOM

**Job #:** 2100-079-06  
**Date:** SEPTEMBER 2009  
**Engineer:** MDC

<table>
<thead>
<tr>
<th>Bus</th>
<th>PANEL_2L1</th>
<th>Rate</th>
<th>Category</th>
<th>M/TyDesc</th>
</tr>
</thead>
<tbody>
<tr>
<td>268</td>
<td></td>
<td>208</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Main Device:** UPTREAM PANEL 4L1 125 AMP BRANCH BREAKER

**Square D, Lx & L10, Micrologic:**

<table>
<thead>
<tr>
<th>Coordination</th>
<th>Setting</th>
<th>Trip/Delay</th>
<th>Breaker Open</th>
<th>Arcing Duration</th>
<th>Limited Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPTU (0.5-1.0 x P)</td>
<td>125A</td>
<td>2</td>
<td>0.00 s</td>
<td>2000 s</td>
<td>42 inches</td>
</tr>
<tr>
<td>LTD (2-14 Sec.)</td>
<td>7150A</td>
<td>2</td>
<td>0.1</td>
<td>2000 s</td>
<td>2</td>
</tr>
</tbody>
</table>

**Frame:**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>250</td>
<td>250</td>
</tr>
</tbody>
</table>


**Boiled Short Circuit Fault:** 4.6 kA 3Phase  
**Arcing Fault in Protective Device:** 2.5 kA 3Phase  
**Arcing Duration:** 2000 s  
**Limited Approach:** 42 inches

<table>
<thead>
<tr>
<th>Arcing Duration</th>
<th>2000 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaker Open</td>
<td>0.00 s</td>
</tr>
<tr>
<td>Trip/Delay</td>
<td>2000 s</td>
</tr>
</tbody>
</table>

**Arc Flash Boundary:** 83° @ 1.2 cal/cm² - 2nd Degree Burn Boundary of Bar Skin

<table>
<thead>
<tr>
<th>Incident Energy</th>
<th>1.2 cal/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Distance</td>
<td>18 inches</td>
</tr>
</tbody>
</table>

**PPE Clothing Category**

**Category 3 - Cotton Underwear + FR Shirt & Pant + FR Coverall**

<table>
<thead>
<tr>
<th>Clothing Description</th>
<th>Hazard Category</th>
<th>Clothing Layers</th>
<th>Arc Rating (cal/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unheated Cotton</td>
<td>0</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>FR Shirt &amp; Pants</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Cotton Underwear + FR Shirt &amp; Pants</td>
<td>1</td>
<td>1 or 2</td>
<td>8</td>
</tr>
<tr>
<td>Cotton Underwear + FR Shirt &amp; Pant + FR Coverall</td>
<td>2</td>
<td>2 or 3</td>
<td>26</td>
</tr>
<tr>
<td>Cotton Underwear + FR Shirt &amp; Pant + Multi Layer Flash Suit</td>
<td>2</td>
<td>3 or more</td>
<td>40</td>
</tr>
</tbody>
</table>

**Proper Protective Equipment Required**

- Note: Prior to performing energized work change the setting of the UPTSTREAM PANEL 4L1 125 AMP BRANCH BREAKER to the to the "Arc Flash Reduction" setting. The result is a PPE Clothing Class of Class 0, an Incident Energy level of 0.29 cal/cm2, and an Arc Flash Boundary at 8 inches under this setting. After the energized work has been completed, return the UPTSTREAM PANEL 4L1 125 AMP BRANCH BREAKER back to the "Coordination" setting.

35. **Electrical Testing, Over-current Protective Device Coordination Study:**

   a. Any project impacting the distribution system will require an Over-current Protective Device Coordination Study of the proposed installation.

   b. Prior to any Over-current Protective Device Coordination Study, the most current study must be reviewed. FS Supervisor may be contacted for this information.

   c. Over-current Protective Device Coordination Study must address potential nuisance tripping related to the proposed installation.

   d. Submittals:

      - Product Data: Computer software program to be used for studies.
      - Product Certificates: Computer software programs, certifying compliance with IEEE 399.
      - In closeout documents provide Owner with a CD of SKM Systems Analysis Power*Tools for Windows (PTW) format files. This CD shall include all files required to edit and evaluate the electronic model, including libraries, one-lines, scenarios, TCC curves, and all reports. Systems shall be modeled using no more than 300 busses. Electronic files using a format not compatible with SKM Power Tools for Windows are not acceptable.
Section 26 00 00 –Electrical continued

- Other Action Submittals:
  i. Coordination-study input data.
  ii. Study and Equipment Evaluation Reports.
  iii. Coordination-Study Report.

e. Quality Assurance:
- Software algorithms shall comply with requirements of standards and guides listed in the following. Manual calculations are not acceptable.
- Coordination-Study Specialist Qualifications:
  i. An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
  ii. Professional engineer, licensed in the state of Oregon, shall be responsible for the study.
  iii. All elements of the study shall be performed under the direct supervision and control of engineer.
- Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- Comply with IEEE 399 for general study procedures.

f. Examination:
- Examine Product over-current protective device submittals for compliance with electrical distribution system coordination requirements and other conditions impacting performance.
- Proceed with coordination study only after a bill-of-material, including the electrical distribution system protective devices, has been assembled.

g. Power System Data:
- Gather and tabulate input data to support coordination study.
- Product Data for over-current protective devices specified in other Sections and involved in over-current protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, over-current protective device submittals, input and output data, and recommended device settings.
- Available fault current at the primary terminals of the building transformer(s).
- Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
  i. Circuit-breaker and fuse-current ratings and types.
  ii. Relays and associated power and current transformer ratings and ratios.
  iii. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance and X/R ratios.
  iv. Generator kilovolt amperes, size, voltage and source impedance.
  v. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation and length.
  vi. Busway ampacity and impedance.
  vii. Motor horsepower and code letter designation according to NEMA MG 1.
  viii. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
     ◊ Special load considerations; starting inrush currents and frequent starting and stopping.
     ◊ Transformer characteristics; primary protective device, magnetic inrush current, and overload capability.
     ◊ Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
     ◊ Generator thermo-damage curve.
Section 26 00 00 – Electrical continued

◊ Ratings, types, and settings of utility’s over-current protective devices.
◊ Special over-current protective device settings or types stipulated by utility.
◊ Time-current-characteristic curves of devices indicated to be coordinated.
◊ Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range and instantaneous adjustment range for circuit breakers.
◊ Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range and current transformer ratio for over-current relays.
◊ Panel-boards, switchboards, motor-control center ampacity and interrupting rating in amperes rms symmetrical.

h. Short-Circuit Study:

- Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
  i. Switchgear and switchboard buses.
  ii. Medium-voltage buses.
  iii. Motor-control centers.
  iv. Distribution panel-boards.
  v. Branch circuit panel-boards.
- Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project down to the smallest protective device. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- The Short-Circuit study and the coordination study shall be performed with the aid of a computer program and shall be in accordance with IEEE 399.
- Calculate momentary and interrupting duties on the basis of maximum available fault current.
- Calculations to verify interrupting ratings of over current protective devices shall comply with IEEE 424, NEC, and/or ANSI.
  i. Transformers: ANSI C57.12.10; ANSI C57.12.22; ANSI C57.12.40; IEEE C57.12.00; IEEE C57.96.
  iv. Low-Voltage Fuses: IEEE C37.46.

i. Study Report:

- Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- Show interrupting (5-cycle) and time-delayed currents (6-cycle and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of over-current relays.
- Equipment Evolution Report:
  i. For 600-V over-current protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
  ii. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
Section 26 00 00 – Electrical continued

iii. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

j. Coordination Study:
   • Perform coordination study with the aid of a computer program. Prepare a written report using results of Short-Circuit study. Comply with IEEE 399.
     i. Instantaneous for normal power shall be a 0.1 second threshold.
     ii. Instantaneous for standby and emergency power shall be a 0.02 second threshold.
     iii. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
     iv. Calculate the maximum and minimum interrupting duty (5-cycles to 2-seconds) short-circuit currents.
     v. Calculate the maximum and minimum ground-fault currents.
   • The coordination study will determine the correct settings for the protective devices which will minimize the damage caused by an electrical fault and allow for selective coordination between the devices. The coordination study shall consider operation during normal conditions, alternate operation and during emergency power conditions.
   • The coordination study shall include the over-current protective devices in all low voltage classes of equipment including, switchgear and switchboard buses, distribution panel-board buses and branch circuit panel-board buses. The coordination study shall also include the closest upstream medium voltage over-current protective device.
   • Comply with IEEE 242 recommendations for fault currents and time intervals.
   • Transformer Primary Over-current Protective Devices:
     i. Device shall not operate in response to the following:
        ◊ Inrush current when first energized.
        ◊ Self-cooled, full-load current or forced air-cooled, full-load current, whichever is specified for that transformer.
        ◊ Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

36. NO pre-fabricated or pre-wired plug mold.

37. Occupancy control is required in all spaces without prior FS Utility & Energy PM and FS Electrician approval.

38. Grounding wire is to be pulled into ALL conduits.

39. All switches and receptacles must have a neutral wire pulled.

40. Conductors and Cables:
   a. Materials:
      • Wiring shall be copper and shall be rated at 600 volts.
      • Wire sizes 14, 12, 10 and 8 shall be stranded only.
      • Wire shall be marked with gauge and insulation type of 24" centers, and shall be color coded as required by the N.E.C.
      • Wire and cable shall be brought to the job in the original containers bearing the U.L. label.
      • Molded connectors with metal thread-on core shall be used for splicing 14, 12 and 10 wire.
      • Switchboards 600volt & below: All copper wire.
      • NO solid copper material.
Section 26 00 00 – Electrical continued

b. Manufacturers known to be acceptable are as follows:
   • Wire and cable: Rome, General Cable, Southwire, Anaconda-Erickson, Okonite, General Electric, Excell.
   • Molded connectors: 3M; Buchanan.
   • Tape: 3M.
   • Wire pulling lubricant: Polywater; Aqua Gel (clear); NO Ideal 77 Yellow.

c. Installation:
   • Wires shall be pulled in such a manner as to avoid kinking or abrasion to the insulation.
   • Use only approved lubricants; oil or grease shall not be used to lubricate wires.
   • Couplings and conduit connectors shall have pre-insulated bushings in place before pulling wires.
   • Wire insulation color shall be the same from one end to another.
   • Do not exceed cable pulling tensions and bending radius as specified by the cable manufacturer.

41. Raceway, Boxes, and Conduit:

   a. Conduit below slab on grade that penetrates slab up to floor boxes, etc. shall be rigid galvanized.
   b. FS Electrical Supervisor review and approval is required for any conduit buried in slabs on grade and/or floor slabs.
      • FS agreement / approval must be documented in a Standards Substitution Request to gain this approval with a diagram(s) of the location(s) conduit would be buried. For example, conduit will be buried in the slab through a designated corridor and not through occupied space.
      • The agreed location(s) are then to be included in final specifications and drawings.
      • The as-built one-line drawing(s) then are required for all buried, encased, concealed wiring and conduit.
   c. FS Electrician is to walkthrough the project to view pathways prior enclosure of walls.
   d. No surface exposed PVC; concealed is acceptable.
   e. NO PVC sweeps or elbows; metal only.
   f. Zinc coated by hot dip galvanizing or sherardizing Electrical Metallic Tubing (EMT).
   g. Galvanized steel and abrasion resistant flexible conduit.
   h. Connections, Couplings, and Fittings:
      • Same material and finish as raceway.
      • Screws must be visible and accessible after installation.
      • Raintight compression types employing split corrugated ring and tightening nut.
      • Steel concrete tight set screw type with insulated throats in connectors or steel watertight type.
      • Insulating bushings.
      • Interior, steel only and no cast.
   i. Conduit Sizing, Arrangement, and Installation:
      • See Communications Room Appendix.
      • Provide conduit for building monitoring cables.
      • Arrange conduit to maintain headroom and a neat appearance.
      • Route exposed conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
      • Maintain 12 inch clearance above removable ceiling tiles.
      • Pull points shall be appropriate sized junction boxes.
      • Individual station outlets will be served by at least a 3/4" conduit run from the nearby cable tray to station location that will be equipped with a 4” deep square box with a single gang mud ring.
Section 26 00 00 – Electrical continued

- All runs beginning at panels shall be no less than 3/4".
- Additional pathway may be required for voice, data, access control, security, etc. to be determined by each project.
- All branch circuits shall be run in metallic conduit or tubing.
- Run circuits above the drop ceilings where possible.
- In equipment rooms run conduit on wall surfaces in a neat fashion as high on the wall as possible.
- Use of metallic conduit is not sufficient for purposes of equipment safety grounding. All circuits regardless of the type of conduit shall be provided with a safety and equipment ground conductor.
- Bring conduit to the shoulder of fittings and couplings and fasten securely.
- Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- All conduit runs are to run parallel to systems and/or walls. Especially when encased in concrete.
- Use conduit bodies to make sharp changes in direction.
- Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-¼ inch size.
- Avoid moisture traps where able. Where unavoidable, provide junction box with drain fitting at conduit low point.
- Avoid condensation between moist warm locations and cool locations by blocking end of conduit that may introduce air flow in conduit a material such as ‘Duct Seal’.
- At conduit transitions from different temperatures seal the box and/or conduit.
- No landing of conduits in box extensions.
- Thoroughly clean interior of conduits from debris, dirt, and foreign materials prior to installation.
- At empty/un-used conduit use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

j. Conduit Support:

- Arrange conduit supports to prevent distortion of alignment by wire pulling operations.
- Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
- Do not fasten conduit with wire or perforated pipe straps.
- Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- If exposed conduit and tubing is attached directly to building surface, use one hole galvanized steel pipe clamps or straps.
- Conduit and tubing in metal stud walls shall be supported by fasteners approved for this purpose.
- Hanger spacing:
  i. Do not exceed 8 feet on center.
  ii. Provide a hanger adjacent to each outlet box.
  iii. Provide one hanger within 12 inches on each side of a change in direction.
- Conduits are not permitted to be supported from ductwork, pipes, t-bar ceiling supports, or other systems foreign to electrical installation.
- Support conduit as close to ceiling structure as practical.
- Coordinate conduit location with other trades.
- All surface run conduit is to be secured with one or two-hole straps.
Section 26 00 00 – Electrical continued

k. Conduit Penetrations:
   • Seal all penetrations in non fire-rated walls.
   • Seal all penetrations in fire-rated walls and floors using one of the following methods:
     i. Provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating.
     ii. Seal opening around conduit with UL listed foamed silicone elastomer compound.

l. Flexible Conduit:
   • Provide separate ground conductor either the full length of the flex or outside of conduit.
   • Limited use for the following:
     i. Vibrating or moveable equipment connections.
     ii. Fished into existing stud walls.
     iii. Distance from the luminare connection to structure to the powering junction box should not exceed 6ft.
   • No MC cable in walls.
   • MC cable is allowed for light fixture and motor connections.

Voice and Data Cable Tray Pathways:
   i. See Communications Room Appendix.
   ii. Cable tray in hallways or other common and direct paths through the building.
   iii. Conduits from station locations shall stub to the cable tray.
   iv. The cable tray or large conduits from the cable tray shall stub into the serving Telecommunication Equipment Room (TER) or Telecommunication Room (TR).

42. Utility Tunnels & Electrical Vault Conduit: items listed are only those different from conduit section above.

   a. Rigid Steel Conduit:
      • Standard pipe with threaded joints for electrical raceway use.
      • Zinc coated by hot dip galvanizing or sherardizing.
      • 3/4” size minimum.
      • Manufacturers known to be acceptable: Allied Tube and Conduit; Triangle PWC Inc.; Western Tube & Conduit.

   b. Rigid Steel or Intermediate Steel Conduit:
      • Exposed indoor runs where subject to damage up to 8-feet above finished floor.
      • In poured concrete or masonry.
      • Exposed outdoor locations.

   c. Intermediate Metallic Conduit (IMC):
      • Standard pipe with threaded joints for electrical raceway use.
      • Zinc coated by hot dip galvanizing of sherardizing.
      • 3/4” size minimum.
      • Manufacturers known to be acceptable: Allied Tube and Conduit; Triangle PWC.

   d. NO PVC (Rigid Plastic) Conduit.
   e. EMT is acceptable:
      • Snap supports and standoffs.
      • No direct mounting to cement or concrete.
Section 26 00 00 – Electrical continued

f. NO conduit bodies.
g. Union Joints for Rigid Steel or IMC Conduit:
   • Split coupling and unions are allowed.
   • Running threads not allowed.
   • Manufacturers known to be acceptable: O.Z. Gedney type SSP.
h. Conduit Sizing, Arrangement, and Installation:
   • Maintain minimum 6” clearance between conduit and mechanical piping.
   • Coordinate installation with other trades.
   • Maintain 12” clearance between conduit and heat sources such as flues, steam pipes and heating appliances.
   • Intermediate Metallic Conduit (IMC), 3/4” home runs minimum.
   • Provide No.12 AWG insulated conductor or suitable pull string in conduit, except sleeves and nipples.
i. Penetrations: Seal tunnel and vault penetrations with non-shrinking, vinyl reinforced, concrete sealant.
j. Underground Duct Bank Installation:
   • Install conduit with minimum grade of 3-inches per 100-feet.
   • Terminate conduit in end bell at manhole entries.
   • Stagger conduit joints in concrete encasement 6-inches minimum vertically.
   • Use suitable separators and chairs installed not greater than 4-feet on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement.
   • Provide minimum 3-inch concrete cover at bottom, top and sides of duct bank.
   • Provide two No.4 steel reinforcing bars in top of bank under paved areas and within 5-feet of building, wall or vault penetration.
   • Conduit stub-ups to equipment shall be rigid steel extended a minimum of 10-feet outside building foundation and 5-feet outside outdoor concrete pads.
   • Terminate conduit with insulated grounding bushing.
   • Clearances between individual ducts:
     i. For like services: Not less than 2-inches.
     ii. For high voltage and signal services: Not less than 6-inches.
   • Upon completion of duct bank installation perform the following:
     i. Pull a standard 12-inch long mandrel, 1/2” smaller than inside duct diameter through each duct.
     ii. After each mandrel has been pulled, a brush with stiff bristles shall be pulled to remove loosened particles.
     iii. Seal ducts at building entrances and outdoor equipment terminations with moisture resistant non-hardening compound.
     iv. Provide plastic spacers to maintain clearances.
     v. Provide non-ferrous tie wires to prevent duct displacement during pouring of concrete. Tie wires shall not act as substitute for spacers.

43. Outlet Boxes:
   a. Each device shall be provided with an outlet box.
   b. Box diameters shall be selected to meet wiring space requirements.
   c. Sectional outlet boxes shall not be used.
   d. Fire Sprinkler/Smoke Supervision devices and their associated back boxes shall be by the same manufacturer.
Section 26 00 00 –Electrical continued

c. Surface mounted outlet boxes shall be utilized only in conjunction with exposed conduits, and shall be of the cast metal type with internal hubs and mounting flanges.
   - Exception: Exposed outlet boxes serving equipment connections in mechanical spaces and other unfinished areas may be pressed steel.

d. Manufacturers known to be acceptable for pressed steel boxes: Bowers; Raco; Steel City.

e. Manufacturers known to be acceptable for cast metal boxes: Bell; T&B.

f. Outlet boxes shall be supported independent from the raceway system.

i. Outlet boxes are to be sealed at exterior walls and as needed in other locations.

44. Cabinets and Enclosures:

a. Cabinets and enclosures include hinged and screwed cover enclosures and cabinets.

b. All control boxes (lighting, auxiliary, fire alarm, etc.) and panels are to have hinged covers with door-in-door panels.

c. Shop drawing submittals for equipment panels are to include wiring schematic diagram, wiring diagram, outline drawing, and construction diagram as described in ANSI/NEMA ICS 1.

d. Manufacturers known to be acceptable: Circle AW; Hoffman; Rittal.

e. Hinged Cover Enclosures:
   - Construction: NEMA 250; Type 1 steel; interior, dust type; exterior, rain type.
   - Finish: Manufacturer’s standard enamel finish.
   - Covers:
      i. Continuous hinge.
      ii. Held closed by latch operable by key. Latch shall be capable of being keyed to cat 15.
      iii. Cat 70 keying required for all access to wiring and electrician access only.
   - Back panel for mounting terminal blocks or electrical components: 14 gauge steel, white enamel finish.
   - Door-in-door panel doors.

f. Terminal Blocks and Accessories:
   - Terminal Blocks: ANSI/NEMA ICS 4; UL listed.
   - Power Terminals:
      i. Unit construction type.
      ii. Closed-back type, with tubular pressure screw connectors.
      iii. Rated 600 volts.
   - Signal and Control Terminals:
      i. Modular construction type.
      ii. Channel mounted.
      iii. Tubular pressure screw connectors.
      iv. Rated 300 volts.

g. Fabrication:
   - Shop assembled enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
   - Provide conduit hubs in exterior and wet locations and knockouts in interior dry locations.
   - Provide protective pocket inside front cover with schematic diagram, connection diagram and layout drawing of control wiring and components within enclosure.
Section 26 00 00 – Electrical continued

h. Installation:
   - Install cabinets and enclosures plumb: anchor securely to wall and structural supports at each corner, minimum.
   - Provide accessory feet for free-standing equipment enclosures.
   - Install trim plumb.

45. Wiring Devices:
   a. Office receptacles are to be located at each corner and 10ft on center.
   b. No plastic wall plates; nylon or metal only.
   c. Convenience and straight-blade receptacles are to be 20 amp specification grade.
   d. Specification grade at a minimum.
   e. Manufacturers known to be acceptable for isolated ground receptacles: Hubbell IG-5362, 20 Amps, 120 Volt; Lovington.

46. Lighting Control:
   a. System shall be non-proprietary.
   b. System shall be remotely accessible via network connections.
   c. System shall be fully commissioned prior to acceptance.
   d. Installer shall have a minimum of 5 years of full time experience in the installation and maintenance of lighting control systems.
   e. Installer staff shall be factory trained and certified; documentation required.
   f. Warranty repair response time: 4 hours maximum.
   g. Where possible all light fixtures shall be modular.

End of Section

Section 26 10 00 – Medium-Voltage Electrical Distribution (Substations; Medium-Voltage Transformers; Medium-Voltage Switchgear; Medium-Voltage Circuit Protection Devices)

1. Pad Mount Transformers:
   a. Pad mount transformers are OFCI.
   b. See Division 33 for concrete pad mounts.
   c. Above ground pad-mounted transformers require prior CPRE and CPS Electrician review and approval. Screening strategies, maintaining appropriate service clearances, may also be required per CPRE direction.
   d. NO drains and/or sump pumps are to be located in transformer rooms.
   e. Submit complete and descriptive shop drawings indicating compliance with the requirements following.
      - Concurrent CPS review and approval is required.
   f. Manufacturers known to be acceptable: General Electric; MGM; Baltau Standard; Square D; ABB; Alstom; Tierney.
   g. Transformer taps are to be adjusted to the proper voltage after system is installed and operating under load.
   h. Equipment:
      - Transformers shall be isolating type. All transformers must be constructed and rated in accordance with all applicable, ANSI, NEMA, and UL requirements / standards.
      - Oil insulated, 3 phase, 60 cycle radial feed transformer for outdoor installation.
      - Furnish four 2.5% full capacity taps in the primary winding, two above and two below rated primary voltage, brought out to an externally operated de-energized tap changer.
Section 26 10 00 – Medium-Voltage Electrical Distribution continued

- The transformer and associated terminal compartments shall be tamperproof.
  
i. There shall be no screws, bolts or other externally removable fastening devices.
  
  ii. Full height, air-filled incoming and outgoing terminal compartments with hinged doors shall be located side by side separated by a steel barrier.
  
  iii. The incoming compartment will be accessible only after the door to the outgoing compartment has been opened.
  
  iv. The incoming line compartment shall enclose the high voltage bushings and provide for incoming cable from below.
  
  v. The compartment shall have a hinged door with a fastening device which is accessible only through the low voltage compartment.
  
  vi. The incoming line compartment shall be arranged for two cable circuits to the transformer.

- Three load break bushings shall be furnished which will accept load break elbows and hold down hardware. Provide a 200 amp load break oil rotary switch. The transformer shall be protected by an internal canister style fuse. Provide a liquid level gauge, pressure gauge, temperature gauge and nitrogen insertion valve stem.

- The outgoing line compartment shall be arranged for cabling from below. The compartment door will be hinged and suitable for padlocking. Provide four low voltage spade bushings or three low voltage spade bushings and one solidly grounded neutral blade for grounded Y secondary voltage.

- The transformer shall be painted green.

2. Liquid Insulated Distribution Transformers:

  a. Liquid insulated distribution transformers are OFCI.
  
  b. Manufacturers known to be acceptable: General Electric; Square D; ABB; Cooper. Must specialize in distribution transformers with ten years documented experience.
  
  c. Warranty: The equipment provided in this specification shall be warranted by the manufacturer, including all parts, labor, and travel expenses, for a period of 1 year from the transformer start-up date, but not more than 2 years from shipment.
  
  d. IEEE C57.12.22:

  • Cooling and Temperature Rise; ANSI C57.12.22; Class KNAN. 65 degrees C, self-cooled.
  
  • Insulating Liquid: Less-flammable transformer liquids: Bio-degradable electrical insulating and cooling liquid derived from edible seed oils conforming to NFPA 70 and FM P7825 for less-flammable liquids having a fire point not less than 300 degrees C tested in accordance with ASTM D92 and a dielectric strength not less than 33 kV tested in accordance with ASTM D877.
  
  • Capacity: kVA
  
  • Winding Material: AL, all windings.
  
  • Primary Voltage: 12.47 kV, delta connected; provide standard primary taps, with externally-operated tap changer.
  
  • Primary Basic Impulse Level: 95 kV.
  
  • Primary Terminations: Bushing wells to ANSI/IEEE 386; provide three insulated connector (200 Amp load-break) bushing inserts.
  
  • Primary Switching: Provide internal oil-immersed operated load break switches.
  
  • Primary Overcurrent Protection: Bayonet-type, oil-immersed, expulsion fuses.
  
  • Secondary Voltage: 208/120 volts, wye connected.
  
  • Secondary Terminations: Externally-clamped bushings with NEMA 6-hole spades for copper conductors.
  
  • Accessories: ANSI C57.12.22 standard accessories including the following.
  
    i. Pressure relief diaphragm
    
    ii. Nitrogen test port.
iii. Nitrogen pressure and vacuum gauge
   ◇ Minimum Range: minus 10 psi to plus 10 psi.
   ◇ Maximum Range: minus 20 psi to plus 20 psi.
   ◇ Steps: 0.5 psi.
   ◇ Accuracy: plus or minus 2.5 percent, maximum.

iv. Magnetic liquid level gage.
v. Dial type thermometer.
vi. Sampling valve.
vii. Drain valve.
viii. Fill valve.

- Overvoltage Protection: Provide distribution class metal oxide surge arrester, separable insulated connector (load-break) type with braided ground straps of sufficient length to reach from the primary termination bushings to the ground pads, with 12 inches slack, minimum.

e. Source Quality Control:

- Equipment Test Schedule. The Owner reserves the right to witness factory tests prior to shipment. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Owner 14 calendar days before scheduled test date. Notify Owner 14 calendar days in advance of changes to scheduled test date.

- Test Instrument Calibration:
  i. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
  ii. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
  iii. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
  iv. Dated calibration labels shall be visible on all test equipment.
  v. Calibrating standard shall be of higher accuracy than that of the instrument tested.
  vi. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:
     ◇ Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
     ◇ Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

- Transformer Design Tests (Liquid-Filled). In accordance with IEEE C57.12.00 and IEEE C57.12.90. Additionally, IEEE C57.12.80 section 5.1.2 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results).
  i. Tests shall be certified and signed by a registered professional engineer.
  ii. Temperature rise: "Basically the same design" for the temperature rise test means a unit-substation transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (KNAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.
Section 26 10 00 – Medium-Voltage Electrical Distribution continued

iii. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a unit-substation transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include both the primary and secondary windings of that transformer.

◊ State test voltage levels.
◊ Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.
◊ Lifting and moving devices: "Basically the same design" for the lifting and moving devices test means a transformer in the same weight range as the transformer specified.
◊ Pressure: "Basically the same design" for the pressure test means a unit-substation transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

• Transformer Routine and Other Tests (Liquid-Filled): In accordance with IEEE C57.12.00 and IEEE C57.12.90. Routine and other tests shall be performed by the manufacturer on the actual transformers prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence shall be as follows.

i. Insulation resistance measurements (provide reference temperature).
ii. Phase relation.
iii. Ratio.
iv. Insulation power-factor.
v. No-load losses (NLL) and excitation current.
vi. Load losses (LL) and impedance voltage.
vii. Leak detection.
viii. Insulating Liquid Tests:

◊ Dielectric breakdown voltage.
◊ Acid neutralization number.
◊ Specific gravity.
◊ Interfacial tension.
◊ Color.
◊ Visual condition.
◊ Water in insulating liquid.
◊ Measure dissipation factor or power factor.
◊ Perform dissolved gas analysis (DGA).

f. Manufacturer’s Field Services:

• Provide nitrogen for blanketed transformer.
• Verify insulating liquid level and temperature. Add additional insulating liquid as necessary

End of Section

Section 26 20 00 – Low-Voltage Electrical Distribution (Overhead Power Systems; Transformers; Switchgear; Switchboards & Panelboards; Enclosed Bus Assemblies; Power Distribution Units; Distribution Equipment; Circuit Protective Devices; Controllers)

1. At all ceiling hung equipment, provide a service outlet at the equipment disconnect.
2. All switches and receptacles are to be taped and/or insulated.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

3. NO bus duct assemblies for risers.

4. Circuit breakers serving the fire alarm must have tamper proof device and locked in the ‘On’ position.

5. Circuit breakers only, NO Edison circuits. NO fuses.
   a. The use of fuses is allowed ONLY for coordination as a final & necessary resort with notification to FS Electrical Supervisor that there is a need to do so.
   b. If fuses are required for the sake of coordination, labeling much occur at all related equipment regarding appropriate fuse size is to be used.
   c. Within mechanical and/or electrical rooms that house or neighbor equipment using fuses, a permanent storage location / cabinet must be provided to hold extra fuses of the correct sizes.

6. Motor Control Centers:
   a. ‘Draw Bucket’ types.
   b. Control voltage transformer to be within the enclosure.
   c. Disconnect at motor shall have auxiliary control contacts.

7. Switchboards, Panel-boards, and Load Centers:
   a. Minimum two extra and empty ¾” conduit stubs are required at every panel for future; at the top of the panel.
   b. Each panel requires a panel breaker for single panel isolation; main breaker per panel.
   c. Not to be located in classrooms, offices, hallways, etc.
   d. Mounting Height for Panel-boards: Top = 72 inches (top of fixture dimension)
   e. Copper bus-bar panels only.
   f. Bolt-a-buss breakers ONLY.
   g. Copper wiring only.
   h. NEC working clearance required and to be maintained.
   i. Panel-boards – Enclosures:
      - Do not paint panel covers.
      - Hinged covers and door-in-door dead fronts only.
      - Circuit directory to reflect final circuiting conditions and room numbers.
      - Circuit directory to reflect circuiting changes required to balance phase loads.

8. Current transformers will be used to proof fan status where VFD is not used.

9. Variable Frequency Drives (VFD):
   a. May also be referred to as Variable Speed Drives (VSD), Adjustable Frequency Drives (AFD); etc.
   b. Requires 2year warranty from the point of final completion; not from point of startup.
   c. Enclosure type and rating requires review with FS Maintenance and Electrical Supervisor.
   d. During construction outside temporary filtering is required.
   e. Vacuum cleaning is required for final completion.
   f. Submittals:
      - Concurrent FS review and approval of construction submittals required.
      - Product data on VFD and related components indicating all features specified.
      - Start up log/check list showing successful operation.
      - Operation and Maintenance data.
   g. Basis of Design Manufacturer and known to be acceptable: ABB.
      - NO third party VFD.
      - NO ‘brand labeled’ VFD.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

- NO packaged VFD.
- Any substitution must comply with requirements listed below.
- It is required that the drive manufacturer have an existing sales representative exclusively for HVAC products, with expertise in HVAC systems and controls as well as an independent service organization.
- The drive manufacturer shall supply the drive and all necessary controls as listed below.
- The manufacturer shall have been in the production of this type of equipment for a minimum of 20 years.

h. General Description.

- VFD consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
- VFD to be dedicated variable torque design for specific use with centrifugal loads.
- Provide completely solid state variable frequency power and logic unit.
- Speed control to be step-less throughout the range under variable torque load on continuous basis.
- VFD is to be controlled by DDC.
- Provide adjustable frequency control with diode bridge/capacity input designed to provide high, constant power factor of 0.95 regardless of load or speed and eliminate SCR line noise.
- Control shall be suitable for operation in ambient temperatures of 0 to 40 degrees C.
- VFD shall be factory tested with an AC induction motor 100% loaded and temperature cycled within an environmental chamber at 104°F.
- VFD drives are to be proofed through user adjustable drive auxiliary output.
- Drives and motors must be compatible.

i. Referenced Standards:

- Underwriters Laboratories: UL508C
- Motors, MG1 parts 30 & 31.
- National Electrical Manufacturer’s Association (NEMA): ICS 7.0, AC Adjustable Speed Drives.
- IEC 16800 Parts 1 and 2

j. Qualifications:

- VFD and options shall be UL listed as a complete assembly. VFD requiring customer supply of external fuses for the VFD to be UL listed is NOT acceptable.
- The base VFD shall be UL listed for 100 KAIC without the need for input circuit breaker and/or fuses. The over current device shall prevent damage to the VFD.
- CE Mark: The VFD shall conform to the European Union Electro Magnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level to ensure the VFD does not emit radiated interference.

k. Self Protection and Reliability Features:

- Adjustable current limit to 60 to 110% of drive rating.
- Adjustable instantaneous over-current trip.
- Under voltage trip.
- Over temperature trip.
- Short circuit protection phase to phase and phase to ground faults phase rotation insensitive.
- Momentary power loss, more than 17 milliseconds.
- Transient protection against all normal transients and surges in incoming power line.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

- Orderly shutdown in event of any of above conditions, drive shall be designed to shut down safely without component failure.
- Provide visual indication and manual reset.

1. Features.
   - Drive logic shall be microprocessor based. Control logic shall be isolated from power circuitry.
   - The free-standing/factory-assembled VFD assembly shall have a circuit breaker disconnect and be UL 508C listed for use on distribution systems with 22,000 AIC.
   - Minimum user adjustable inputs and outputs:
     i. 2 independent analog outputs.
     ii. 3 digital outputs.
     iii. 6 digital inputs.
     iv. ALL are to be independent of the VFD function.
   - Frequency Stability: Output frequency will be held to +0.1% of maximum frequency regardless of load, +10% input voltage change or temperature changes within ambient specification.
   - Built-in digital display on the panel face shall be capable of indicating output frequency, voltage and current and shall provide indication of over current, over voltage, current limit, ground fault, over temperature, input power on, minimum or maximum speed adjustment, power on, fault condition.
   - Start and stop control.
   - If applicable, the control circuit transformer will have primary and secondary fusing.
   - Minimum and maximum speed control.
   - Adjustable acceleration and deceleration; independently adjustable 10-100 second.
   - Hand-Off auto switch(s).
   - Programmable Auto Restart after power outage.
   - The following disconnect switching is required at a minimum:
     i. Safety Disconnect: Does not need to be fused. Shall include an early break auxiliary contact to disable the drive when in the ‘Off’ position.
     ii. Service Switch: To be mounted at the ‘Safety Disconnect’ for an orderly shut-down on control. A label shall be included to read ‘NOT and Emergency Shut-Down for VFD’.
   - Remote contacts for fault, and on/off status.
   - Adjustable motor output voltage.
   - Analog output voltage of 0-10 VDC, 4-20 MA proportional to control output frequency.
   - Manual speed control for each motor.
   - UL listed enclosure is to be completely assembled and tested in an ISO9001 manufacturing facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
   - Provide output filters for all VFD locations more than 25 conductor feet from the motor they serve. Output reactors shall permit VFD to be located up to 350ft from the motors they serve.
     i. This is a requirement for motors only when the supply voltage is greater than 240 volts line to line.
   - The VFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD with only one DC reactor shall add AC line reactors. This increased impedance lower harmonic distortion (Vthd) meeting IEEE-519 guidelines.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

- The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV (Metal Oxide Varistor); phase to phase and phase to ground, a capacitor clamp and 5% impedance reactors. MOV to protect against transients that would trip a VFD off line or cause serious damage.

- VFD shall have the following adjustments:
  i. A minimum of 2 PID (Proportional Integral Derivative) set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control.
  ii. The VFD shall have 250 ma of 24 VDC (minimum) auxiliary power and be capable of loop powering a transmitter supplied by others.
  iii. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus.
  iv. There shall be at least two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer and winter set points, etc.
  v. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain set point of an independent process (i.e. valve, dampers, etc.).
  vi. All set points, process variables, etc. are to be accessible from the serial communications network.
  vii. The set points shall be set in engineering units and not require a percentage of the transducer input.
  viii. Allows complete control of a system or process.

- The VFD shall include a fireman’s override input. Upon receipt of a contact closure from the fireman’s control station, the VFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. ‘Override Mode’ shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.

- All VFD shall have EMI / RFI filters. The onboard filters shall allow the VFD assembly to be CE marked and the VFD shall meet product standard EN 61800-3 for the first environment restricted level, and exceed FCC guidelines with motor cables less than 100 feet.

- All VFD through 50HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. Prevents damage to the VFD when the electrical contractor wires the input power to motor terminals.

- The VFD shall catch a spinning load in forward and reverse direction

- Serial Communications:
  i. The VFD shall have an RS-485 port as standard. The standard protocol shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profinet, EtherCAT, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority. Use of non-certified protocols is not allowed.
  ii. The VFD shall allow the DDC to control and monitor the drive’s digital and analog outputs via the serial interface. This control shall be independent of any other VFD function.
  iii. The VFD shall include an independent PID loop for customer use. This independent PID loop may be used for cooling tower bypass valve control, chilled water valve control, etc. Both the VFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the connection is lost.
iv. Serial communication:

◊ Capabilities shall include, but not be limited to: run-stop control; speed set adjustment; proportional/integral/derivative PID control adjustments; current limit; acceleration and deceleration time adjustments; and lock and unlock the keypad.
◊ The drive shall have the capability of allowing the DDC to monitor feedback such as: process variable feedback; output speed/frequency; current (in amps); percent torque; power (kW); kilowatt hours, with the ability to reset; operating hours, with the ability to reset; drive temperature.
◊ The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and output values.
◊ All diagnostic warning and fault information shall be transmitted over the serial communications bus.
◊ Remote VFD fault reset shall be possible.
◊ The following additional status indications and settings shall be transmitted over the serial communications bus: keypad ‘Hand’ or ‘Auto’ selected; bypass selected; the ability to change the PID set point; the ability to force the unit to bypass, IF bypass is specified.
◊ The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode, IF bypass is specified.

• Bypass Features: Inclusion of any VFD bypass system, methods, or features require complete review, discussion, and approval of Owner’s Electrical Supervisor. If/when a factory wired bypass systems is approved the following is required.
  i. All features shall be UL listed by the drive manufacturer as a complete assembly and carry a UL508 label.
  ii. Door interlocked, and pad-lockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
  iii. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.
  iv. The drive bypass shall provide single-phase motor protection in both the VFD and bypass modes.
  v. The following operators shall be provided:
  ◊ Bypass Hand-Off-Auto.
  ◊ Drive mode selector.
  ◊ Bypass mode selector.
  ◊ Bypass fault reset.
  vi. The following indicating lights (LED type) shall be provided and a test mode or push to test feature shall be provided:
  ◊ Power-on (Ready).
  ◊ Run enable (safeties) open.
  ◊ Drive mode select damper opening.
  ◊ Bypass mode selected.
  ◊ Drive running.
  ◊ Bypass running.
  ◊ Drive fault.
  ◊ Bypass fault.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

◊ Bypass H-O-A mode.
◊ Automatic transfer to bypass selected.
◊ Safety open.
◊ Damper opening.
◊ Damper end-switch made.

vii. The following relay (form C) outputs from the bypass shall be provided:

◊ System started.
◊ System running.
◊ Bypass override enabled.
◊ Drive fault.
◊ Bypass fault (motor overload or underload, broken belt).
◊ Bypass H-O-A position.

viii. The digital outputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.

ix. Customer Interlock Terminal strip. Provide a separate terminal strip for connection to freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in Fireman’s Override). The remote start/stop contact shall operate in VFD and bypass modes.

x. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman’s override. Two modes of operation are required:

◊ One mode forced the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.
◊ The second fireman’s override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).

xi. The VFD shall include a ‘run permissive circuit’ that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freeze-stat, high static pressure switch, etc.) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.

xii. Class 20 or 30 (selectable) electronic motor overload protection shall be included.

xiii. An internal switch to select manual or automatic bypass may be required in consultation with the FS Electrical Staff for VFDs on building systems that do not have redundancy and/or the building system can not operate at 60 hertz.

xiv. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

m. Installation:

- VFD shall be installed in accordance with applicable codes and manufacturer’s written installation instructions.
- Install on a strut support system.
- VFD not to be mounted inside motor control centers or fan units.
- Each VFD will operate only one motor.
Section 26 20 00 – Low-Voltage Electrical Distribution continued

n. Start Up:
   • Comply with manufacturer’s instructions for startup.
   • Start up shall be provided under the direct supervision of the manufacturer’s representative and factory trained personnel.
   • Certified factory start-up shall be provided for each drive by a factory authorized service center.
   • A certified start-up form shall be filled out for each drive with a copy provided in the O&M manual, to the PM, and a copy kept on file at the manufacturer.

o. Product Support: Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. 24 hour technical support line shall be available on a toll-free line.

p. Warranty:
   • Warranty shall be 24 months from the date of certified start-up.
   • Warranty shall include all parts, labor, travel time, software, software updates, and access tools at no additional cost to the Owner.
   • 24 hour support line shall be available on a toll-free line.

q. Harmonic Measurement:
   • Perform harmonic measurement at the point where the utility feeds multiple loads (PCC) to verify compliance with the latest version of IEEE 519-1992.
   • Provide a report of the voltage THD and current TDD for Engineer and Facilities Maintenance review prior to substantial completion.
   • Provide labor, materials, and protection as needed to access the test points.
   • The readings shall be taken with all drives and other loads at full load, or as close to this as field conditions allow.

r. Field Quality Control:
   • Prior to installation, manufacturer’s representative shall coordinate VFD control interface with the control contractor and verify the intended installation (controls, wiring, etc.) complies with the manufacturer’s recommendations.
   • Field Test: Except where initial VFD operation clearly shows the performance meets or exceeds the requirements, test to show compliance. Tests shall be performed by the manufacturer’s representative in the presence of the PM and/or FS Electrician.

End of Section

Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment (Photovoltaic Collectors; Packaged Generator Assemblies; Battery Equipment; Power Filters & Conditioners; Transfer Switches)

1. Battery backups require FS Electrician and Utility & Energy PM review and approval.

2. Photovoltaic Collectors:
   a. Label per NEC 690.17.
   b. Wire each module disconnect so that readily accessible per definition (100).
   c. Requires blocking diodes on source circuit.
   d. Requires disconnects on all ungrounded conductors after blocking diodes.
   e. Ground system per NEC 690.47c.
   f. Each inverter will have one point of connection.
   g. Each inverter will have GFPD included.
   h. Follow exhibit NEC 690.6
Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment continued

3. Motors and Generators:
   a. Design B motors only.
   b. Manufacturer known to be acceptable for motor-bases: Overly Hautz, steel adjustable motor bases with double adjusting bolts. No exceptions.
   c. All 3phase motor disconnects must contain auxiliary contacts.

4. Transfer Switches:
   a. Coordinated switch status thru power monitoring system.
   b. The transfer switch shall be the product of a firm regularly engaged in the assembly or manufacture of this equipment. The component parts of the unit shall be the product of firms regularly engaged in the manufacture of these parts.
   c. Must be IAC / NEC rated.
   d. Manufacturers known to be acceptable: Russell; Asco; GE/Zenith.
   e. All conduit, wiring, and electrical connections required between the various items of the System shall be provided and installed complete.
   f. Installation and start-up shall be supervised, checked and tested by a qualified representative of the equipment manufacturer.
   g. System Demonstration:
      • Demonstrate operation of transfer switch in the presence of the FS Electrical Supervisor & CPS Electrical Supervisor and Commissioning Agent by operating normal power source under load and verifying transfer switch transfers to alternate source and back to normal source after normal power is restored.
      • Verify transfer switch status and source availability are annunciated properly to the power monitoring network.

5. Automatic Transfer Switches:
   a. Material and Component Requirements:
      • Each switch shall be furnished with full load current rating at 208Y/120 volts, 480/277, 3-phase, 4-wire, 60 Hertz AC normal and emergency.
      • Shall be capable of switching all classes of load and shall be rated for continuous duty when installed in non-ventilated enclosures.
      • The switch shall be of the inherent 4-pole switched neutral type with all poles on a common shaft.
      • Relays and control circuits shall be provided to obtain fixed preferential control with transfer switch connected to the normal source of power under normal conditions.
      • Upon a sustained drop in voltage of 80% in any phase of the normal power source from rated voltage and after a delay of 7 seconds for standby power and 5 seconds for emergency power, switch shall close a circuit to automatically start the engine generator and transfer the load to the emergency power source provided the voltage and frequency of that source are at least 90% of rated value. The switch shall be electrically operated but mechanically held in both the normal and emergency positions and shall include an electrically continuous neutral position. The operator shall be momentarily energized from the source to which the load is being transferred. Upon return of normal power to within 10% of rated voltage on all phases, and after a preset time delay adjustable from 2 to 25 minutes, the switch shall automatically transfer the load to the normal source.
      • If the emergency power source shall fail during the generator delay period prior to return to normal source, the time delay shall be bypassed and the switch shall return to normal source, the time delay shall be bypassed and the switch shall return immediately to the normal source.
      • A test switch shall be provided to simulate failure of the normal power source and to test the operation of a transfer switch.
Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment continued

- A manual operator shall be provided for maintenance servicing of the transfer switch in accordance with UL-1008.
- An override switch shall be provided to bypass the automatic transfer controls so that the transferred switch will remain indefinitely connected to the emergency power source, regardless of the condition of the normal power source.
- Transfer switch shall have a zero to six second adjustable time delay off position between source transfers to ensure residual voltage decay from motors and transformers.
- In-phase monitors shall not be used on transfer switches serving motor loads.
- Each automatic transfer switch shall be furnished with voltage sensing relays for each phase. Connection of these sensing relays shall be made to the normal power input terminals of the transfer switch. Voltage range shall be field adjustable.
- A fused red indicating light identified with a nameplate reading “Emergency Power” shall be provided to indicate operation on emergency power and a fused green indicating light identified with a nameplate entitled “Normal Power” shall be provided to indicate operation on normal power. These signals shall be transmitted to the remote enunciator.
- The automatic transfer switch shall be installed in a NEMA Type 1 wall or floor mounted enclosure conforming to NEMA ICS and comply with the requirements of UL-508.
- Main terminals requiring field wiring connections shall be suitable for copper wiring.
- The automatic transfer switch shall be suitable for satisfactory performance when installed for operation at 200-feet altitude, 104°F high and minus 53°F low ambient temperature, 90% relative humidity.
- Modbus RTU or IP/TCP communications.
- Painting and Finishing:
  - All surfaces to be painted shall be thoroughly cleaned to insure that they are free from all oil, grease, welding slag and spatter, all mill scale, products of corrosion, dirt or other foreign products.
  - Painting shall consist of at least one coat of rust inhibiting primer and one coat of finish enamel.
  - The rust inhibiting primer shall be applied to a clean, dry surface as soon as practicable after cleaning.
  - Painting shall be with manufacturer’s current materials according to manufacturer’s current process except that the total dry film thickness shall be not less than 2.5 mils.
  - The paint shall be free from runs, sags, orange peel or other defects.
  - Color of the finish coat of paint shall be manufacturer’s standard.
- Status Contacts:
  - Provide a set of Form ‘C’ contacts for remote monitoring of ATS status.
  - Provide the following contacts:
    ◊ Normal Power Available.
    ◊ Emergency Power Available.
    ◊ ATS on Normal Source.
    ◊ ATS on Emergency Source.
- System Operation and Performance Requirements:
  - Switches for use in Science Complex and other load critical areas (such as Computing Center, MRI facility, etc.) defined by FS Electrical Supervisor & CPS Electrical Supervisor shall be closed transition with bypass isolation, and shall be provided with phase sensing and monitoring relays.
  - All standby transfer switches must come with an inhibit capability.
  - Each switch shall be enclosed in a NEMA-1 enclosure with lockable doors. Access into enclosure shall be front and rear according to the manufacturer’s recommendations for maintenance.
Section 26 30 00 – Facility Electrical Power Generating & Storing Equipment continued

- Nameplates shall identify all equipment, operating handles, and devices with engraved plastic laminated nameplates. Nameplates will be red background with white lettering. Engraving shall identify equipment and supply sources to match nomenclature identification shown on equipment schematic and wiring diagrams.
- All relays, timers, control circuitry, and accessories shall be visible and traceable from the front of the enclosure. Control devices which change state shall be mounted so that their state can be visually determined without the aid of instruments.
- Identify all control wire terminations by tubular sleeve type markers to agree with wire marking identification on manufacturer’s equipment drawings.
- Indicating lamps shall be LED.
- Provide contacts and terminals required to provide remote control and monitoring by the CPS monitoring and control system.
- Switch and bypass/isolation switch shall be mounted in a freestanding enclosure, bussed together with copper bus to provide a complete and pretested factory assembly.
- The automatic transfer switch shall be completely isolated from the bypass/isolation switch by means of insulating barriers and separate access doors to positively prevent hazard to operating personnel while servicing or removing the automatic transfer switch.
- The normal and emergency contacts shall be mechanically and electrically interlocked to prevent simultaneous closing.
- Main contacts shall be mechanically locked in position.
- Submit detailed maintenance manuals and drawings which include wiring diagrams, dimensions, front view and catalog information indicating complete electrical and mechanical characteristics.
- Execution:
  i. In accordance with manufacturer’s installation instructions. Installation shall provide clearances indicated by manufacturer for testing and maintenance of assembly.
  ii. Provide field engineer’s supervision and assistance as necessary for testing by others of transfer system coordinated with the CPS control system to demonstrate proper operation.
  iii. Adjust all timing controls and parameters and provide. A set-up sheet of final settings inside the enclosure.

  c. Provide operation and maintenance training on site for FS personnel. Include troubleshooting, repair and maintenance manuals for each participant.

End of Section

Section 26 50 00 – Lighting (Interior; Emergency; Exit Signs; Special Purpose; Exterior)

1. Lamp holders shall be compatible with the ballast system.
2. Lighting above suspended ceilings for equipment access and serviceability is required. Owner is to decide where access is required.
3. Exterior balconies must be well lit for personal safety as well as use in the evening hours by UO Custodial.
4. Integrated lighting into casework requires prior FS Electrician review and approval.
5. Lighting design and placement must allow access to ballasts and lamps for the purpose of replacement and maintenance without damage to surrounding finishes, equipment, etc.
6. Track lighting is allowed only with prior FS Electrician and Utility & Energy PM review and approval.
7. Tunnel lighting fixture is Lithonia; Kennel; 2x11in; 13watt lamps.
8. Light level sensors are to have continuous adjustment capabilities and are to be compatible with dimming ballasts if provided.
Section 26 50 00 – Lighting continued

9. Fluorescent Ballasts – T5 and T8 High Efficiency Program Start

a. Physical Characteristics:
   - Electronic ballast shall be physically interchangeable with standard magnetic core and coil ballasts.
   - Ballast shall be furnished with integral leads, color-coded to ANSI C82.11.
   - Ballast must be formed from recyclable steel painted in accordance with UL 935 standards. Plastic products with gaseous discharges are not allowed.

b. Performance Requirements:
   - Ballast shall be Programmed Start and provide >100,000 on/off cycles before 50% lamp failure.
   - Ballast shall operate at 120 volts, or 277 volts, with +/- 10% variation tolerance, 60 Hz or Multi-voltage for between 108 and 305 volts, 50/60 Hz.
   - Ballast shall be 90% efficient and use 10% or less of the total system power on the primary lamp application.
   - Ballast shall eliminate lamp striation (spiraling effect) with Anti-Striation circuitry.
   - Ballast shall have a start time of less than .7 seconds.
   - Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when used with the primary lamp at 120 volts. It shall be less than 20% on other approved lamps.
   - Ballast shall have a Power Factor greater than 98% when used with primary lamp at 120 volts and greater than 90% in other applications.
   - Ballast shall have independent parallel lamp operation.
   - Ballast shall have less than a 1.7 lamp current crest factor.
   - Lamps may be remote or tandem mounted up to a maximum of 18ft overall lead length.
   - Ballast shall have a minimum starting temperature of 0 degree F.
   - Ballast shall have the capability to restart replacement lamps without resetting power.
   - Ballasts for T5 and T5HO lamps shall be ‘Program Start’ with end-of-life detection.

   • Ballast shall be Sound Rated A.
   • Ballast output frequency to the lamps shall be above 20kHz to minimize visible flicker and outside 30-42kHz to avoid interference with infrared devices.
   • Ballast shall have transient voltage protection.
   • Ballast shall have a Power Factor greater than 98% when used with primary lamp at 120 volts and greater than 90% in other applications.
   • Ballast shall be Sound Rated A.
   • Ballast output frequency to the lamps shall be above 20kHz to minimize visible flicker and outside 30-42kHz to avoid interference with infrared devices.

   - Ballast shall have independent parallel lamp operation.
   - Ballast shall have less than a 1.7 lamp current crest factor.
   - Lamps may be remote or tandem mounted up to a maximum of 18ft overall lead length.
   - Ballast shall have a minimum starting temperature of 0 degree F.
   - Ballast shall have the capability to restart replacement lamps without resetting power.
   - Ballasts for T5 and T5HO lamps shall be ‘Program Start’ with end-of-life detection.

c. Regulatory Requirements:
   - ANSI C82.11 for electronic ballast performance.
   - FCC Title 47 CFR part 18, non-consumer equipment standards, class A.
   - ANSI C62.41, Category A2 for Transient Voltage protection.
   - UL 935 standards and be UL Listed and CSA Approved.
   - UL Class P, Type 1 Outdoor, and Type HL.
   - UL law and contain no Polychlorinated Byphenois (PCBs).
   - All US state and federal, and Canadian provincial and federal efficiency laws.
   - RoHS Directive 2002/95EC on the restriction of hazardous substances such as lead, cadmium, mercury, hexavalent chromium, PBBs and PBDEs.

d. Other:
   - Ballast shall carry a 5year warranty from the date of manufacture. Warranty shall be valid for maximum case temperature of 70 degrees C.
   - Manufacturer shall carry a system warranty life to a minimum of 36 months or 10,500 hours, whichever comes first on cycles of 15 minutes or more per start.
   - Manufacturer must have a 5 year history of designing and manufacturing electronic ballasts.
   - Ballast must be manufactured in an ISO 9002 Certified Facility.
Section 26 50 00 – Lighting continued

- Ballast shall be available with Ballast Factor of no less than 0.60 Xtra-Low, 0.87 Normal, and 1.15 High Power for the primary lamp application.
- Product submittals must include PF, THD, and system watts for the specified system.

10. Fluorescent Ballasts – T8 High Efficiency Instant Start

a. Physical Characteristics:
   - Electronic ballast shall be physically interchangeable with standard magnetic core and coil ballasts.
   - Ballast shall be furnished with integral leads, color-coded to ANSI C82.11.
   - Ballast must be formed from recyclable steel painted in accordance with UL 935 standards. Plastic products with gaseous discharges are not allowed.
   - Ballast shall have a maximum height of 1.2 inches and maximum weight of 1.5 lbs.

b. Performance Requirements:
   - Ballast shall operate at 120 volts, or 277 volts, with +/- 10% variation tolerance.
   - Ballast shall be 90% efficient and use 10% or less of the total system power on the primary lamp application.
   - Ballast shall eliminate lamp striation (spiraling effect) with Anti-Striation circuitry.
   - Ballast shall have Active Current Regulation to control lamp current to each lamp independently to ensure lamp life is not reduced when a lamp fails within the circuit.
   - Ballast shall provide UL Class CC, Closed Cabinet protection to prevent ignition of non-UL controlled thermoplastic diffuser and overheating of bi-pin lamp holders.
   - Ballast shall have constant Ballast Factor if one or more lamps fail.
   - Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when used with the primary lamp at 120 volts. It shall be less than 20% on other approved lamps.
   - Ballast shall have a Power Factor greater than 98% when used with primary lamp at 120 volts and greater than 90% in other applications.
   - Ballast shall be Sound Rated A.
   - Ballast output frequency to the lamps shall be above 20kHz to minimize visible flicker and outside 30-42kHz to avoid interference with infrared devices.
   - Ballast shall be Instant Start with independent parallel lamp operation.
   - Ballast shall have an optimal 1.4 lamp current crest factor to maximize lamp life.
   - Lamps may be remote or tandem mounted up to a maximum of 18ft overall lead length.
   - Ballast shall have a minimum starting temperature of 0 degree F.
   - Ballast shall have the capability to restart replacement lamps without resetting power.
   - Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

c. Regulatory:
   - ANSI C82.11 for electronic ballast performance.
   - FCC Title 47 CFR part 18, non-consumer equipment standards, class A.
   - ANSI C62.41, Category A3 for Transient Voltage protection.
   - UL 935 standards and be UL Listed and CSA Approved.
   - UL Class P, Type 1 Outdoor, and Type HL.
   - UL law and contain no Polychlorinated Byphenois (PCBs).
   - All US state and federal, and Canadian provincial and federal efficiency laws.
   - RoHS Directive 2002/95EC on the restriction of hazardous substances such as lead, cadmium, mercury, hexavalent chromium, PBBs and PBDEs.
Section 26 50 00 – Lighting continued

d. Other:

- Ballast shall carry a 5 year warranty from the date of manufacture. Warranty shall be valid for maximum case temperature of 70 degrees C.
- Ballast must be manufactured in an ISO 9002 Certified Facility.
- Product submittals must include PF, THD, and system watts for the specified system.
- Manufacturer must have a 5 year history of designing and manufacturing electronic ballasts.
- Manufacturer shall carry a system warranty life to a minimum of 36 months or 10,500 hours, whichever comes first on cycles of 15 minutes or more per start.

11. Emergency and Egress Lighting:

a. To be fed from an emergency panel from a standby feeder vs. battery backup. Battery backup of these systems is not preferred unless standby is not available.

b. IF a battery backup is used, then batteries are to be on a dedicated circuit not to impact computers, equipment, etc. during exercising and/or charging of batteries.

c. Shall be integrated into the overall lighting scheme without requiring separate fixtures.

d. NO radioactive materials to self-start exit lighting.

e. Green exit lights.

f. Manufacturers known to be acceptable for exit lights: Hubbell/Presco Lite; LED lamps; Model PLED1EMGWW.

g. Photo luminescent exits are allowed in locations where sufficient light already exists. Not allowed if additional light must be provided to power photo luminescent.

12. Lighting Accessories:

a. 5% extra lamps are required at the end of projects for all specialty lamps installed.

b. High performance T5 acceptable.

c. T8 fluorescents preferred.

d. Fluorescent lamps are to be 80 CRI or better.

13. General Lighting Control:

a. Full Owner review and approval during design of system is required.

b. Non proprietary systems.

c. System shall be fully commissioned prior to acceptance.

d. Installer shall have a minimum of 5 years experience in the installation and maintenance of lighting control systems and/or be factory trained and certified.

e. Warranty response time must be 4 hours or less.

f. Owner Training:

- A minimum of 1hr overview training for the key building occupants (to be determined by project) regarding everyday use is required with any lighting system. This can be increased based upon complexity or scope of the lighting system(s).
- A minimum of 2hrs FS Electrician training is required with any lighting system to a maintenance and service level(s). This can be increased based upon complexity or scope of the lighting system(s).

14. Dimming Control:

a. Classrooms must have a dimming range of 1% to 90% with variable switching options available.

b. If dimmable lighting is requested in spaces types other than classrooms, the dimming range should be 10% to 90% with variable switching options available.

c. Manufacturers known to be acceptable for dimming control: Lutron Grafix-Eye.

d. 4 to 5 presets are to be programmed for space users. If an individual user changes the settings of a preset condition, the system is to reset to the defaulted 4 or 5 presets after use.

e. Control units, or switching, are to be accessible through media cabinets and NOT wall-mounted.
Section 26 50 00 – Lighting continued

f. In addition to presets, an all on/off control is required without delayed response.
g. Proper labeling of all preset scenes is required.
h. A minimum of 2 circuits required within dimming controls.

15. Exterior Lighting:

a. Also reference CPRE policies and Campus Outdoor Lighting Plan.
b. White light ONLY. NO high pressure sodium light.
c. Site placement of light poles and trenching for light poles is to be coordinated with tree locations and FS Exterior staff.
d. Building mounted light fixtures are to be avoided.
e. Circuating and control of walkway lighting shall be from individual buildings and controlled by central photocells mounted on the building.
f. All fixtures shall be individually fused with in-line fuse trips.
g. Bypass capability in the circuity is required for ALL exterior lighting.
h. Photocell over-ride is required with a manual and mechanical over-ride.
i. Aim fixtures at completion of project, as appropriate to address glare control and light trespass issues.
j. Parking Lot Lighting:
   • Light source is to be metal halide lamps, 250-400.
   • Pole height shall be no more than 25ft.
   • Glare-control / light-trespass issues must be addressed. Consultant shall submit photo metrics to demonstrate compliance.

k. Site Security Lighting:
   • Locations are to be identified during design.
   • Light source shall be metal halide.
   • Glare-control / light-trespass issues must be addressed submitting photo metrics to demonstrate compliance.
   • Lighting control by photocell.

l. Owner Furnished Contractor Installed (OFCI) Light Posts, Lamps, and Luminaries for information and reference only:
   • Post: Visco, painted campus standard green.
   • Fixture: Holophane UGV10DHMT6806
     i. (Agate St. only: Sternberg 4410-DPF fixtures.)
   • Globe: Granville G-V-8N. (Agate St. only, D650 globes.)
   • Junction boxes shall be installed adjacent to exterior post lights.
   • One tenon adapter per fixture/pole with a 1/4” 20 thread set screw to fasten the adapter to the tenon; not noted in the detail below.
   • 10-ft poles, 100 watt metal halide.
   • 12-ft poles, 150 watt metal halide.
   • 120 volt or 208 volt power only.
   • Light pole bases are to be anchored.
   • Light pole base may have an optional 120 volt receptacle with welded adapter. This receptacle access is to be either (1) a keyed cover, or (2) labeled with panel and circuit location to be turned on and off by appropriate personnel as needed.
Section 26 50 00 – Lighting continued

- Underground J-box detail ‘Carson’ 1419-12-4YE

- Plan view detail of Mow slab for pole light base in lawn conditions adjacent to sidewalks:
Section 26 50 00 – Lighting continued

- Basis of design for light pole foundation; consultant review and detailing per project is still required: detail by M.R.Richards Engineering, revised 4-2-2009.
Section 26 50 00 – Lighting continued

- Basis of design for light pole foundation; consultant review and calculation per project still required: structural calculations by M.R.Richards Engineering, revised 4-2-2009.

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**LIGHT POLE FOUNDATION**

| POLE HT | 12'-0" |
| POLE DIA | 6" |
| GLOBE DIA | 1'-6" |
| POLE WT | 100 LBS |
| GLOBE WT | 100 LBS |

**WIND OVERTURNING AT 20 PSF WIND**

\[ N = 0.02 \left( 0.5 \times 12 \times 2/2 + 0.75 \times 2 \times \pi \times 12.75 \right) = 1.17 \text{ FT-K} \]

\[ V = 0.16 \text{ K} \]

**SEISMIC OVERTURNING AT \( V = 0.5g \)**

\[ N = 0.5 \left( 0.1 \times 6 + 0.1 \times 12.75 \right) = 0.94 \text{ FT-K} \]

\[ V = 0.1 \text{ K} \]

**WIND GOVERS**

**POLE FOUNDATION, NONCONSTRAINED**

- 2'-0" DIA
- 3'-0" DEEP
- CLASS 5 SOIL

100 PCF LATERAL BEARING \( \times 1.33 \times 2 = 266 \text{ PCF} \)

\[ A = 2.34 \times 0.16 \times 266 \times 2 = 851 \]

\[ d = 0.5 \times 0.851 \times (1 + 1 + 4.36 \times 7.3 / 0.851)^{2/3} = 2.74 < 3.0 \text{ FT} \quad \therefore \text{OK} \]

**ANCHOR BOLTS**

- 3/4" DIA
- 9" DIA BOLT CENTER

\[ T = M/D = 1.17 \times 12 / 9 = 1.56 \text{ K} \]

3/4" BOLT O.K. FOR 2.7K W/ 5" EMB

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(2) FLOWER BASKETS @ 9'-0" HT

\[ W_T = 35 \text{ LBS EA} \]

\[ A = 2.5 \text{ SF} \]

\[ M_{wind} = 1.17 + 2 - 2.5 - 9.1 \times 0.02 = 2.07 \times \frac{1}{2} = 2.07 / 2 = 27.46 \]

\[ M_{seismic} = 0.14 + 2 \times 0.635 \times 5 \times 1 \times 1.25 \times \frac{1}{2} = 1.35 \]

\[ A = 2.34 \times .26 / .266 \times 2 = 1/4 \]

\[ d = 0.5 \times (1.14) \left[ 1 + \left( 4.36 \times 7.36 / 1.14 \right) \right] = 3.30' \]

**Use 3'-6" Depth**

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*End of Section*
Section 27 00 00 – Communications (Maintenance; Common Work Results; Identification; Schedules)

1. See also Section 09 50 00 – Ceilings.
2. See also Division 23 for Instrumentation & Control for HVAC (DDC) Standards.
3. See also Division 26 for Electrical.
4. See also Division 28 for Electronic Safety & Security
5. See also Division 33 for Utilities and Monitoring & Verification Instrumentation Standards.
6. See also appendices for various space type requirements.
7. N&TS following refers to UO Network & Telecom Services.
8. NEC and IEEE working clearance required and to be maintained.
9. NEC and IEEE definitions will apply to all standards that follow.
10. NO demolition of one item shall occur in order to repair and/or replace another item.
11. ALL deleted items must be removed and not just abandoned.
12. Systems and system components in new construction, remodels, and retrofits are to be compatible with existing systems and system components to the extent possible.
13. Training provided MUST be to a maintenance/technician level for ALL systems.
14. Voice and data cabling shall not block mechanical access points.
15. Power supply is to be from a standby feeder or UPS.
16. Communication conduits are to be a maximum of 40% full for future cabling allowance. High use buildings are to install conduit 100% oversized for future cabling.
17. Boxes, panels, equipment gutters, etc. are to be cleaned inside and out upon completion and prior to acceptance of work.
18. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner personnel prior to specification and/or installation.
19. Accessibility of Equipment:
   a. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
   b. Refer to and abide by all OSHA requirements, as appropriate.
   c. OSHA 1910 Subpart D - Walking-Working Surfaces standards for working platforms must be followed. Provisions to meet these standards must be incorporated into the building design.
   d. All necessary access points for maintenance must be provided and coordinated.
   e. Inaccessible Equipment:
      - If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
      - ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.
Section 27 00 00 – Communications continued

20. UO Network & Telecom Services (N&TS) Work Includes:
   a. All outside plant fiber optic and telephone cabling to provide service to the building or space.
   b. Switching to the private FS network trunk; DDC controls.
   c. All wiring harness in the building entrance MDF, patch cords, and network equipment to bring service into all racks.

21. Contractor Work to be Included:
   a. Pathways, hard cabling, and termination.
   b. Furnishing and installation of all labor and materials required for the installation of a voice and data cable infrastructure.

22. Low Voltage Wiring:
   a. Fire Alarm and monitoring, and data/telecom wiring can share the same cable trays or conduit with N&TS and EH&S approval, and with proper and complete coordination.
   b. Voice and data requirements are to be determined and provided for the following equipment:
      • Fire alarm and monitoring.
      • Security.
      • Closed Circuit TV.
      • Access Controls.
      • Elevators.

23. Communication Identification requirements:
   a. Labels shall consist of permanent typewritten label systems. Hand written labels are not acceptable.
   b. Horizontal cable IDs shall be assigned to every horizontal category 5e cable.
   c. The cable ID shall be constructed as follows: the three digits building number (in this case, 014), the IDF letter (A, B, or C), followed by a four-digit sequential jack number. For example, if a cable were pulled to IDF C and was the 65th cable pulled to that IDF, the cable ID for that cable shall be 014C0065. All cables in a single faceplate shall have sequential jack numbers.
   d. Cable TV RG6 shall be identified with a sequential, unique number. This number shall be combined with the room number to form the cable ID. For example, if this was the 10th cable TV cable pulled on the project and it was pulled to room 257, the cable ID would be 257-10.
   e. Cable tags containing the unique cable ID shall be placed on both ends of all cables, 6 inches from the connector and/or termination blocks. Each label shall be pre-printed with the cable ID as indicated. Hand written cable labels are not acceptable.
   f. Individual station outlets shall be labeled with the designator of the cables terminated at that particular outlet. Plates shall be permanently labeled in typewritten ink or professional engraving. Station faceplates shall have the building and IDF letter at the top of the faceplate (for example, 014C). Individual jacks in the station faceplate shall be labeled with the sequential jack numbers (for example, 0065).
   g. If at any time during the job the cable tag becomes illegible or removed for whatever reason, the Contractor shall immediately replace it with a duplicate pre-printed cable tag at the Contractor's expense.
   h. Patch panels shall be labeled with the permanent room numbers above the jacks and an abbreviated cable ID consisting of the sequential jack number below the individual jacks. For example, if a set of four cable were pulled between IDF C and room 103 and these were the sequentially cables 65, 66, 67, and 68, the patch panel would be have a single label ‘Room 103’ above the set of four jacks, and each of the individual jacks would have the labels 0065, 0066, 0067, and 0068 placed under the jacks.
Section 27 00 00 – Communications continued

24. Communication Pathways:

a. Furnish and install communications conduit raceways, boxes, cable trays, innerduct and fittings including:
   - Communications conduit systems.
   - Wireway systems.
   - Surface raceway systems.
   - Telecommunications outlet boxes.
   - Pull box enclosures.
   - Cabinets.
   - Pulltape and duct plugs.
   - Raceway identification banding.

b. Record Documents: Plan drawings showing completions and as-built corrections which indicate type, size, placement, routing, and/or length for raceway and cable tray components; e.g., manholes, hand holes, conduit, wireway, boxes, enclosures, etc.

c. Raceways, Boxes, Enclosures, Cable Tray Materials and Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended.

d. The product identification codes used for the Communications Raceways and Boxes in Part 2, Products, are summarized in the following table.

<table>
<thead>
<tr>
<th>Product Designation</th>
<th>Product Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGS</td>
<td>Rigid galvanized steel</td>
</tr>
<tr>
<td>CRS</td>
<td>PVC externally coated RGS</td>
</tr>
<tr>
<td>EMT</td>
<td>Galvanized steel tubing</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinylchloride conduit</td>
</tr>
<tr>
<td>ENT</td>
<td>Electrical nonmetallic tubing</td>
</tr>
<tr>
<td>LMC</td>
<td>Liquidtight metal conduit</td>
</tr>
<tr>
<td>LNC</td>
<td>Liquidtight nonmetal conduit</td>
</tr>
</tbody>
</table>

e. Rigid Metal Conduit and Fittings:
   - Type RGS: Rigid galvanized steel.
   - Type CRS: PVC externally coated conduit; rigid steel conduit with external PVC coating and internal galvanized surface.
   - Fittings and Conduit Bodies: In-line straight-through, threaded, galvanized steel fittings and Type C conduit bodies only; do not use bends or tees, e.g., Lbs.
   - Bonding and Grounding Locknuts and Wedges: Malleable iron with set screws and lug screws.
   - Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.
   - Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solder-less lugs or lug screws.
   - Sealing Fittings: Threaded type conduit seal fittings and sealing compound suitable for hazardous location installations in accordance with NEC:
     - Crouse-Hinds retrofit sealing fitting EYSR.
     - Crouse-Hind CHICO A sealing compound.

f. Electrical Metallic Tubing and Fittings:
   - Type EMT: Electrogalvanized steel tubing.
Fittings and Conduit Bodies:
  i. General: in-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. LBs.
  ii. Wet Areas: steel compression-type couplings and nipples.
  iii. Dry Areas: set screw-type couplings and nipples.

Bonding Locknuts: Malleable iron with set screws and lug screws.
Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.
Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solderless lugs or lug screws.

Conduit Accessories:
  1. Duct Spacers: Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch (100 mm) diameter conduit with 1-1/2-inch (38 mm) separation.
    i. Base Spacer: S288NHN.
    ii. Intermediate Spacer: S289NHN.
  2. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.
  3. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch (13 mm) tape 9216-JK.
  4. Duct Plugs:
    i. Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch (100 mm) PVC plugs with pull tab, P258NT.
    ii. Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g., Pacific Plastics No. 5900514, George-Ingraham 0605, or Vikimatic P4000WT.

Raceway Coating:
  1. Manufacturers known to be acceptable: Koppers Bitumastic; Scotchwrap.
  2. Bitumastic material or plastic tape.

Penetration Sealing Systems:
  1. Firestopping: Provide fire barrier penetration sealing materials as specified in Firestopping section.
  2. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

Telecommunications Outlet Boxes:
  1. Sheet Metal Outlet Boxes: Minimum 4-inch by 4-inch by 2-inch-deep (100 by 100 by 50 mm-deep) galvanized steel for use with single- and double-gang plaster rings.
  2. Nonmetallic Outlet Boxes: Minimum 4-inch by 4-inch by 2-inch-deep (100 by 100 by 50 mm-deep). Provide gasketed, watertight cover.
  3. Cast Boxes: 4-inch by 4-inch by 2-inch-deep (100 by 100 by 50 mm-deep) cast Feralloy, gasketed single- or double-gang cover, threaded hubs. For hazardous locations, provide boxes approved for applicable atmosphere classification.
Section 27 00 00 – Communications continued

- Floor Boxes for Installation in Cast-In-Place Concrete Floors: Flush mounted and fully adjustable formed steel as shown on the Drawings.
- Plaster Rings: Single or double gang as shown on the Drawings.

k. Pull Boxes:
   - Construction: NEMA Standard No. 250.
   - Type 1 Steel: Galvanized steel enclosures designed for use as junction boxes and pull boxes with flat screw-applied covers, with or without knockouts, and gray enamel finish.

l. Outside Plan Vaults / Handholes: Preformed concrete with metal cover or cast iron manhole cover. Utility Vault company or equivalent.

m. Innerduct:
   - Outdoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated, ribbed, or smooth walled, semi rigid PVC or heavy-wall polyethylene tubing.
   - Indoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated, ribbed, or smooth walled, semi rigid nonflammable PVC tubing, which meets UL94V-O vertical flame test for general applications.
   - Plenum-Listed Indoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated walled innerduct for use in plenum air handling spaces.

n. Innerduct Fittings:
   - Couplings: Metallic or nonmetallic quick-connect, reverse threaded, and Schedule 40 couplings for connecting sections of installed innerduct.
   - Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing the outside walls of one or more innerduct ends to the inside wall of 4-inch (100 mm) inside diameter conduits, e.g.:
     i. Four 1-inch (25 mm) innerduct configuration.
     ii. Three 1-1/4-inch (32 mm) innerduct configuration.
   - Innerduct Plugs: 1-inch (25 mm) and 1-1/4-inch (32 mm) compression-type innerduct plugs for sealing innerducts, with wing nut for hand tightening and eyebolt for securing pulltape.
   - Innerduct Caps: Removable push-in caps for plugging 1-inch (25 mm) and 1-1/4-inch (32 mm) innerduct.

o. Wire Basket Runway Systems:
   - Manufacturers known to be acceptable: Cablofil; FlexTray; GS Metals.
   - Cable Tray Sections and Components:
     i. Provide metal wire basket runways, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units.
     ii. Construct units with rounded edges and smooth surfaces and with the following additional construction features.
     iii. Materials and Finish: Continuous steel welded and formed wire mesh, electro zinc finish.
   - Type of Runway System:
     i. Tray sizes have 4-inch side height.
     ii. Supply all straight sections in standard 120 inches, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on Drawings.
     iii. Tray Widths: 12 inches, 18 inches, 24 inches.
     iv. Make splice plates the fast splice type as indicated below for each tray type.
Section 27 00 00 – Communications continued

v. Make splice plates of yellow zinc dichromate steel.
vi. Furnish splice plates with straight sections and fittings as required by manufacturer.


viii. Wire Basket Runway Supports: Place so that the support spans do not exceed a maximum of 4 feet o.c.

ix. Loading Capacities: Wire basket runways to meet NEMA Class Designations.

p. Workmanship:

- Manufactured products, materials, equipment, and components to be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer’s specifications and printed instructions.
- The installation of all system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
- Place support for framing, raceways, cable trays, backboards, equipment racks, and cabinets.

q. Protect products from the effects of moisture, corrosion, and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing, and wireway capped with manufactured seals during construction.

r. Minimum Conduit Size:

- 1-inch (25 mm) for aboveground installations.
- 4-inch (100 mm) for underground applications.

s. Conduit Type to be Used:

- Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
- Interior Dry Locations, Exposed: EMT with set screw fittings.
- Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
- Interior Wet Locations: EMT with compression fittings.
- Exterior, Exposed Including Roof: Rigid steel conduit.
- Concrete-Encased or Buried Duct Banks:
  - PVC Schedule 40 conduit.
  - Rigid steel conduit when additional protection is required.
  - Flexible Conduit (Interior Exposed):
    - Liquidtight flexible metal conduit for use with copper cable.
    - Liquidtight flexible nonmetallic conduit for use with fiber optic cable.
  - Conduits that are to be used for service entrance conductors shall be either:
    - Concrete encased PVC schedule 40 or
    - Rigid or Intermediate metallic conduit (RMC or IMC)

 t. Conduit Bends and Sweeps:

- Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
- Make sweeps in parallel or banked runs of conduits, 2 inches (50 mm) and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
- Field-Made Bends and Sweeps:
  i. Use an acceptable hickey or conduit-bending machine.
  ii. Do not heat metal raceways to facilitate bending.
Section 27 00 00 – Communications continued

iii. Before installing 4-inch (100 mm) field-made sweeps in duct banks, pull a 3-1/2-inch (89 mm) diameter by 12-inch (300 mm) long mandrel through duct sections to verify circularity and sweep radius.

- The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.
- Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes, and Fittings:
  i. Underground or Underslab 4-inch (100 mm) Conduit: 60 inches. (1.5 m)
  ii. Other Conduit Runs:
      o One-inch (25 mm) conduit, 11 inches (275 mm).
      o Two-inch (50 mm) conduit, 21 inches (525 mm).
      o Three-inch (75 mm) conduit, 31 inches (775 mm).
      o Four-inch (100 mm) conduit, 40 inches (1000 mm).
      o Other sizes, 10 times the inside diameter of the conduit.

- Do not install boxes, bends, elbows, tees, conduit bodies, and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
  i. Conduit Bodies: in-line straight-through Type C condulet fittings can be used as pull boxes for conduit up to a maximum of 2 inches (50 mm) ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB, and X, are not allowed.
  ii. Refer any design or installation conflicts with these requirements to the Owner.

u. Penetrations:
- Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
- Empty Conduits: Removable screwtight duct plugs.
  i. Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
  ii. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.
- Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure’s integrity.
  i. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1 inch (13 to 25 mm) larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
  ii. Conduits that rise vertically through a slab to be stubbed 6-inches (150 mm) above the floor and capped pending future use.
- Drywall Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.
- Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:
  i. Provide a watertight seal.
  ii. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
  iii. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
  iv. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
Section 27 00 00 – Communications continued

• Where raceways penetrate fire-rated walls, floors, or ceilings, fire stop openings around communications penetrations to maintain the fire-resistance rating as specified in Firestopping section.

v. Above-Ground Conduit Installation:

• Support conduit installed in aboveground interior and exterior locations at a maximum of 7 feet (2.1 m) on center.
• Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
• Securely attach aboveground conduit under the provisions of this Section.
• Conceal conduit in finished areas, leave exposed in unfinished areas and where not possible to conceal. In finished areas, the Owner will make the final decision on conduit concealment.
• Run exposed and concealed conduits parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance. Follow surface contours as much as possible.
• No section of conduit located within buildings to exceed 100 feet (30 m) in length between pull points and/or pull boxes. Pull points in conduits 2” and larger shall not be conduit bodies, but rather boxes or wireway.

• Expansion/Deflection Joints:
  i. Where indicated on the Drawings, provide specific purpose expansion/deflection fittings for conduit crossing building expansion/deflection joints in structures or concrete slabs. Expansion fittings to have copper bonding jumper.
  ii. For PVC conduit, provide expansion/deflection joints for 25 degrees F maximum temperature variation. Install in accordance with manufacturer’s instructions.
  iii. For rigid steel conduit located in exterior areas, provide expansion/deflection joints for maximum site temperature variation, installed in accordance with manufacturer’s instructions.

• Provide each conduit passing from a nonhazardous or noncorrosive area to a hazardous area and each conduit entering an enclosure within a hazardous area with a sealing fitting in accordance with NEC Article 500. The sealing fitting to be UL listed and to be filled with approved sealing compound of the same manufacture.

• Hubs, Bushings, and Insulating Sleeves:
  i. Interior Box and Cabinet Connections: Install insulating throat connectors wherever conduit terminates in boxes or cabinets. In addition, install bonding type locknuts at metallic conduit terminations.
  ii. Wet and Hazardous Box and Cabinet Connections: Use watertight threaded conduit sealing hubs with insulated throat and bonding type locknuts for fastening rigid steel conduit to cast or sheet metal pull boxes.
  iii. Exposed Conduit Terminations: Cap exposed steel communication conduit ends with bushings or smooth collars to protect cable sheath.

• Flexible Conduit:
  i. Make no bends in flexible conduit that exceed allowable bending radius of the cable to be installed or that significantly restricts the conduit’s flexibility.
  ii. A flexible conduit section to be long enough to allow the item to which it is connected to be withdrawn or moved off its base.
  iii. For final connection to TO's or equipment, where flexible connection is required to minimize vibration or where required to facilitate removal or adjustment of equipment, provide 12-foot (3600 mm) minimum lengths of flexible conduit or as indicated on the Drawings.
Section 27 00 00 – Communications continued

w. Pulltape and Duct Plugs:
   - Following conduit installation, install pulltape (mueltape) with preprinted foot markers in each empty
     conduit containing a bend or over 10 feet (3000 mm) in length, except sleeves, nipples, and runs with
     openings in cleanroom areas. Tie the pulltapes securely to duct plug or wall racking at each end.
   - Immediately after pulltape installation, for conduit openings on conduits underground, install
     screwtight, removable, watertight, and dust-tight duct plugs in conduit ends.
   - Verify lengths at the time of installation and provide as-built documentation.

x. Wireway Type to be Used:
   - Interior, Exposed: steel.
   - Interior, Concealed: not approved.
   - Exterior, Exposed: steel or nonmetallic.

y. Wireway Installation:
   - Install wireway, as indicated on the Drawings.
   - Securely support wireways at intervals not to exceed 5 feet (1500 mm) and at each end or joint for
     individual sections.
   - Attach wireways and related materials under the provisions of this Section.
   - Run exposed wireways parallel or perpendicular to walls, structural members, or intersections of
     vertical planes to maintain headroom and provide a neat appearance.
   - Close dead ends of wireway with fittings by the same manufacturer.
   - Gasket each joint in oiltight gutter.
   - Mount raintight gutter in horizontal position only.
   - Maintain grounding continuity between raceway components to provide a continuous grounding path.

z. Telecommunications Outlet Box Installation:
   - Provide 4-inch by 4-inch by 2-inch (100 mm by 100 mm by 50 mm) deep outlet boxes for mounting
     telecommunications outlets with single- or double-gang plaster rings as required, or as indicated on
     the Drawings.
   - Do not install outlet boxes back to back in walls. Provide minimum 6-inch (150 mm) separation,
     except provide minimum 24-inch (600 mm) separation in acoustic-rated walls.
   - Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate
     masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit
     conduit hubs to be located in masonry void spaces.
   - Provide knockout closures for unused openings.
   - Support telecommunications outlet boxes independently of conduit.
   - Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet
     boxes.
   - Install outlet boxes in walls without damaging wall insulation.
   - Coordinate mounting heights and locations of outlet boxes mounted above counters, benches, and
     backsplashes.
   - Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs,
     accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush
     outlet boxes in hollow stud wall.
   - Provide cast outlet boxes in exterior and wet locations.
Section 27 00 00 – Communications continued

aa. Raceway Identification Banding:

- Degrease and clean surfaces to receive tape labels.
- Exposed conduits and wireway, including raceways above lay-in or accessible ceilings, together with associated pull boxes to be banded at intervals of not over 10 feet (2500 mm) and at direction changes. Two-band identification to be different contrasting colors as follows:

<table>
<thead>
<tr>
<th>Raceway Use</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grounding</td>
<td>Green</td>
</tr>
<tr>
<td>Building fire alarm system/voice evacuation</td>
<td>Red</td>
</tr>
<tr>
<td>Telecom/data</td>
<td>Yellow</td>
</tr>
<tr>
<td>Facility management system (FMS) and general</td>
<td>Blue and black</td>
</tr>
<tr>
<td>control circuitry</td>
<td></td>
</tr>
<tr>
<td>CCTV</td>
<td>White</td>
</tr>
<tr>
<td>Building monitoring and security</td>
<td>Gray</td>
</tr>
<tr>
<td>Controls (non-FMS)</td>
<td>Brown and white</td>
</tr>
</tbody>
</table>

bb. General Cable Tray Installation Methods:

- Cut standard straight sections of materials to length in the field.
- Deburr and file rough cable tray edges and any cut sections.
- Cable tray locations shown on the Drawings are approximate unless dimensioned.
- Install cable tray as shown on the Drawings and securely attach under the provisions of this Section.
- All cable tray ladder or trough to be accessible.
- Maintain minimum 6-inch (150 mm) clearance between cable tray and piping. Locate cable tray at least 12 inches (300 mm) away from heat sources such as parallel runs of flues, steam or hot water pipes, and heating appliances.
- Run exposed and concealed cable tray parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance.
- Passageways to not be obstructed.
- Cable tray routed at the ceiling to be routed within the assigned communications utility space.
- Install appropriate cable tray bends, dropouts, and other accessories to protect minimum cable bend radius and provide adequate support at locations where cable direction changes occur.

c. Provide firestopping per code requirements at all fire wall penetrations.

dd. Innerduct Type to be Used:

- Underslab and Underground Conduit Installation: Outdoor or indoor innerduct.
- Aboveground, Exterior, and Interior Conduit Installations: Indoor innerduct.
- Interior Exposed Locations Including Cable Tray Installations:
  - Nonplenum Areas: Indoor innerduct.
  - Plenum Areas: Plenum-listed innerduct.

e. Innerduct Installation:

- Pull innerduct through conduit and wireways, or place innerduct in cable trays using continuous unspliced lengths of innerduct between pull boxes, and/or section termination points as indicated on the Drawings.
- Cut innerduct square. Deburr cut ends.
- Bring innerduct to the shoulder of fittings and couplings and fasten securely.
**Section 27 00 00 – Communications continued**

- Wipe innerduct and fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.
- Provide suitable innerduct slack in pull boxes, and at turns to ensure that there is no kinking or binding of the tubing.
- Make changes in direction of communications innerduct runs with sweeps of the longest possible radius and at least 10 times the inside diameter of the innerduct.
- During innerduct pulling, care to be taken to avoid excessive tension, which can cause deformation of the innerduct. Inspect innerduct following placement and replace any damaged sections.
- Indoor Conduit Installation:
  i. Arrange innerduct neatly, cut to proper length, and remove surplus. Provide trained and bundled innerduct pigtails extending at least 18 inches (450 mm) beyond exposed conduit openings.
  ii. At locations where the ends of innerduct sections appear in a pull box, join the pulltape and then splice innerduct sections together using couplers which do not reduce the inside diameter of the innerduct.
- Cable Tray Installation: Tie wrap innerduct to one side of vertical ladder rack every 2 feet (600 mm) minimum, and to one side of horizontal ladder-type cable tray every 5 feet (1500 mm) minimum.
- Following installation, visually inspect innerduct, remove any burrs at openings, and, if necessary, clean innerduct interior.

**ff. Pulltape and Installation:**

- All conduit runs longer than 10ft shall have pulltape with pre-printed footage markers installed.
- Following conduit or innerduct installation, install pulltape (muletape) with preprinted foot markers in all sections longer than 10ft, except runs with openings serving cleanroom areas. Tie the pulltape securely to wall racking at each location.
- Verify lengths at the time of installation and provide as-built documentation.

**gg.** Provide ground connections and bonding continuity between raceway and cable tray sections, boxes, enclosures, cabinets, and fittings as required.

**End of Section**

**Section 27 10 00 – Structured Cabling** (Telephone Backbone Cabling; Optical Fiber Backbone Cabling; Category 6A Backbone Cabling; Category 5E Horizontal Cabling)

1. Telephone Backbone Cabling:
   a. Furnish and install all labor and materials required for the installation of a voice backbone cabling distribution system. This system is intended to provide for distribution of traditional analog and digital dial tone. Owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.
   b. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
   c. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the workmen on the job shall have attended a vendor sponsored training program covering installation and termination of cable.
   d. Guarantee:

      - Guarantee all work against faulty and improper material and workmanship for a minimum period of 1 year from the date of final written acceptance by Owner, except where guarantee or warranties for longer terms are specified herein.
Section 27 10 00 – Structured Cabling continued

- Upon notification of a problem, the warranty provider shall furnish within 48 hours and at no cost to the owner, such labor and materials as are needed to restore the system to proper operation.

c. Products:
   - Outdoor telephone backbone
     i. Backbone cable: any 24 AWG REA PE89 or PE39 cable, pair count as specified on drawings.
     ii. Termination: Circa Enterprises 1880 ECA, sized to match pair count of cable, fully populated with Circa 3B1FS 5-pin protector modules.
   - Indoor telephone backbone
     i. Backbone cable: Any ARMM type shielded twisted pair, pair count as specified on drawings.
     ii. Termination: 110 blocks with legs with C5 block connectors, sized appropriately to accommodate specified pair count.
     iii. 110 wire management: Jumper troughs installed between each 300 pair of 110 blocks.

f. General Installation:
   - The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings. Manufacturer installation specifications shall take precedence if there is a conflict with this section.
   - Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
   - Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated. Unless otherwise noted on the drawings, all cable should be assumed to be rated CMR.
   - All cable shown on drawings to be routed in conduit and cable tray system, where provided.
   - At the same time cable is pulled into a cable pathway, also install a mule tape of appropriate size to facilitate future cable pulls along those pathways.
   - Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
   - Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
   - Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.

g. Telephone Backbone Installation:
   - Follow manufacturer instructions when installing and terminating cable.
   - When breaking out cables with more than one 25-pair binder group, each binder group must be identified with a cable tie of appropriate color at the point of fan out.
   - Outdoor telephone backbone cable:
     i. Terminate cable in lighting protection units on both ends of the cable.
     ii. Install shield bond connectors at each end of each cable. Bond this connector to the bonding point inside the lightning protection unit.
     iii. Bond the lightning protection unit to the telecommunications grounding busbar.
Section 27 10 00 – Structured Cabling continued

- Indoor telephone backbone cable:
  i. Terminate cable onto wall mounted 110 blocks. The location of this telephone backbone cabling block shall be coordinated with the work specified in the horizontal cabling section. The telephone backbone cabling block shall be placed under any 110 blocks installed as part of the work specified by the horizontal cabling specification.
  ii. Install shield bond connectors at each end of each cable. Bond this connector to the telecommunications grounding busbar.

- Lightning protection, backbone 110 blocks, and special dial tone 110 blocks shall be organized into a logical and easy to use cross connect field, with suitable wire management for cross connects between blocks, both vertically and horizontally. The scope of this work does not include installation of the special dial tone 110 blocks, however, it does include coordination with this work to provide a logical and easy to use cross connect field complete with cable management for routing of cross connect jumpers.

h. Telephone Backbone Cable Identification:

- Each telephone backbone cable shall be assigned a unique identifier consisting of the following components:
  i. Abbreviation for the originating telecommunications room. Typical originating telecommunications room is MDF.
  ii. Abbreviation for the terminating telecommunications room. Typical terminating telecommunications room will be IDF-B, IDF-C, etc.
  iii. Pair count.

- The unique cable ID shall be constructed from these 3 components. For example, if you were labeling a 25 pair cable that is run from the MDF room to IDF D, your cable label would be MDF-IDF-D-25.
- Cable shall be labeled at each telecommunication room, near the location that the cable enters the telephone punch blocks.
- Cable shall be labeled every 50’ along the length of the cable in open trays, and on each side of all wall penetrations.
- Cable routed in conduit systems shall be labeled at each pull point. This includes the every time cable enters or exits a conduit, j-box, or pull vault.
- Labels shall consist of permanent typewritten label systems. Hand written labels are not acceptable.

i. IDF and Service Entrance Rooms:

- Construction of the backboards, overhead ladder racking, and open relay racks is specified in other sections and is not included in work specified in this section.
- Telephone backbone cable shall be routed onto overhead ladder racking systems and around the room to the backboard location indicated for termination of telephone backbone cabling.

j. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

k. The owner will perform all cross-connects and patching unless otherwise noted.

l. Grounding:

- This specification does not include a grounding system. Grounding is specified elsewhere. That work will install a ground busbar mounted on the backboard in the IDF.
Section 27 10 00 – Structured Cabling continued

- A 6AWG insulated conductor shall be run from the telecommunications grounding busbar to the shield of the indoor cable or to the ground point of the outdoor lightning protection.
- All grounding shall be in compliance with the NEC code Article 800, Article 250, well as EIA/TIA standard 607.

m. Cable Testing:
- Provide 48 hour advance notice of testing.
- Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
- Remove all defective cables from pathways system. Do not abandon cables in place.
- The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
- The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
- All test results and corrective procedures are to be documented and submitted with the as-built drawings.

n. All telephone backbone twisted pair cabling shall be tested for grounds, shorts, continuity of conductors and shields, reversals, and transpositions. The contractor shall guarantee 99% good pairs on all backbone cable with no more than one bad pair in any binder group.

o. Acceptance is upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables/wires installed.

p. As built documentation shall include 3 copies of the following:
- Annotated CAD prints and disks of the electrical set of prints indicating routes of installed cables, slack loop locations, and termination points.
- All test results both in machine readable format as well as printed neatly bound and organized. Each test shall clearly indicate cable and pair designations.

2. Optical Fiber Backbone Cabling:

a. Furnish and install all labor and materials required for the installation of a Corning fiber cable system.

b. Owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.

c. The scope of this work includes coordination with the division 28 access control and CCTV security contractors who may need to place UTP cable and patch panels in open relay racks in the IDF.

d. Quality Assurance:
- Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed. Where conflicts exist between manufacturer instructions and these plans and specifications, the manufacturer instructions shall take precedence.
- The installed system shall be covered by the Corning Cable Systems Corning Extended Warranty Program.

e. The installed optical fiber cable system shall be covered by the Corning LANscape Extended Warranty Program. This warranty must cover each product component installed as well as the total performance of the optical fiber cable system. Corning Cable Systems shall guarantee to repair or replace defective products free of charge after installation.
Section 27 10 00 – Structured Cabling continued

f. Products:

- Fiber optic distribution units shall be sized according to total number of fiber panels or modules installed:
  - i. 1 to 4 panels/modules: Corning CCS-03U with integrated splice housing
  - ii. 4 to 12 panels/modules: Corning CCH-04U
  - iii. Above 12 panels/modules: provide as many Corning CCH-04U as are required to accommodate the panels/modules.

- Rack Mount Fiber Optic Splice Housing shall be sized according to the number of splice trays required.
  - i. 1 to 2 splice trays: no dedicated splice housing required if using Corning CCS-03U
  - ii. 1 to 12 splice trays: Corning CSH-03U
  - iii. 12 to 22 splice trays: Corning CSH-05U

- All fiber cables shall be of an all dielectric construction

- Outdoor Fiber Cable Package
  - i. Cable must be warranted by the Corning for use in outdoor applications and listed for use in applications requiring a UL listing of CMR or OFNR.
  - ii. Cable must utilize loose buffer tube construction with no more than 12 fibers per buffer tube.
  - iii. Cable must be water blocked, either with construction flooded or gel free with water swellable yarns and tapes.

- Indoor Fiber Cable Package
  - i. Cable must fire rated for use in the space it is installed.
  - ii. Individual fiber subunits shall consist of 900 micron tight buffer.

- Multi Mode Fiber
  - i. 62.5 micro multi mode fiber cable: Corning 62.5µm/125µm. Attenuation: 3.0 dB/km @ 850 nm; 1.5 dB/km @ 1300 nm. Minimum effective modal bandwidth: 200/500 Mhz/km.
  - ii. Multi mode ST fiber panels: Corning CCH-CP06-15T 6-fiber ST Panels
  - iii. Multi mode ST connectors: Corning 95-101-52-SP 62.5 micron anaerobic-cure connectors

- Single Mode Fiber
  - i. Cable: Corning SMF28 single mode fiber.
  - ii. 6-Fiber Single mode SC fiber modules pre-loaded with six factory SC/UPC pigtails: Corning CCH-CP06-3C-P03RH
  - iii. 12-Fiber Single mode SC fiber modules pre-loaded with twelve factory SC/UPS pigtails: Corning CCH-RM12-39-P03RH.

- All racking will be provided by work in other sections. No racking is specified in this section.

g. General Installation:

- The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings. Corning installation specifications shall take precedence if there is a conflict with this section.
Section 27 10 00 – Structured Cabling continued

- Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
- Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: OFNR, OFNP rated. Unless otherwise noted on the drawings, all cable should be assumed to be rated OFNR.
- All cable shown on drawings to be routed in conduit and cable tray system.
- At the same time cable is pulled into a cable pathway, also install a mule tape of appropriate size to facilitate future cable pulls along those pathways.
- Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks and cabinets.

h. Fiber Optic Cable Installation:

- Manufacturer instructions shall be carefully followed during the installation of fiber optic cable. Particular attention should be paid to pulling tension and bend radius.
- At least 30ft of slack cable shall be coiled neatly and mounted to the telecommunications backboards using Velcro tie wraps in at each termination point.
- Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- Fiber optic splicing/distribution shall be placed at the top of the left-most rack or cabinet in the IDF when viewed from the front of the rack or cabinet unless otherwise noted on the drawings or in this specification.
- Indoor Fiber Cable
  i. Where routed through tray system, all indoor fiber cable shall be installed in plenum rated inner duct.
  ii. Inner duct is not required where cable is installed in conduit and that conduit does not contain any other than fiber optic cables. In conduits that are populated with other cabling, inner duct shall be provided and installed.
- Outdoor Fiber Cable
  i. Each intermediate vault shall have 80ft of slack cable coiled and stored neatly.
  ii. Fanout kits shall be installed on all buffer tubes containing multi mode fiber.
  iii. Fanout kits are not required for single mode fiber.
- Multi Mode Fiber Cable
  i. Multi mode fiber cable shall be terminated with ST anaerobic-cure connectors.
  ii. Fiber shall be hand or machine polished according to Corning instructions.
  iii. Terminated fiber shall be mounted in standard color code order into ST bulkhead panels mounted in the fiber optic enclosures.
Section 27 10 00 – Structured Cabling continued

- Single Mode Fiber Cable
  i. Single mode fiber cable shall be terminated by fusion splicing factory SC/UPC pigtail modules onto the backbone cabling.
  ii. The fiber count in the SC/UPC pigtail modules shall be matched to the fiber count in the cabling being terminated.
  iii. If a cable has 6 single mode fibers, then a 6-fiber pigtail module shall be used to terminate that cable.
  iv. If a cable has 12 or multiples of 12 single mode fibers, then 12-fiber pigtail modules shall be used to terminate that cable.
  v. Fiber slack of buffer tubes or indoor fiber sub-units shall be neatly coiled within the fiber splice enclosure. No slack loops of buffer tubes shall be allowed in the cabinet or on the relay rack.
  vi. Each fiber cable shall be stripped to expose the 6 or 12-fiber sub units or buffer tubes upon entering the fiber splice enclosure and the sub units or buffer tubes routed to the splice tray.
  vii. A maximum of 12 strands of fiber shall be spliced in each tray and no more than one cable shall be spliced in a tray, which means that some trays will only contain 6 splices.

i. Fiber Optic Backbone Cable Identification
  - Each fiber optic cable shall be assigned a unique identifier consisting of the following components:
    i. Abbreviation for the originating telecommunications room. Typical originating telecommunications room is Core1 or Core 2.
    ii. Abbreviation for the terminating telecommunications room. Typical terminating telecommunications room will be MDF, IDF-B, IDF-C, Warehouse IDF, etc.
    iii. Fiber type: MM for multi-mode, SM for single-mode, or HY for a hybrid multi and single mode cable.
    iv. Strand count. If cable is a hybrid multi and single mode cable, the multi mode strand count should be indicated first, followed by the character slash “/” followed by the single mode strand count.

- The unique cable ID shall be constructed from these 4 components. For example, if you were labeling a hybrid 24 multi mode, 12 single mode fiber cable run from the MDF to IDF B, your cable label would be MDF-IDFB-HY-24/12.
  - Cable shall be labeled at each telecommunication room, near the location that the cable enters the fiber optic panels or splice enclosures.
  - Each splice tray shall be clearly labeled with cable ID and specific strand counts in that tray.
  - Cable shall be labeled every 50’ along the length of the cable in open trays, and on each side of all wall penetrations.
  - Cable routed in conduit systems shall be labeled at each pull point. This includes the every time cable enters or exits a conduit, j-box, or pull vault.
  - Fiber optic panels shall be labeled with the destination of the fiber cable, the fiber type, the strand number within the cable.

j. IDF Rooms:
  - Construction of the backboards, overhead ladder racking, open relay racks, and server cabinets is specified in other sections and is not included in work specified in this section.
  - In all IDFs, the fiber optic cable shall be routed onto overhead ladder racking systems. The installation shall be coordinated with work by others.
  - Fiber optic slack loops shall be placed in out of the way locations on the walls. Slack loops shall not be placed on the overhead ladder racking, open relay racks, or server cabinets.
Section 27 10 00 – Structured Cabling continued

- The sections that specify the work of installing the open relay racks in IDF rooms has stipulated that space at the top of the left most rack is to be reserved for fiber optic enclosures that will be installed as work specified in this section. Close coordination with the contractor installing the open relay racks is required.

k. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

l. The owner will perform all cross-connects and patching unless otherwise noted.

m. Cable Testing:
   - Provide 48 hour advance notice of testing.
   - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
   - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
   - Remove all defective cables from pathways system. Do not abandon cables in place.
   - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
   - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
   - All test results and corrective procedures are to be documented and submitted with the as-built drawings.

n. Fiber Optic Cable Testing
   - After all terminations have been completed, tests will be conducted using an OTDR prior to loss testing. Contractor will OTDR all fibers in both directions. OTDR testing will verify proper installation of the cable, splices, and connectors and will establish the length of the cable to be used during acceptance.
   - After OTDR testing on a span is complete, contractor shall then perform loss testing at two wavelengths specified below. Loss tests shall be recorded for each fiber for each wavelength. These values shall be used to perform acceptance calculations described below.
     i. Multi Mode fiber wavelength testing shall be at 850nm and 1310nm.
     ii. Single Mode fiber wavelength testing shall be at 1310nm and 1550nm.
   - Contractor shall perform span loss calculations to compute the maximum allowed loss for each span at each wavelength. These span loss calculations shall be compared to measured performance. Span loss shall be calculated based on manufacturer guaranteed performance at the measured wavelength adjusted by the length of the cable. To that figure, span loss shall add .5dB for each mated connector and .25dB for each fusion splice. This figure is the maximum loss at that wavelength that is allowed for the cable span.
   - A fiber cable is accepted when the measured loss in all fiber strands in the cable less than the calculated span loss.
   - Cables that are not accepted will be removed and replaced at the contractors expense.

o. Acceptance will be upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables/wires installed.

p. As built documentation shall include 3 copies of the following:
   - Annoted CAD prints and disks of the electrical set of prints indicating routes of installed cables, slack loop locations, and termination points.
Section 27 10 00 – Structured Cabling continued

- All test results both in machine readable format as well as printed neatly bound and organized. Each test shall clearly indicate cable and fiber strand designations.

3. Category 6A Backbone Cabling:
   a. Furnish and install all labor and materials required for the installation of PANDUIT® Augmented Category 6 cabling shown on the drawings. This backbone cabling system will provide connectivity from the MDF to individual IDFs.
   b. Unless otherwise noted, owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.
   c. The scope of this work includes coordination with the division 28 access control and CCTV security contractors who may need to place UTP cable and patch panels in open relay racks in the IDF.
   d. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
   e. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
   f. The contractor shall have completed Panduit product and installation training.
   g. The Category 6A Backbone Cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
   h. Products:
      • Category 6A unshielded twisted pair cable: any cable warranted by Panduit to support 10 Gigabit applications.
      • Category 6A patch panels: Panduit CPPL24WBLY mini-com 24 port patch panels loaded with mini-com TX6A 10Gig jacks, black in color.
      • Relay rack horizontal wire management: Panduit WMPF2E 2 position wire management panel.
   i. General Cable Installation:
      • The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
      • Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
      • Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated.
      • All cable shown on drawings to be routed in conduit and cable tray system, where provided.
      • At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
      • Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
      • Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
Section 27 10 00 – Structured Cabling continued

- Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.
- Unless otherwise specified in the drawings, each IDF shall be served by 12 category 6A cables from the MDF.
- No installed category 6A cable shall exceed 90 meters in length.
- The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades. All support hardware shall be category 5e compliant, which means that D-rings and bridle rings are not allowed.
- Cabling shall be secured to the “J-hooks” and cable basket tray using Velcro wraps. The Velcro wraps will be cinched snug enough around the cable bundle to keep them uniform and routed neatly through the hooks or basket tray, but not so tight as to damage the cables themselves.
- Where conduit is not provided, cable shall be bundled neatly and attached securely to building structure at intervals not to exceed 5 feet. Cable shall not be attached to conduit, ducting, or piping. It shall not be allowed to drape over building elements.
- The category 6A cabling in the racks shall be installed with sufficient and appropriate rear mounting clips, brackets, and rear cable management to provide a secure and maintainable system.
- Unless otherwise noted below, the category 6A cabling shall be terminated in category 5e jacks that are mounted into category 6A patch panels.
- Horizontal front facing wire management panels are to be two position finger duct. A single wire management panel must be installed facing the front of the racks at the top position in the rack and under each patch panel. Thus, there is to be one more wire management panel than patch panel.
- In each IDF, space at the top of the left most rack shall be reserved for a fiber optic enclosure that will be installed under work specified in other sections.
- The category 6A backbone cable shall be installed into patch panels that are installed under the fiber optic enclosure referenced in the above item.
- Only category 6A backbone cabling shall be installed in the category 6A backbone patch panels. These panels shall be dedicated to backbone cabling use and not used for category 5e horizontal cabling.
- Unless specifically directed by the owner, relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.

i. Category 6A backbone cable identification:

- Each category 6A backbone cable shall be assigned a unique cable ID that is constructed out of the following components:
  - The IDF identification that the cable terminates in (IDF-B, IDF-C, etc.).
  - A 3-digit cable number. Each category 6A cable pulled to an IDF shall be number sequentially starting at 001 and increasing for each cable pulled to that IDF.

- For example, the label for the 12th cable run to from the MDF to IDF B shall have cable ID IDF-B-012.
- Each cable shall be identified with a typewritten cable tag containing the cable ID that shall be shall be placed on both ends of all cables, 6 inches from the connector and /or termination blocks. Each label shall be created using a label maker appropriate for cable installation. Hand written cable labels are not acceptable.
Section 27 10 00 – Structured Cabling continued

j. Patch Panel Identification
   • Above each set of jacks shall be a label indicating where the cabling runs to. If the cabling is run from the MDF to IDF-B, then the patch panel in the MDF shall be labeled “To IDF-B” and in IDF-B, the panel shall be labeled “To MDF”
   • Below each jack in every patch panel, the 3-digit cable number representing that jack. All cable numbers in all patch panels must be sequential.
   • Label shall be typewritten label tape, 3/8 inch wide with industrial strength adhesive.

k. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

l. The owner will perform all cross-connects and patching unless otherwise noted.

m. Cable Testing:
   • Provide 48 hour advance notice of testing.
   • Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
   • Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
   • Remove all defective cables from pathways system. Do not abandon cables in place.
   • The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
   • The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
   • All test results and corrective procedures are to be documented and submitted with the as-built drawings.
   • Category 6A cable:
     i. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
     ii. All category 6A cables shall be tested and certified to support 10GbaseT Gigabit Ethernet.

n. Acceptance will be upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables installed.

o. As Built Documentation:
   • The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, rack designations, as well as major conduit, cable tray, and installed cable routes.
   • The contractor shall include machine readable results of all test results neatly bound and organized. Each test shall clearly indicate jack and/or cable designations.

4. Category 5E Horizontal Cabling:
   a. Furnish and install all labor and materials required for the installation of a PANDUIT® category 5e cabling system. This horizontal cabling system will provide connectivity from each IDF to indicated station outlets, and provide and install all open relay racks and overhead ladder racking in the IDFs.
   b. Work described in this section includes all open relay racks in all IDF rooms, all overhead ladder racking for cable routing and support inside all IDF rooms.
   c. Unless otherwise noted, owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.
   d. The scope of this work includes coordination with the division 28 access control and CCTV security contractors who may need to place UTP cable and patch panels in open relay racks in the IDF.
Section 27 10 00 – Structured Cabling continued

e. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
f. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
g. The contractor shall have completed Panduit product and installation training.
h. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
i. Products:
   - Horizontal Cabling:
     i. Category 5e unshielded twisted pair cable: any manufacturer extra headroom (300+ Mhz) category 5e cable.
     ii. Category 5e Station Jacks: Panduit mini-com TX5e jacks CJ5E88TGXX, color to match electrical outlet color.
     iii. Single gang device plates: Panduit mini-com CFPnXX classic series device plates or CFPnSY for stainless steel device plates, number of jack positions as required. Match color and style of electrical trim.
     iv. Modular Furniture device plates: Panduit mini-com appropriate for modular furniture yet to be selected. This is a coordination issue. Bid shall include modular furniture device plates.
     v. Category 5e patch panels: Panduit CPPL48WBLY mini-com 48 port patch panels loaded with mini-com TX5e jacks, black in color.
     vi. Special alarm and emergency dial tone IDF termination hardware: 110 blocks with legs, terminations with C4 block connectors
   - Wireless Access Point Horizontal Cabling; see above horizontal cabling for materials with the following exceptions:
     i. Station termination: Panduit 2-port surface mount housing for above ceiling applications and 2-port single gang device plate for terminations in finished walls.
     ii. Category 5e Station Jacks: Panduit mini-com TX5e jacks.
j. IDF Racks and Ladder Rack:
   - Relay Racks: Chatsworth/CPI 55053-703 7ft relay racks
   - Relay rack horizontal wire management: Panduit WMPF2E 2 position wire management panel.
   - Overhead ladder racking: Chatsworth/CPI 10250-718 18” wide rack, and Chatsworth/CPI 10250-724 24” wide rack.
   - Cable Runway Radius Drop: Chatsworth/CPI 12100-7XX cross member runway radius drop and Chatsworth/CPI 12101-701 string runway radius drop.
   - Cable Retaining Post: Chatsworth/CPI 10596-706 6” retaining post and 10596-708 8” retaining Post
   - Mounting hardware, splices, grounding kits, and support brackets: Chatsworth/CPI
k. General Installation:

- The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
- Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
- Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated.
- All cable shown on drawings to be routed in conduit and cable tray system, where provided.
- At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
- Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.

l. Horizontal Category 5E Cable Installation:

- Unless otherwise specified, each station outlet shall consist of four (4) category 5e cables. Four port device plates shall be loaded with four jacks.
- No installed category 5e cable shall exceed 90 meters in length.
- The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades. All support hardware shall be category 5e compliant, which means that D-rings and bridle rings are not allowed.
- Cabling shall be secured to the “J-hooks” and cable basket tray using Velcro wraps. The Velcro wraps will be cinched snug enough around the cable bundle to keep them uniform and routed neatly through the hooks or basket tray, but not so tight as to damage the cables themselves.
- Where conduit is not provided, cable shall be bundled neatly and attached securely to building structure at intervals not to exceed 5 feet. Cable shall not be attached to conduit, ducting, or piping. It shall not be allowed to drape over building elements.
- Cabling shall be installed with a 15ft slack loop placed as near to the station outlet as possible. Often this slack loop will be in the cable tray or above a drop ceiling where conduit is stubbed from the outlet box.
- The scope of this work includes Installation of workstation cables into modular furniture systems. These systems have not yet been specified, so bid should be based on quantities of jacks shown on drawings. The actual installation shall be coordinated with the modular furniture system contractor. This includes assisting in planning cable routes into the furniture systems, selecting appropriate device plates for the furniture system, selecting appropriate outlet locations, and installing the cabling into the furniture systems at the appropriate time during the furniture system installation. Prior to the furniture system installation, the workstation cables will be pulled near the entrances to the furniture systems. The cabling shall be pulled with sufficient slack to reach the outlet location. This slack left coiled in a location where it will not be susceptible to damage. After the modular furniture systems are installed, the contractor will pull cable to the outlet locations and complete the cable installation.
Section 27 10 00 – Structured Cabling continued

As of the date of the bid set of construction drawings, the modular furniture plan is not complete. Drawings are representative only and should be used to bid quantities of cabling and outlets. The drawings do not reflect actual outlet locations.

- Installation of communications cabling into floor boxes shall be coordinated with the electrical sub contractor. Provide and install appropriate device plates for mounting the jacks in the electrical contractor installed floor boxes.
- Installation and termination of communications cabling will require coordination with the cable television cabling work specified in 27 70 80. Coordinate cable pulls and communications device plates with this work.
- The category 5e cabling in the racks shall be installed with sufficient and appropriate rear mounting clips, brackets, and rear cable management to provide a secure and maintainable system.
- Unless otherwise noted below, the category 5e cabling shall be terminated in category 5e jacks that are mounted into category 5e patch panels. All cables run to a single station device plate shall be terminated on sequential jacks in the patch panels.
- Horizontal front facing wire management panels are to be two position finger duct. A single wire management panel must be installed facing the front of the racks at the top position in the rack and under each patch panel. Thus, there is to be one more wire management panel than patch panel.
- In each IDF, space at the top of the left most rack shall be reserved for a fiber optic enclosure that will be installed under work specified in other sections. Rack layout shall be coordinated with this work.
- Unless specifically directed by the owner, relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.
- Wall phone wiring: All outlets for wall phones are to meet ADA height and location requirements for handicapped access. For specifically identified wall phone locations, a single voice outlet shall be installed to provide voice-only communication. Two category 5e cables shall be pulled to each location. At the station end, one cable shall be tagged and coiled for future use and the other cable shall be terminated in a single category 5e jack and the jack mounted into a stainless steel wall phone plate. Both of the category 5e cables pulled to a wall phone location shall be terminated on the IDF end in the category 5e patch panel system.
- Pay Phone wiring: All outlets for pay phones are to meet “American Disabilities Act” (ADA) height and location requirements for handicapped access. A single voice outlet shall be installed to provide voice-only communication. Two category 5e cables shall be pulled to each location. All pay phone cabling shall be terminated at the station end in a duplex device plate with jacks blue and gray in and in the IDF end on wall-mount 110-style punch blocks.
- Elevator wiring: For each elevator location, a duplex outlet shall be installed to provide voice-only communication. Two category 5e cables shall be pulled to each location. All elevator cabling shall be terminated in the IDF on wall-mount 110-style punch blocks. Installation of elevator system jacks shall be coordinated with the elevator installer. Provide cross connects to extend elevator dial tone from the telephone service entrance blocks to telephone backbone cabling, and then onto to this cabling.
- Fire and Security Alarm wiring: For each alarm location, a duplex outlet shall be installed to provide voice-only communication. Two category 5e cables shall be pulled to each location. All elevator cabling shall be terminated in the IDF on wall-mount 110-style punch blocks. Installation of alarm system jacks shall be coordinated with the alarm installer. Provide cross connects to extend elevator dial tone from the telephone service entrance blocks to telephone backbone cabling, and then onto to this cabling.
- The scope of this work includes coordination with the contractor installing the cable TV system. This coordination requires coordination of cable pulls and device plates where TV outlets share conduit and/or device plates with cable TV.
Section 27 10 00 – Structured Cabling continued

m. Wireless Access Point Category 5E Cable Installation:
   • Please refer to specifications outlined in the above Horizontal category 5e cable installation section.
   • Unless otherwise specified, each wireless access station outlet shall consist of two (2) category 5e cables.
   • Where the wireless access point station termination point is above the drop ceiling, the station outlet shall be terminated in a two port surface housing that is attached to the building structure or basket tray.
   • Where the wireless access point station termination is on a wall, it shall be mounted in a standard two port single gang device plate.
   • The wireless access point category 5e cabling shall be terminated on the category 5e patch panel system.

n. Horizontal cable identification:
   • Each category 5e cable shall be assigned a unique cable ID that is constructed out of the following components:
     i. The three digit building number.
     ii. The IDF identification that the cable terminates in.
     iii. A 4-digit cable number. Each cable pulled to an IDF shall be number sequentially starting at 001 and increasing for each cable pulled to that IDF.
   • For example, the label for the 92nd cable run to IDF B in building 16 shall have cable ID 016B0092.
   • Each cable shall be identified with a typewritten cable tag containing the cable ID that shall be placed on both ends of all cables, 6 inches from the connector and/or termination blocks. Each label shall be created using a label maker appropriate for cable installation. Hand written cable labels are not acceptable.

o. Device Plate identification:
   • Each device plate shall be labeled as follows:
     i. At the top of the device plate, the building number and IDF letter (for example, every device plate with conductors run to IDF B in building 16 shall have 016B at the top of the device plate).
     ii. Under each individual jack, the 4-digit cable number.
   • All jacks in a single device plate much have sequential cable numbers.
   • Device plate labeling shall be typewritten label tape with industrial strength adhesive.

p. Patch Panel Identification:
   • Each group of four sequential jacks representing a typical device plate in the category 5e panels must be labeled with the room number of that the device plate resides in. This room number must be the permanent room numbers assigned by the owner, not the construction room numbers. The room designation shall be placed above the jacks in the panel.
   • Below each jack in every patch panel, the 4-digit cable number representing that jack. All cable numbers in all patch panels must be sequential.
   • Label shall be typewritten label tape, 3/8 inch wide with industrial strength adhesive.

q. 110-Block Identification: Each 4-pair position on the special horizontal cable 110 blocks shall be labeled with the cable ID and the function (elevator, fire alarm, etc) on the 110 designation strip.
Section 27 10 00 – Structured Cabling continued

r. IDF and Service Entrance Rooms:
   • Backboards are specified in other sections and will be provided and installed by others.
   • Drawings indicate number of racks to install in each IDF and provide a diagrammatic view of the overhead ladder racking. The drawings are diagrammatic only and are not necessarily indicative of the amount of overhead ladder racking that will be required to support the cabling from where it enters the room and is routed to the open relay racks. The scope of this work includes installing any and all overhead ladder racking to support all voice/data cabling that is routed inside of each IDF.
   • Contractor is responsible for providing earthquake bracing and support for all racks installed in telecommunications rooms.
   • Each relay rack must have front facing vertical wire management chases installed on each side of the rack.
   • Racks shall be firmly fastened to the floor and have overhead ladder rack run from the top of the each rack to the wall at the rear of the rack.
   • Each IDF shall have space reserved in the top left most rack for fiber optic enclosures that are specified in other sections.
   • Relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.
   • Contractor shall install overhead ladder racking to provide bracing as well as pathway to support and route all cabling to racks in low voltage and telecommunication rooms. The overhead ladder racking shown on drawings is illustrative only and is meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of ladder racking hardware required to support the cabling described herein and shown on the drawings.
   • Overhead ladder racking must be installed to provide sufficient pathways to route limited energy cabling in the IDF rooms. Drawings are schematic design only and do not necessarily indicate the size, routing, or amount of ladder racking required to support all installed cabling. Size as needed; minimum size 18 inches. Category 5e bend radius shall be maintained by avoiding sharp corners where tray joins together at right angles as well as routing cable properly out of the tray and onto the relay racks using radius runway drops. Cable retaining posts shall be installed where needed to dress cable to the overhead ladder racking. When used, posts shall be installed with spacing no greater than 18”.

q. Termination Hardware: Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

r. The owner will perform all cross-connects and patching unless otherwise noted.

s. Grounding:
   • Furnish and install a telecommunications grounding system. This grounding system shall consist of a main ground busbar in the service entrance location and a ground busbar installed in each of the telecommunications rooms in the project.
   • The ground busbar shall be mounted on the IDF backboard.
   • A 2AWG insulated conductor shall be run from the main grounding busbar to each of the ground busbars in each telecommunications room. Conductor insulation shall be green in color.
   • All metallic cable tray, ladder rack, raceways, cable sheath/armor, enclosures, and equipment racks and other conductive surfaces shall be properly bonded with 5eWG insulated conductors to the grounding system. All paint and other coatings shall be removed at all contact surfaces to ensure proper ground.
Section 27 10 00 – Structured Cabling continued

- All grounding shall be in compliance with the NEC code Article 800, Article 250, well as EIA/TIA standard 607.

  t. Cable Testing:
  - Provide 48 hour advance notice of testing.
  - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
  - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
  - Remove all defective cables from pathways system. Do not abandon cables in place.
  - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
  - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
  - All test results and corrective procedures are to be documented and submitted with the as-built drawings.
  - Category 5e cable:
    - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
    - All category 5e cables shall be tested and certified to support 1000baseT Gigabit Ethernet.
  
  u. Acceptance will be upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables installed.
  
  v. As Built Documentation:
  - The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, rack designations, as well as major conduit, cable tray, and installed cable routes.
  - The contractor shall provide 3 copies of all test results neatly bound and organized. Each test shall clearly indicate jack and/or cable designations.

End of Section

Section 27 30 00 – Voice Communications (Switching & Routing Equipment; Telephone Sets, Facsimiles, & Modems; Messaging; Call Accounting; Call Management)

1. Campus Emergency Phones:

<table>
<thead>
<tr>
<th>Campus Emergency Phones Product</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Note(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercom System</td>
<td>Airphone</td>
<td>IE-JA door station</td>
<td>Flush mount with stainless cover. Or approved equal.</td>
</tr>
<tr>
<td></td>
<td>Airphone</td>
<td>IE-1GD handset</td>
<td>Or approved equal.</td>
</tr>
<tr>
<td></td>
<td>Airphone</td>
<td>PT=1210N 12V AC power supply</td>
<td>Or approved equal.</td>
</tr>
</tbody>
</table>

  a. N&TS will install the phones, the pedestals lights, and terminates all wires/cables related to campus emergency phones.
  b. NO emergency phones shall be planned without DPS and N&TS.
  c. Pedestals, or wall boxes, and pipe:
    - All phones require a mounting system and a pathway from that location back to the nearest Building Entrance Terminal (BET) or Intermediate Distribution Frame (IDF).
    - The location of that termination location shall be coordinated with N&TS.
Section 27 30 00 – Voice Communications continued

- Both the phones and the lights are low voltage systems and can run over one cable located in one conduit.
- Exterior phones are mounted on pedestals and interior phones are mounted in a wall box.
- Fabrication, foundation, and anchor bolts for exterior pedestals are to be performed by the Contractor.
- Conduit pathways for both exterior and interior phones are to be installed by the Contractor.

d. The emergency phones receive their dial tone and programming from The UO telephone system (PBX). This work is performed by N&TS.

e. Emergency Phones (information only): The UO has standardized on units manufactured by Gai-tronics, model 293-003. It is important to coordinate ANY variation from this standard with UO Network & Telecom Services because the central software and lights do not work with units from other manufacturers.

f. Lights (information only):
   - Each outside emergency phone is equipped with an LED/Lucite light unit that attaches to the phone, it lit at all times, and flashes when the phone has been activated. The flashing will stop at a predetermined time built into the light. (Lights were engineered by Cliff Dax, an engineer for the Technical Science Administration (TSA) within the College of Arts and Sciences.)
   - Lights are powered by 48 V +/- DC current provided by power supplies using a spare pair of the telephone system wire.
   - The power supplies are located at the campus telephone system hub locations.

g. Conduits and Cables:
   - Contractor provided and installed.
   - UO Network & Telecom Services terminations and activations.
   - Provide three (3) 1in conduits to each pedestal; one for future power flexibility; one for communication cables; one for future camera cables.
     i. The power conduit needs to have 1ft of separation from the communication and camera conduits once the conduits leave the pedestal base.
     ii. Conduits may not be daisy chained from pedestal to pedestal.
     iii. Pull boxes must be provided between the pedestal and point of service every 200ft.

- All of the phones and lights connect back to the building BET’s or IDF’s via telephone wire in conduit, tunnel, or other pathways.
- Where these telephones are outside, the cable used from the phone to the BET or IDF shall be flooded cable rated for underground burial in conduit.

h. Approved Campus Emergency Phone Exterior Pedestal image:
Section 27 30 00 – Voice Communications continued

i. Approved Campus Emergency Phone Wall box image:

![Emergency Phone Wall Box](image)

End of Section

Section 27 40 00 Audio Visual Communications (Systems; Electronic Digital Systems)

1. See also Classrooms Appendix.

2. Requires UO Media Services design input, review, and approval of cable types & sizes, pathway sizes & routes, and AV equipment locations.

End of Section

Section 27 70 00 Cable Television

1. Cable Television Cabling:
   
a. Furnish and install all labor and materials required for the installation of cabling that will support an OFOI cable TV distribution system. This work is to provide a “pull only” and termination of the station outlets for the system.
   
b. Owner will provide all amplifiers, splitters, taps, and IDF closet terminations. Others will provide televisions, video sources (VCR/DVD/etc), and all in-room drop cords. Close coordination with the owner will be required.
   
c. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
   
d. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the workmen on the job shall have attended a vendor sponsored training program covering installation of cable TV systems.
   
e. Guarantee:
      
      • Guarantee all work against faulty and improper material and workmanship for a minimum period of one (1) year from the date of final written acceptance by Owner, except where guarantee or warranties for longer terms are specified herein.
      
      • Upon notification of a problem, the warranty provider shall furnish within 48 hours and at no cost to the owner, such labor and materials as are needed to restore the system to proper operation.
   
f. Products Manufacturers Known to be Acceptable:
      
      • Amplifiers: by owner
      
      • RG6 drop cable: quad-shield Commscope, Belden
      
      • Cable TV Backbone Cable: Commscope PIII-625
      
      • Splitters/taps: by owner.
Section 27 70 00 Cable Television continued

- F-connectors: any manufacturer compression type F connectors similar to Thomas and Betts snap-n-seal product
- Station device plates: Panduit device plates with mini-com CMFSRIxx self terminating F connector.

g. Cable TV Distribution:
- All cable TV drop cable shall be CATV/CL2 or CATVP/CL2P rated quad-shield RG6.
- Cable TV backbone cable shall be run from the service entrance room location to each of the telecommunication rooms. Cable TV backbone cable shall be of .625” rigid construction.
- The actual cable TV distribution system itself will be provided by others. This work is to install horizontal and backbone cabling and station termination of horizontal cable.

h. Installation:
- The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
- Install each cable TV drop as an uninterrupted conductor section between the IDF location and the station outlet. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications. Daisy chaining of station outlets is not acceptable.
- At the IDF location, all cable TV RG6 drop cabling shall be installed to an owner-specified area of the communications backboards, identified, and coiled for finish work by others.
- The station end of the drop cable must be terminated with a compression F connector and installed into a self terminating F connector bulkhead mounted in a communications device plate.
- There are locations where the station end device plate will be shared with the existing augmented category 5e cabling. Coordination with the 271513 sub-contractor will be required to coordinate the provisioning of communications device plates. It is in the scope of this work to coordinate the device plate and cable installation in these shared locations.
- Backbone cable TV cabling shall be installed as shown on the drawings. This cable shall be identified and coiled on the owner-specified area of the communications backboards.
- Cable pulling shall be coordinated with other limited energy cabling installation contractors to eliminate any possibility of damaged cabling.
- The cable TV cabling in the IDF shall be installed with sufficient and appropriate mounting clips, brackets, and cable management to provide a neat, secure, and maintainable system.
- Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed (i.e., CATV/CL2, CATVP/CL2P rated).
- All cable shall be routed through the building cable tray/conduit system, where available.
- Where cable tray or conduit is not available, cable bundled neatly and shall be attached to building structure at intervals not to exceed 5 feet.
- At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
- The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades.
- At no point will any station cable be tie wrapped or fastened to the cable tray. After cables have exited the cable tray they will be tie wrapped to the "J-hooks". The tie wraps will be cinched snug enough around the cable bundle to keep them uniform and in the hooks, but not so tight as to damage the construction of the cables themselves.
- Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
Section 27 70 00 Cable Television continued

- Contractor shall closely coordinate and work with the owner and engineer on the construction, termination and routing of the cabling in the IDF's, overhead ladder racking, and backboard space allocation.

  i. Identification:
  - Cable tags containing a unique cable ID designator shall be placed on both ends of all cables, 6 inches from the connector. Each label shall be typewritten with permanent ink with the appropriate cable number as indicated. Hand written cable labels are not acceptable
  - Individual cable sheaths and station end faceplates shall be labeled with the designator of the specific cable. Cable designation shall consist of the IDF letter designation and the individual cable number. Cable sheaths shall be labeled on each end. Station device plates shall be permanently labeled in typewritten ink with the letter of the IDF the cable is run followed by the 3 digit cable number. Cables shall be numbered sequentially, starting from 1. Each IDF termination shall be labeled with cable number and permanent (not construction) room designation

  j. All terminations of cable TV RG6 shall be via compression F connectors.

  k. System Testing:
  - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
  - Conduct cable testing as described below upon completion of installation. Test fully completed systems only. Piecemeal testing is not acceptable, except by prior written approval from the Architect.
  - Remove all defective cables from pathways system. Do not abandon cables in place.
  - Testing shall involve continuity testing to verify that the installed cabling has not be cut or shorted during the installation process.
  - The owner further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
  - All test results and corrective procedures are to be documented and submitted to the Owner within fourteen (14) working days of test completion.

  l. Acceptance:
  - Upon receipt of the Contractor's documentation of cable testing, the Architect will review the installation and may request a test in his presence, of up to 1% of the cable drops installed.
  - The contractor shall provide the owner with hands-on training for the use and operation of the system.

  m. As Built Documentation:
  - The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, as well as major conduit, cable tray, and installed cable routes.
  - The contractor shall provide CAD prints of the one-line diagram of the system showing signal levels at every device, including every outlet in the system.
  - The contractor shall provide 3 copies of all test results neatly bound and organized. Each test shall clearly indicate cable designations.

End of Section

END OF DIVISION 27
Section 28 00 00 – Electronic Safety & Security (Maintenance; Common Work Results; Schedules)

1. See also Section 08 30 00 – Specialty Doors & Frames.
2. See also Section 09 50 00 – Ceilings.
3. See also Division 14 for Elevator requirements.
4. See also Division 23 for Instrumentation & Control for HVAC (DDC) and VFD for HVAC Standards.
5. See also Division 26 for Electrical.
6. See also Division 27 for Communications.
7. See also Laboratory Appendix for environmental controls, alarming, notification, signage, etc.
8. See also appendices for various space type requirements.
9. NEC and IEEE working clearance required and to be maintained.
10. NEC and IEEE definitions will apply to all standards that follow.
11. UO goals of sustainability, life-cycle costs, maintainability, serviceability, high performance, quality equipment, and efficient campus inventory must be maintained. First costs may be impacted slightly as a result, but a better product will follow.
12. Access control, CCTV, and intrusion systems information shall be considered sensitive information. As such, the release of detailed information about the systems and how such systems are monitored shall be limited to those with a ‘need to know’.
13. Exterior placement of any and all equipment requires CPRE and FS approval to ensure compliance with the UO Campus Plan. If approved, all University policies shall be followed.
14. Building system zoning requires FS and Utilities & Energy Management PM review and approval.
15. NO demolition of one item shall occur in order to repair and/or replace another item.
16. ALL deleted items must be removed and not just abandoned. All abandoned or deleted conductors shall be physically removed. Conduits, pull boxes and outlet boxes small remain.
17. Systems and system components in new construction, remodels, and retrofits are to be compatible with existing systems and system components to the extent possible.
18. System Installation Requirements:
   a. Systems shall be fully commissioned prior to acceptance.
   b. Installer shall have a minimum of 5 years of full time experience in the installation and maintenance of systems with factory training and certification; documentation required.
   c. Boxes, panels, equipment gutters, etc. are to be cleaned inside and out upon completion and prior to acceptance of work
   d. Warranty repair response time: 4 hours maximum
19. Training provided MUST be to a maintenance/technician level for ALL systems. Trainings shall be conducted only by factory certified, factory trained personnel who can demonstrate a minimum of 2 years of experience in the installation and operation of the access control system installed.
20. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent FS personnel prior to specification and/or installation.
21. Accessibility of Equipment:
   a. Refer to and abide by all OSHA requirements, as appropriate.
Section 28 00 00 – Electronic Safety & Security continued

b. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.

c. Equipment above ceilings shall be located within corridors or above doorways.

d. Design and installation of all equipment shall be accessible for operation, maintenance, repair, and replacement as required by NEC and OSHA General Requirements. - 1910.303.

e. Thorough coordination of ceiling access(s) with electrical equipment above.

f. In mechanical and electrical rooms any components requiring routine service/maintenance must be installed / mounted below 7ft in height. Prior to installation of any component above 7ft requires onsite review and explanation with FS Maintenance and/or FS Electrical Supervisor.

g. Inaccessible Equipment:
   - If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
   - ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.

22. Identification:

a. See also Division 26 for electrical identification requirements.

b. Fire alarm wiring / cabling must be marked as such every 50ft.

c. During finish construction, labeling is to be reviewed and approved by the PM, EH&S (Fire Alarm systems), and FS Lock & Door Shop (ACS, Surveillance, and Intrusion systems).

d. All conductors (copper and fiber) shall be individually labeled within cabinets and at both ends of conductor.

e. Fire Alarm: All circuit breakers, junction boxes, covers, etc. are to be labeled ‘Fire Alarm’ and red in color from the manufacturer; not just painted red.

23. Raceway & Boxes Conduit:

a. As-built one-line drawing(s) is required for all buried, encased, concealed wiring and conduit.

b. PM, EH&S (Fire Alarm systems), and FS Lock & Door Shop (ACS, Surveillance, and Intrusion systems) are to walkthrough the project to view pathways prior to encasement or enclosure.

c. Fire Alarm and monitoring, and data/telecom wiring can share the same cable trays or conduit with N&TS and EH&S approval, and with proper and complete coordination.

End of Section

Section 28 10 00 – Electronic Access Control & Intrusion Detection (Access Control; Intrusion Detection)

1. Access Control Systems (ACS):

a. The ACS system installed under this scope of work shall provide controlled access to building interior and real-time monitoring of doors at multiple locations simultaneously.

b. The ACS system shall be controlled by FS Lock & Door Shop existing computer system. ACS system hardware installed under this scope must be compatible with current version and allows future upgrades.

c. The ACS building controllers shall be LAN addressable and shall be connected to FS Lock & Door Shop provided Ethernet receptacles.

d. At reader doors where power assist devices are located, the ACS system shall shunt the exterior power assist operator button while door is locked so that it may only be used with valid card presentation to protect power assist drive assembly.
Section 28 10 00 – Electronic Access Control & Intrusion Detection continued

e. The ACS system shall control primary access points to be determined with each project and requires FS Lock & Door Shop review and approval.
f. All doors controlled by ACS shall be equipped with request-to-exit (REX) devices and door contacts.
g. Required Submittals:
   • Manufacturer’s specifications and technical data for all components.
   • List of programming decisions that need to be made by the FS Lock & Door Shop for proper operation of the system. Included in this list shall be all console/local passwords or access codes as well as any proposed field-assigned passwords or access codes.
   • Panel and power supply drawings layouts on backboard allocated for CCTV and ACS in telecommunications closet. Indicate desired location of 120 VAC power receptacles on this drawing for coordination.
   • One-line diagram showing all devices, controllers, and cable types between devices.

h. Access Control Products: The appropriate product models are to be approved by designated FS Lock & Door Shop during project design and specification.

<table>
<thead>
<tr>
<th>Access Control Product</th>
<th>Manufacturer</th>
<th>Model:</th>
<th>Note(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building ACS Controllers</td>
<td>AMAG</td>
<td>Multi-Node 2100 series</td>
<td>Required to integrate into existing campus access control system.</td>
</tr>
<tr>
<td>Proximity Readers</td>
<td>Indala</td>
<td>FlexPass mid-range FP3213A+ / 10022</td>
<td>To be 26 Bit Wiegand compliant for card only entry. Or with optional keypad entry.</td>
</tr>
<tr>
<td>ACS Rex Device</td>
<td>Bosch</td>
<td>To be approved</td>
<td></td>
</tr>
<tr>
<td>ACS Door Contact</td>
<td>Sentrol</td>
<td>To be approved</td>
<td></td>
</tr>
<tr>
<td>ACS Door Prop Alarm</td>
<td>Design Security, Inc.</td>
<td>To be approved</td>
<td>With key switch.</td>
</tr>
<tr>
<td>Electrified Locking Device</td>
<td>VonDuprin</td>
<td>6000 series; 24VDC strike plates</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>HES</td>
<td>9600 series; 24VDC surface mounted rim device</td>
<td>-</td>
</tr>
<tr>
<td>Magnetic Door Lock Device</td>
<td>-</td>
<td>-</td>
<td>Allowed ONLY with prior FS Lock &amp; Door Shop review and approval.</td>
</tr>
<tr>
<td>Wire &amp; Cable</td>
<td>-</td>
<td>CAT 5</td>
<td>UL listed for use in plenum spaces. Installed per manufacturer’s instructions.</td>
</tr>
<tr>
<td>Outdoor Wire &amp; Cable</td>
<td>-</td>
<td>CAT 5</td>
<td>UL listed for outdoor use; wet environments; recommended for such use by manufacturer. Installed per manufacturer’s instructions.</td>
</tr>
<tr>
<td>Door Release Button</td>
<td>-</td>
<td>-</td>
<td>Momentary switch as approved by FS Lock &amp; Door Shop. Located at DVR or monitor station.</td>
</tr>
<tr>
<td>Post Base for Card Reader</td>
<td>-</td>
<td>-</td>
<td>OFCI; Division 08</td>
</tr>
</tbody>
</table>

2. Access Control Systems (ACS) Installation:
   a. Quality Assurance: All workers involved with this installation must have completed manufacturer training and have a minimum of 2 years experience installing like equipment or have a minimum of 5 years of installation experience with specified equipment.
   b. Install all equipment and cabling in a manner consistent with manufacturer recommendations and instructions.
Section 28 10 00 – Electronic Access Control & Intrusion Detection continued

  c. Install all devices and components shown on drawings required for proper operation of the system.
  d. Mount devices level and in a uniform fashion.
  e. Install FS Lock & Door Shop furnished post bases for card readers in coordination with concrete pours. Also coordinate installation and pours with required power.
  f. Contractor shall furnish and install all cabling associated with the operation of both CCTV and ACS system.
  g. Contractor shall not pull any ACS cables in conduits containing or intended to contain voice and data wiring.

3. Starting Access Control (ACS) Equipment & Systems:
   a. Coordinate with FS Lock & Door Shop setup of Ethernet network and IP address assignment; setup programming for ACS building controllers; reader definitions; door alarm points.
   b. When the installation of all system components and cabling is complete, initial testing shall consist of local walk-through, and working demonstration of all features.
   c. All passwords or access codes for the system shall remain at factory default unless the factory default poses a security risk, in which case all passwords shall be communicated in writing and give written FS Lock & Door Shop approval of such change. Any costs associated with password recovery shall be borne by the Contractor.
   d. The Owner shall be provided with a minimum of 2hrs training of the installed system after all startup and testing procedures have been completed and as-built documentation delivered.
      - Minimum hours of required training may increase based upon the system size and complexity.
      - Training will include both an overview for building occupants and an in-depth session for FS maintenance to a service level.
   e. Prior to FS Lock & Door Shop final acceptance of the system all zones must be tested in the presence of designated representative(s) from FS Lock & Door Shop.

   a. With as-builts, record drawings, O&M manuals, etc. deliverables a complete list is required of all system devices, power packs, etc. noting their installed locations.
   b. Guarantee all work against faulty and improper material and workmanship for a minimum of 1 year from the date of final written acceptance by FS Lock & Door Shop, except where guarantee or warranties for longer terms are clearly requested and specified.
   c. During the entire warranty period the Contractor must provide all related software upgrades to the installed system(s).
   d. Upon notification of a problem, the warranty provider shall furnish within 48 hours at no cost to the Owner such labor and materials as are needed to restore the system to proper operation.
   e. During the entire warranty period the Contractor must guarantee a 4 hour response time for problem resolution.
   f. Prior to the end of the warranty period, with FS Lock & Door Shop present, the Contractor is to conduct a 1 year inspection repairing any item(s) at Contractor’s cost and provide a report of system equipment and system operational functions.

End of Section

Section 28 20 00 – Electronic Surveillance (Video Surveillance; Electronic Personal Protection)
Section 28 20 00 – Electronic Surveillance continued

1. Surveillance and Intrusion Systems:
   a. All labor, equipment, materials, documentation and services necessary for a complete and operational Closed Circuit TV (CCTV) monitoring system. Work will include the installation of wiring, cabling, cameras, power supplies, digital video controllers, flat panel displays, and other components necessary to provide a fully operational CCTV monitoring.
   b. Installed system shall be a turnkey package including design review, construction supervision, coordination, and commissioning services.
   c. OFOI and/or OFCI hardware will be determined by each project with the FS Lock & Door Shop.
   d. The system wiring, equipment, and installation shall comply with all listed requirements as well as any and all applicable national, state and local codes and standards.
   e. System Description:
      • The CCTV monitoring system installed shall provide for real-time monitoring of multiple cameras at multiple viewing locations simultaneously, as well as, recording for later review of video.
      • The CCTV system shall be equipped with a video recorder (DVR or NVR where applicable NVR equipment is specified) that shall have the following characteristics:
         i. Equipped with a 16 port PoE (Power over Ethernet) switch or 16 camera ports.
         ii. Equipped to serve remote display of live and recorded video over client LAN. Client software shall be provided with DVR / NVR.
         iii. Record at a minimum of 12 frames per second with DVR system and 5-7 frames per second with NVR system for each camera location simultaneously.
         iv. Feature that it records only when motion is detected. Motion is defined to be changes in pixels on a camera allowing the user to specify the percent pixel change that defines motion.
         v. DVR / NVR shall be a 16 camera unit with 500 GB storage capacity.
         vi. Stored video shall be retrievable from the DVR / NVR indexed by time and have fast-forward and rewind functions.
         vii. DVR shall be equipped with a keyboard, mouse, and 17” color LCD display.
         viii. DVR / NVR shall allow live monitoring and continuous recording while viewing stored video.
      • Cameras shall:
         i. Be 1/3 inch color cameras having minimum of 480 TV lines of resolution. IP cameras capable of low-light recording (IR if needed) and high resolution (720 lines of resolution or greater). All camera models must be approved by FS Lock & Door Shop.
         ii. Have vari-focal lenses and auto-iris to allow for field-of-view optimization and ability to automatically adjust to changing lighting conditions. Lenses shall be those recommended by camera manufacturer.
         iii. Be powered over limited energy conductors from a central power supply mounted in the communications closets of Point of Entry.
         iv. Mini-dome cameras are to be used at elevator cab ceilings. Elevator Subcontractor will install coax cable in elevator traveling cable. CCTV Contractor shall run cable from elevator machine rooms to DVR / NVR and monitor. Coordinate camera installation in elevators with elevator installer.
         v. Inventory of cameras may include: areas with cash handling equipment; bike storage; primary entries; stairwells; etc. Camera inventory and locations will be determined by each project and require FS Lock & Door Shop review and approval.
Section 28 20 00 – Electronic Surveillance continued

- The CCTV system shall be equipped with FS Lock & Door Shop specified number of cameras.
- Surveillance Products: The appropriate product models are to be approved by designated FS Lock & Door Shop during project design and specification.

<table>
<thead>
<tr>
<th>Surveillance Product</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Note(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Video Recorder</td>
<td>AMAG stand alone NVR or DELL server</td>
<td>To be approved</td>
<td>Where applicable NVR system and equipment are requested and specified.</td>
</tr>
<tr>
<td>Digital Video Recorder</td>
<td>Peisco</td>
<td>To be approved</td>
<td>Required to integrate into existing DPS remote view software. See also, previous system description within this section.</td>
</tr>
<tr>
<td>Standard Color Camera</td>
<td>Panasonic or Sony</td>
<td>To be approved</td>
<td>Or approved equal.</td>
</tr>
<tr>
<td>Minidome Color Camera</td>
<td>Bosch FlexiDome, Sony</td>
<td>To be approved</td>
<td>Vandal resistant 24 VAC, with variable focal lens and auto iris. Or approved equal.</td>
</tr>
<tr>
<td>Exterior Color Camera</td>
<td>Panasonic or Sony</td>
<td>To be approved</td>
<td>Weatherproof. Or approved equal.</td>
</tr>
<tr>
<td>Exterior Color Camera</td>
<td>Panasonic or Sony</td>
<td>To be approved</td>
<td>Weatherproof. Or approved equal.</td>
</tr>
<tr>
<td>IP Cameras</td>
<td>AXIS or approved</td>
<td>To be approved</td>
<td>IP cameras must be compatible with AMAG NVR Solutions system.</td>
</tr>
<tr>
<td>Cameras</td>
<td>ALL</td>
<td>ALL</td>
<td>At least 720 lines of TV resolution during normal lighting conditions. Low-light cameras may switch to black &amp; white in low lux conditions. See also, previous system description within this section.</td>
</tr>
<tr>
<td>Camera Power Supply</td>
<td>Altronix</td>
<td>To be approved</td>
<td>16 fused output and 24 VAC. Or approved equal.</td>
</tr>
<tr>
<td>Camera Mounts &amp; Adapters</td>
<td>-</td>
<td>To be approved</td>
<td>ALL cameras to include necessary mounts and adapters recommended by manufacturer for the application.</td>
</tr>
<tr>
<td>Camera Cable</td>
<td>-</td>
<td>To be approved</td>
<td>Cat5e or Siamese type depending on installation.</td>
</tr>
<tr>
<td>Security/Burglar Alarm</td>
<td>Radionics, Bosch, or Detection System Control Units</td>
<td>-</td>
<td>Programmable by Bosch RPS software, version 3.7 or later.</td>
</tr>
</tbody>
</table>

2. Surveillance and Intrusion Systems Installation:

a. Quality Assurance: All workers involved with this installation must have completed manufacturer training and have a minimum of 2 years experience installing like equipment or have a minimum of 5 years of installation experience with specified equipment.

b. Install all equipment and cabling in a manner consistent with manufacturer recommendations and instructions.

c. Install all devices and components shown on drawings required for proper operation of the system.

d. Mount devices level and in a uniform fashion.

e. Camera power supplies are to mount in the Point of Entry rooms.

f. Wiring to cameras shall be CAT 5e twisted pair and shall include any necessary components to transmit video and power across CAT 5e cabling.
Section 28 20 00 – Electronic Surveillance continued

g. Contractor shall furnish and install all cabling associated with the operation of CCTV system.

h. Contractor shall **not** pull any CCTV cables in conduits containing or intended to contain voice and data wiring.

3. Surveillance and Intrusion Systems and Equipment:

   a. Coordinate with FS Lock & Door Shop setup of Ethernet network and IP address assignment; camera setup to ensure proper focus and view to satisfaction.

   b. When the installation of all system components and cabling is complete, initial testing shall consist of local walk-through, and working demonstration of all features.

   c. All passwords or access codes for the system shall remain at factory default unless the factory default poses a security risk, in which case all passwords shall be communicated in writing and give written FS Lock & Door Shop approval of such change. Any costs associated with password recovery shall be borne by the Contractor.

   d. The Owner shall be provided with a minimum of 2hrs training of the installed system after all startup and testing procedures have been completed and as-built documentation delivered.
      - Minimum hours of required training may increase based upon the system size and complexity.
      - Training will include both an overview for building occupants and an in-depth session for Facilities maintenance to a service level.

   e. Prior to FS Lock & Door Shop final acceptance of the system all zones must be tested in the presence of designated representative(s) from the FS Lock & Door Shop.

4. Surveillance and Intrusion Systems Closeout, Warranty, and Support:

   a. With as-builts, record drawings, O&M manuals, etc. deliverables a complete list is required of all system devices, power packs, etc. noting their installed locations.

   b. Guarantee all work against faulty and improper material and workmanship for a minimum of 1 year from the date of final written acceptance by FS Lock & Door Shop, except where guarantee or warranties for longer terms are clearly requested and specified.

   c. During the entire warranty period the Contractor must provide all related software upgrades to the installed system(s).

   d. Upon notification of a problem, the warranty provider shall furnish within 48 hours at no cost to the Owner such labor and materials as are needed to restore the system to proper operation.

   e. During the entire warranty period the Contractor must guarantee a 4 hour response time for problem resolution.

   f. Prior to the end of the warranty period, with FS Lock & Door Shop present, the Contractor is to conduct a 1 year inspection and provide a report of system equipment and system operational functions.

End of Section

Section 28 30 00 – Electronic Detection & Alarm (Fire Alarm)

1. References: City of Eugene; current IBC; current IFC per the authority having jurisdiction (AHJ).

2. Fire Alarm system design required review and approval by EH&S.

3. Magnetic door holders must be tied into the fire alarm system if the fire alarm system supports the function.

4. Access to detection devices must remain clear and accessible at all times.

5. Any device, component, etc. with locking characteristics shall be keyed to a cat 15 key.

6. Provide local/remote annunciation bypass.

7. Provide alarm verification function on smoke detector circuitry only.
Section 28 30 00 – Electronic Detection & Alarm continued

8. Minimum Documentation Requirements:
   a. Catalog sheets:
      • Showing configuration and dimensions of the equipment or device described.
      • Providing technical specifications, such as operating voltage, operating temperature, and humidity limitations, mounting and wiring information, and a description of the function and operation of the devices.
      • Showing choice of color; if color is an option.
   b. Contractor AHJ approval drawings:
      • Showing every device provided under this section at its relative spatial location.
      • Sections and elevations utilized as necessary to accurately describe the installed location of devices.
      • All devices, dampers, detectors, etc. shall be individually identified; at the device and on the AHJ approved drawings.
      • Location of all devices, dampers, detectors, etc. shall include locating dimensions from fixed reference points.
   c. Equipment mounting details:
      • Showing mounting locations for floor and wall mounted equipment including distance from floor, column lines, and fabrication details for special mounting brackets.
      • Details and special installation instructions; these details may be included on the plan drawings if the space allows.

9. System Operation:
   a. All fire alarm systems are to be tied into the central monitoring station per EH&S instruction.
   b. The system alarm operation subsequent to the alarm activation of smoke detector or other required initiating device, or any other approved normally open contact device shall cause the following operations:
      • Identify the location of activation on the alarm panel LCD display and cause the alarm LED to flash and sound the tone-alert on the control panel and remote enunciator.
      • Activate audible signals until silenced by authorized personnel.
      • A supervised signal notifying Dispatch at DPS shall be activated.
   c. Addressable system shall:
      • Maintain smoke detector pre-selected sensitivity while compensating for temperature changes, component drift, and dust accumulation.
      • Provide trouble signal at control panel prior to the point where the desired sensitivity can no longer be maintained and shall identify the specific detector.
      • Provide a second trouble signal at the control panel when the desired sensitivity can no longer be maintained.
      • Be capable of displaying the peak value registered by each smoke detector between service periods.
      • On command provide a listing only of detectors which are about to reach the point where the trouble signal will result if those detectors are not cleaned.

10. Addressable Devices:
   a. Individual device annunciations shall be available at the control panel.
   b. Annunciation shall include the following conditions for each point: Alarm, Trouble, Open, Short, Device Missing / Failed ground fault.
   c. Shall have the capability of being disabled or enabled individually.
Section 28 30 00 – Electronic Detection & Alarm continued

d. Up to a total of 250 addresses shall be available with a minimum of 100 address points. Field
programming shall allow addresses to be added or dropped as required.

e. Communication reliability is provided by parity data bit error checking and checksum routines.

f. Device addresses must be set by rotary switch settings.

g. Placement of the devices on the communications line in any random order of addresses shall be
allowable.

h. Device placement of certain order shall not be necessary for proper operation.

i. Communications line distance up to 2500 feet to the furthest device shall be allowable. Communications
line distance up to 10,000 feet total, including t-taps, shall be allowable.

j. Addressable interface module shall provide required operations for connection to up to 250 addressable
devices.

k. Ceiling mount detector bases on flush/surface mounted outlet boxes and after building interior finishes
have been completed and cleaned.

l. Addressable Smoke Detectors, Heat Detectors, and Duct Smoke Detectors: Addressable detectors are to
be 3 type technology, multi-sensor detectors with the following characteristics:

- Integrated 3 sensing technology of ion, photo, and heat detection: Processing and analyzing
  information from each sensor.
- Automatic device mapping: Detector transmittal of its location.
- Electronic addressing: Permanently stored programmable address.
- Environmental compensation: Detector compensation for adjustments in its installed environment to
  prevent unwanted alarms within 30 minutes.
- Wide sensitivity range window.
- Pre-alarm: Detector alerts prior to the sensor reaching a full evacuation.
- Identification and alert of dirty or defective detector.
- Automatic day and night sensitivity adjustment.
- Stand-alone operation: Detector decisions and input of alarm even if the controller fails.
- Twin status LEDs: Normal and alarm states.
- Multiple mounting base potential.

m. Addressable Smoke Detectors:
- Units shall twist lock onto addressable base with alarm led.
- Address shall be set by means of rotary switch in the base.
- Unit shall connect to the addressable communications line and require no extra power connections.

n. Addressable Heat Detectors:
- Addressable thermal detectors, 155 degrees F rate of rise.
- Units shall twist lock onto addressable base with alarm led.
- Address shall be set by means of DIP switch in the base.
- Address setting shall not require removal of the base.
- Units shall connect to the addressable communications line and require no extra power connections.

o. Addressable Duct Smoke Detectors:
- Mount detectors on bases after dust and debris has been removed from ductwork.
- Locate housing downstream of the supply fan and before the first ductwork elbow at a location
  recommended by the manufacturer.
- Duct smoke detectors are to be mounted to the exterior housing of the duct and equipped with air
  sampling tubes. No in duct type detectors will be accepted.
- Housing with photoelectric detector.
- Units shall twist lock onto addressable base with alarm LED.
- Units shall have remote test.
Section 28 30 00 – Electronic Detection & Alarm continued

- Address shall be set by means of DIP switch in the base.
- Address setting shall not require removal of the base.
- Units shall connect to the addressable communications line and require no extra power connections.
- Duct smoke detectors must conform to NFPA 90A, UL 268A, and be UL listed for use in air-handling systems.
- Provide sampling tubes running the full width of the duct in the center of the air stream.
- Provide detectors that conform with the mechanical codes and to the specified air flows.
- Provide detectors listed with and powered by the fire alarm control panel.
- Provide detectors with a visible indicator that shows when the unit is in an alarm condition.
- Provide a remote visible indicator for detectors located in concealed locations such as above a ceiling, over six feet from the finished floor, etc.
- Identify remote lamps and switches as well as the affected fan units with etched plastic placards.
- Provide detectors with auxiliary contacts to provide control, interlock, and shutdown functions for HVAC equipment.

p. Addressable Manual Pull Station:
- Single action, locked, with Cat-15 keyed access only. NO glass or ceramic retainer bars.
- Stations shall have their address set by means of a DIP switch on the back.
- Station shall connect to the addressable communications line and require no extra power connections.
- Stations shall be flush mount in remodel areas where construction allows.
- If surface mounted devices are needed due to construction type, furnish with matching red boxes.

q. Addressable Zone Adapter Module:
- Units shall mount on standard 4” square box.
- Address shall be set by means of rotary switch in the base.
- Units shall connect to the addressable communications line and requires 24 VDC power.

r. Addressable 4 Wire Module:
- Units shall mount on standard 4” square box.
- Address shall be set by means of rotary switch in the base.
- Units shall connect to the addressable communications line and requires 24 VDC power.

s. Addressable Signal Module:
- Units shall mount on standard 4” square box.
- Addresses shall be set by means of rotary switch in the base.
- Units shall connect to the addressable communications line and requires 24VDC power.

t. Addressable Control Module:
- Units shall mount on standard 4” square box.
- Address shall be set by unsupervised operation.
- Address shall be set by means of rotary switch in the base.
- Units shall connect to the addressable communications line and requires 24 VDC power.

11. Alarm Signals:

a. Install housing on recessed wall mounted back box (surface box on cement/cmu walls) within 6” below ceiling. Existing notification devices being replaced shall be replaced in their existing location. Identify wires with numbered labels in junction boxes, device boxes, or main panels.

b. Labeled numbers shall be consistent with as-built drawings.
Section 28 30 00 – Electronic Detection & Alarm continued

c. Bells are to be mounted on a single recessed gang plate with a red exterior finish and interior finishes matching existing surfaces. Exterior and interior bells are to be 8".
d. Horn and strobes devices:
   • Devices shall not be mounted in any location that has a likely potential to be covered / concealed in the future by other designed / installed features.
   • Horn in combination with strobe visual signals mounted on a double gang plate.
   • Strobe only devices mounted on a single gang plate.
   • Devices shall be acceptable for use under ADA standards.

12. Sprinkler Flow and Tamper Switches:
   a. Each device will require supervisory with interface module.
   b. Sprinkler valve positions to be supervised normally open unless special circumstances apply.

13. Fire Alarm Panel:
   a. Access to panel must be accessible via a corridor or mechanical room only.
   b. New panel shall replace existing panel in existing location.
   c. Cabinet to be surface mount with hinged door.
   d. Horizontal width limited to a maximum of 2’-0” and vertical height allowable from floor to ceiling.
   e. Panel accessories (notification appliance batteries, etc) are to be in line vertically with control panel within control cabinet.
   f. New panel shall be provided with 75% spare capacity for future system devices.
   g. New panel shall be keyed to a University cat-15 key.
   h. Fire alarm panels and system devices must be reconcilable within 30 minutes of installation or re-installation with out requiring program changes.
   i. Manufacturers known to be acceptable: Notifier; Edwards Systems Technology (EST) if 30min reconciliation requirements are met.

14. Installation and Wiring:
   a. Furnish and install Isolated Loop Circuit Protectors (ICLP) on communication, and signaling lines, including shields on all circuits that extend beyond the building by any means.
   b. The ICLP shall be located as close as practicable to the point at which the circuits enter or leave a building.
   c. The ICLP grounding conductor shall be No.12 AWG wire having a maximum length of 28 feet in as straight a line as practicable and connected to the building unified ground per NEC.
   d. The ICLP shall have a line response time and an earth response time of less than (1) nanosecond capable of accepting 2000 amps (8 x 20us pulse).
   e. Shield to earth current shall be 5000 amps maximum.
   f. The ICLP shall be protected by a high dielectric insulating material and be of physical size to allow mounting in a standard 4-11/16in square and 2-1/8in deep electrical box.
   g. Spark gap devices or devices incorporated in or installed within the Fire Alarm control panel in lieu of the specified ICLP are not acceptable.
   h. Wiring and conduit arrangement shall be supplied by vendor in shop drawings.
   i. Wire installed must be approved by the manufacturer for Power Limited fire alarm use per NEC.
   j. Final connections between the equipment and the wiring system shall be made under the supervision of a representative of the equipment manufacturer.
Section 28 30 00 – Electronic Detection & Alarm continued

15. Testing:
   a. A written Acceptance Test Procedure (ATP) shall be provided for demonstration/training on the system and certification of proper system operation. In coordination with the PM and EH&S, the ATP shall be prepared by the contractor and submitted to the EH&S office for approval four (4) weeks or more prior to the performance of the ATP that includes the following requirements.
   b. Prior to inspections / testing with the City of Eugene a 100% test of the entire system is required with the PM and EH&S. If this 100% test in an occupied building test must occur during off hours when the building is empty.
   c. Scheduling and performance of final inspection & testing with the Fire Marshall must be coordinated with the PM and EH&S, and building occupants.
   d. If the results are not satisfactory to EH&S, the corrections will be made and a retest will be required at the contractor’s expense prior to City inspection.
   e. Contractor representative and fire alarm technician shall be present for all testing and the fire alarm technician shall conduct the testing.
   f. Testing will be performed in accordance with NFPA 72 and the City of Eugene’s requirements.
   g. The following items and procedures will be required as a minimum for the testing of the system.
      • Bypass and control switches shall be operated to indicate proper supervision of the switch.
      • Valve and sprinkler flow supervision switches shall be operated to verify proper response.
      • Valve and sprinkler flow supervision switches shall have one wire removed to verify proper supervision.
      • Each alarm output, detection or supervision zone may be tested for proper response to ground conditions.
      • AC power shall be interrupted to see if the system will operate on batteries.
      • Critical fuses shall be removed to check for proper supervision.
      • Detectors shall be tested for alarm operation.
      • Alarm sounding devices will be tested for proper operation.
      • HVAC control functions and circuits shall be tested for proper supervision and operation.
      • Complete preliminary report form per Chapter 1 of NFPA 72.
   h. Additional requirements for testing may be as requested by local authority having jurisdiction and/or the EH&S representative.

16. Training:
   a. Vendor and installing Contractor shall conduct training session(s) during which maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the PM and EH&S.
   b. The session(s) shall be conducted by a manufacturer’s representative and installing Contractor thoroughly familiar with the characteristics of the installed system.
   c. Owner shall be provided with a minimum of 8 hours training of the installed system after all startup and testing procedures have been completed and as-built documentation delivered.
      • Minimum hours of required training may increase based upon the system size and complexity
      • Training will include both an overview for DPS staff and building occupants and an in-depth review/training session for EH&S Representative.

17. Closeout, Warranty, and Support:
   a. With as-builts, record drawings, O&M manuals, etc. deliverables a complete list is required of all system devices, power packs, etc. noting their installed locations.
   b. Reviewed and accepted record drawings will be available for verification purposes. Record drawings and performance testing are conditions for substantial completion.
Section 28 30 00 – Electronic Detection & Alarm continued

c. Guarantee all work against faulty and improper material and workmanship for a minimum of 1 year from the date of final written acceptance by PM and EH&S, except where guarantee or warranties for longer terms are clearly requested and specified.
d. Upon notification of a problem, the warranty provider shall furnish within 48 hours at no cost to the Owner such labor and materials as are needed to restore the system to proper operation.
e. During the entire 1 year warranty period the Contractor must guarantee a 4 hour response time for problem resolution.
f. During the entire 1 year warranty period the Contractor must provide all related software upgrades to the installed system(s).
g. At end of the 1 year warranty period, with PM and EH&S present, the Contractor is to conduct a 1 year inspection and provide a report of system equipment and system operational functions.
h. In addition to the 1 year system warranty, any software changes and/or updates that impact the life safety and/or panel function must be provided at no cost to the Owner for the additional period of 3 years.

End of Section

END OF DIVISION 28
Section 31 00 00 – Earthwork (Maintenance; Common Work Results; Schedules)

1. See also Division 01 for General Requirements.
2. See also Division 02 for Site Construction.
3. See also Division 03 for Concrete.
4. See also Division 32 for Exterior Improvements.
5. See also Division 33 for Utilities.
6. See also appendices for various space type requirements.
7. Tunnels and buried utilities must be located prior to jack-hammering, excavation, etc. If tunnel ceiling damage occurs this must be adequately repaired at the contractor’s expense.
8. FS Cartographer locates shall be initiated through ‘one-call’ to City of Eugene.
9. When designing within tunnels clear walkways, service areas, and other accesses must be maintained.
10. No site drainage piping internal to buildings.

End of Section

Section 31 10 00 – Site Clearing (Selective Tree & Shrub Removal & Trimming; Earth Striping & Stockpiling)

1. See also Section 01 56 00 for Tree and Plant Protection & Preservation.
2. No existing onsite topsoil, or stockpiled soil, may be re-used without PM and FS Exterior Supervisor approval.
3. Tree Removal:
   a. Removal of trees is subject to FS Exterior Supervisor review and approval as well as the requirements described in the Campus Tree Plan.
   b. If trees are to be removed and they are located within construction fencing, then fencing is to be installed and posting of tree removal is to be placed on the fencing.
   c. If trees are to be removed and they are located outside of construction fencing, then each tree is to be posted for removal for a minimum of 2 weeks prior to removal.
   d. ALL trees to be removed over 6-inches caliper are to be individually posted for removal at least 2-weeks prior to removal.
   e. Postings are to include PM contact information.

End of Section

END OF DIVISION 31
Section 32 00 00 – Exterior Improvements (Maintenance; Common Work Results; Schedules; Commissioning)

1. See also Division 01 for General Requirements.
2. See also Division 02 for Site Construction.
3. See also Division 03 for Concrete.
4. See also Division 31 for Earthwork.
5. See also Division 33 for Utilities.
6. See also appendices for various space type requirements.
7. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner FS personnel prior to specification and/or installation.
8. Tunnels, buried utilities, etc. must be located prior to exterior improvement work as applicable. If tunnel ceiling damage occurs this must be adequately repaired at the contractor’s expense.
9. FS Cartographer locates shall be initiated through ‘one-call’ to City of Eugene.
10. Cut existing pavement prior to excavation with vertical, straight-line joints using saw designed for cutting pavement. Replace to condition of existing prior to cutting.
11. All exterior improvements are subject to FS review. Exterior improvements beyond standard landscape maintenance and replanting projects (e.g. landscape designs for new planting areas, retaining walls, or sidewalks) are also subject to CPRE review.

End of Section

Section 32 10 00 – Bases, Ballasts, & Paving (Base Courses; Flexible Paving; Rigid Paving; Unit Paving; Aggregate Surfacing; Curbs & Gutters; Paving Specialties)

1. Vehicle loaded access shall be provided at building perimeters for the purpose of maintenance activities.
2. If utility vaults, metal covers, etc. are located in sidewalks the surface is to be textured to reduce slip hazards.
3. Use of exterior pavers requires prior CPRE and FS Exterior review and approval. If used installation methods shall eliminate sinking under vehicle traffic, preferably set with a concrete pad base vs. sand.
4. Walkways to loading/service areas:
   a. Shall be designed and constructed to withstand heavy vehicle traffic.
   b. Shall be as short in length as possible
   c. Shall be 8ft wide at minimum. Walkways only, proper service or loading areas may be larger; see Loading Docks and Service Areas appendix.
   d. Shall avoid conflicts with heavy volumes of bicycle and/or pedestrian traffic.
   e. Shall avoid conflicts with trees and landscaping.
Section 32 10 00 – Bases, Ballasts, & Paving continued

5. Sidewalks:
   a. Water vaults are not to be located in sidewalks.
   b. Standard sidewalk detail: Standard sidewalks designed to support pedestrian traffic only will have a minimum of 4 inches of 4000psi concrete with a 6 inch minimum of base rock.

   ![Standard Walk Diagram]

   c. Vehicle loaded sidewalk detail: Sidewalks designed to support vehicle weight will have thickened edges and rebar to support vehicle weight; minimum of 6 inches of 4000psi concrete with a 4 inch minimum of base rock at the outside thickened edge.

   ![Maintenance Vehicle Access Sidewalk Diagram]

End of Section

Section 32 30 00 – Site Improvements (Retaining and Site Walls)

1. All seat and retaining walls less than 5 ft in height must utilize anti-skating strategies; bumps or interruption strategies must be integrated into the design of the concrete. Anti-skating bumps and/or strategies shall not be secured in mortar joints.
Section 32 30 00 – Site Improvements continued
2. Typical OFOI anti-skateboard bumps:

典型OFI的反滑板凸起

NOTES:
- Skateboard bumps provided by University (hot dip galvanized or standard green powder coated finish).
- 1 1/2” minimum on center set back from edge of wall.
- 2’ to 3’ spacing on center (depending upon wall material and jointing).
- Bumps to be anchored in a 3/4” hole by epoxy cement.

Section 32 80 00 – Irrigation (Pumps; Planting Irrigation)

1. Irrigation Systems:
   a. Record Drawings:
      - Indicate two dimensions for all valves (including quick couplers and drain valves), stub-outs and mainline T’s, L’s and ends.
      - Dimension mainline pipes and wire runs at the beginning, mid-point and end of each curve or at each change of direction, or at 25-ft intervals along the curve if longer than 50-ft.
   b. Materials:
      - Backflow Preventer: Use Conbraco top entry double check valves. Models must be designated for operation at an elevation with respect to the system.
      - PVC Primer: Oatey Lo-V.O.C. purple primer #31903.
      - Glue: IPS Corporation Weld-On 705 PVC or 721 PVC. Ensure that manufacturer’s expiration date is not exceeded.
      - Pipe, Fittings, Sleeves:
        i. PVC Type I, NSF approved as per ASTM-D01784, D-1785, D-2242 and Product Standard 21/70, 22/70.
        ii. All lateral lines are to be schedule 40 with solvent-weld connection fittings.
        iii. PVC fittings to be schedule 40, solvent-weld type.
        iv. All mainline pipes to be schedule 40.
        v. No galvanized pipe or fittings may be used.
        vi. Sleeves to be schedule 40 PVC.
      - Manual Control Gate Valves:
        i. Use USA manufactured valves, resilient seat gate valves.
        ii. 125 PSI cold-water-rated, construction to be brass or bronze on 2-inches and under sizes.
        iii. All gate valves to have wheel handled operations.
Section 32 80 00 – Irrigation continued

- Electric Remote Control Valves: Toro P-220 series with EZ Reg Pressure.
- Quick Coupling Valves: Rain Bird 44RC.
- Master Valves:
  - Normally open and same size as mainline.
  - Mfg: 24V AC, Bermad 410
  - Detail: Zone Valve Assembly from UO Tennis Courts and Field Renovation Project (L11.0)

- Manufacturers known to be acceptable for valve covers and boxes:
  - Double-check valves: Carson 1730-18, T-Lid, green in color. (7-19-11 correction)
  - Automatic control valves: Carson 1419-12, T-Lid, one valve per box, green in color. (7-19-11 correction)
  - Quick coupler: Carson 910-10, T-Lid, green in color. (7-19-11 correction)

- Detail: Swing Joint Pop-up Spray Heads
Section 32 80 00 – Irrigation continued

- **Pipe Joint Tape:**
  i. Teflon on all threaded joints.
  ii. 4 wraps of Teflon tape.
  iii. No pipe dope.

- **Sprinkler Heads:**
  i. Spray heads shall be Toro 570Z PRX COM series.
  ii. Nozzles shall be Toro Precision Nozzles series or Toro Precision S Rotating Nozzles series.
  iii. All rotor heads to be approved by FS Exterior Supervisor; either Rainbird 5000+ or 3500+.
  iv. No drip or micro-sprays.
  v. Detail: Rainbird & Toro Stream Rotors.

- **Automatic Controller:**
  i. The Water Management System shall be a Toro Sentinel Water Management System and related Toro Sentinel equipment.
  ii. The System shall include the following general components:
      o Sentinel Field Satellites
      o Sentinel Communication Hardware
      o Computer to Satellite Communications shall be Narrowband, UHF data radio
      o The irrigation flow sensor shall be a Toro Model TFS-150, TFS-200, TFS-300 PVC[TEE] Irrigation Flow Sensor sized the same as the mainline.
      o Cabinet shall be Toro Sentinel Stainless Steel exterior mounted cabinet, powder coated UO green.
      o The contractor shall supply to UO one (1) Toro RLS-RB Sentinel Retro-Link Assembly for systems with 24 or fewer stations. For systems with more than 24 stations the contractor shall supply to UO two (2) Toro RLS-RB Sentinel Retro-Link Assemblies.
iii. Detail: Toro Sentinel Exterior Wall Mount Controller
Section 32 80 00 – Irrigation continued

Detail: Toro Sentinel Pedestal Mount Controller

NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. CONTRACTORS NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/Info
   REFERENCE NUMBER 095-113.

PEDESTAL MOUNT CONTROLLER
STAINLESS STEEL
Section 32 80 00 – Irrigation continued

- Conduit and Fittings:

- Wire:
  i. Copper, ASTM B-3, #14 minimum.
  ii. PE-39 cable from controller to flow sensor must be a single, un-spliced length.
  iii. Two yellow AWG #12 control wires from controller to normally open master valve must be a single, un-spliced length each.
  iv. Blue tracer wire AWG #14 along the entire mainline from the controller.

- Connectors: Scotch Lok 3570, 3M DBY.

- Backfill Materials:
  i. See also Section 32 90 00 Soil Testing.
  ii. Planting Areas: Native on-site soil, free of rocks and other deleterious materials. If rock or other deleterious materials are encountered, bed pipe with 4-inches of fill sand on all sides of pipe and/or wire.
  iii. Paved Areas: All backfill to be fill sand under paved areas.
  iv. Drain and Sump Areas: Pea gravel, 3/4-inch x 1/2-inch washed round rock.

- Construction:
  i. Monuments: Carefully maintain bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.
  ii. Trenching or Pulling Pipe:
    i. Width of trench to be 1-1/2 times the pipe’s outside diameter.
    ii. Minimum cover depth to be:
        ◊ 18-inch for main lines.
        ◊ 12-inch for lateral lines.
    iii. More than one pipe is permitted in the same trench:
        ◊ 2 pipes may be stacked vertically if 4-inches of earth separates them.
        ◊ 3 or more pipes must be laid 4-inches apart horizontally in trench.
  iii. Remove any rocks or other material from the bottom of the trench that might damage pipe.
  iv. Sleeve Installation:
    i. Schedule 40 PVC pipe.
    ii. Provide under sidewalks and other locations as selected by/with Owner to install irrigation system and allow future flexibility.
    iii. Provide vehicle markers where sleeve ends are concealed.
    iv. Extend sleeves a minimum of 1-foot beyond sidewalks on each side.
    v. Run sleeves level and perpendicular to sidewalks and pavement.
    vi. Empty sleeves are to be marked on the sidewalk with an ‘S’ stamped in the horizontal face of the concrete.
  v. Threaded Plastic Pipe: Wrap joints with Teflon tape, 4 wraps.
  vi. Valve Covers and Boxes Installation:
    i. Set all valve boxes at grade of lawn or shrub mulch surface.
    ii. Ensure 48-inches of wire are coiled around 1/2-inch pipe in box.
Section 32 80 00 – Irrigation continued

iii. 1” minimum clearance from any pipe.
iv. All valve boxes are to be double stacked.
v. Detail: Irrigation Sleeves from UO Tennis Courts and Field Renovation Project (L11.0).

- Flushing:
  i. Flush main prior to installing valves.
  ii. After piping risers and valves are installed, but prior to installing sprinkler heads, thoroughly flush piping system under full water head. Maintain flushing until all foreign matter is removed from the line.
  iii. Cap risers immediately after flushing.

- Pressure Tests:
  i. Isolate electric valves and test with a pressure pump after installing and before backfilling the mainline.
  ii. Maintain 100 psi minimum pressure for at least 24-hours without leaks or pressure loss. Call for Landscape Architect and FS Exterior Supervisor inspection at beginning and end of this period.

- Automatic Control Wire:
  i. Run low-voltage control wires in metal conduit to 12-inches below grade.
  ii. Provide conduits as necessary where turning corners or going through walls.
  iii. Install wire beneath mainline pipe and coil extra wire at each turn to allow for contraction of wire.
  iv. Bundle wire together at 5-foot intervals with plastic tape or similar.
  v. Install secure and plumb.
  vi. Install wire in continuous runs with no splices.
  ◊ IF splices are FS approved, make all splices in a valve box and note these on record drawings and provide an extra coil of each wire at each splice to allow for contraction of wire due to temperature or settlement of backfill.

- Quick-Coupling Valve Assembly:
  i. Install plumb in valve box, with top of valve set 3-inches below top of box and grade.
  ii. Open crushed rock in valve box to 4-inches below top of valve.
  iii. Support quick coupler by attaching an 18-inch #4 rebar with 2 stainless steel clamps each side.
Section 32 80 00 – Irrigation continued

iv. Detail: Quick Coupling Assembly from UO Tennis Courts and Field Renovation Project (L11.0).

- Sprinkler Head Installation:
  i. Install all heads plumb or perpendicular to finished grade.
  ii. Compact earth under pipe at sprinkler heads to prevent settlement from pulling sprinklers below grade.
  iii. Install at center of symbol of drawings, except as follows:
    ◊ Do not install any sprinkler body that is next to a sidewalk, curb, header, etc. higher than the top surface of the sidewalk or curb and leave 2 to 3-inches space from sprinkler rim to curb.
    ◊ Part circle sprinkler heads next to buildings, 18 to 24-inches out from the building.
  iv. Set head elevations in existing turf, set top of sprinkler flush with top of turf mat or 1/2-inch above earth grade, whichever is highest.
Section 32 80 00 – Irrigation continued

- Detail: Point of Connection Assembly from UO Tennis Courts and Field Renovation Project (L11.0)

2. Irrigation Audit Requirements:
   a. All irrigated landscape areas shall have a Landscape Irrigation Audit performed by a certified Landscape Irrigation Auditor, certified and in good standing with the Irrigation Association (IA).
   b. The auditor shall be retained by the PM independent of contractors associated with the project.
   c. The audits shall be conducted in accordance with the current edition of the IA’s Landscape Irrigation Auditor’s Handbook.
   d. The results of the audit shall be provided to the PM and installing Contractor in a report signed by the Auditor.
   e. The minimum efficiency requirements to be met in the audit are 60% distribution uniformity for all fixed spray systems and 70% distribution uniformity for all rotary systems.
   f. All zones not meeting these minimums shall be corrected by the irrigation installer and retested to meet these specifications. Compliance with this provision is required before final acceptance of the system.
   g. A pre audit equipment review shall note any installation errors, necessary repairs, performance deficiencies and problems, etc., the review shall also have included verification of the installation and operation of all Toro Sentinel Central Controls System equipment, flow sensors, telecommunication paths etc. Any deficiencies shall be corrected by the installer before the audit begins.
   h. The audit report shall include the marked up drawing of the system design showing as built conditions. The drawing shall show the station numbers, station locations, sprinkler head locations, head types, nozzle size, and distance between sprinkler heads.
**Section 32 80 00 – Irrigation continued**

i. As-Built drawing shall be provided to the auditor by the installation contractor prior to field precipitation measurements being collected.

j. Auditor shall collect all data necessary to calculate precipitation rates (zone areas, flow rates), note and record soil types, root depths, sun exposure, slope and plant material characteristics for each zone. Auditor shall perform catch-can tests of each zone and mark corresponding catch-can location on the as built irrigation drawing. Shrubs zones precipitation catch-can measurements are to be taken before planting.

k. Auditor shall measure flow rates, static and dynamic system pressures, and record catch-can quantities and locations for each zone.

l. Audit report shall provide pressure readings per station, catch device readings and locations, distribution uniformity for individual stations, precipitation rates per station, and full database information for programming Toro Sentinel ET based central control software. The report shall include a Toro Sentinel data summary spreadsheet for Toro Sentinel Programming.

**End of Section**

**Section 32 90 00 – Planting** (Preparation; Turf & Grasses; Plants; Accessories; Transplanting)

1. Plants likely to require excessive maintenance shall be avoided or judiciously located with FS Exterior Supervisor prior approval. Avoid using plants as formal hedge plantings.

2. Wherever possible, and appropriate, plants are to be used to screen uses such as parking lots and service areas to soften the visual impact, vs. fences and similar barricades. Avoid using plants as formal hedge plantings.

3. 12 inches of soil is required for all lawn/grass areas.

4. 18 inches of soil is required for all tree, shrub, and planted areas.

5. Plantings are to be used as much as possible for sun shading.

6. Plantings must be chosen and placed carefully to minimize debris dropping onto buildings or into building systems.

7. Planting within drip lines of established trees is prohibited.

8. Grading:
   a. Grass lawns shall have a maximum slope of 5:1.
   b. Planted areas shall have a maximum slope of 3:1. Exceptions require approval from FS Exterior Supervisor.
   c. Areas intended to be essentially level (such as squares and courtyards) shall be level to the eye but sloped sufficiently to provide adequate drainage. A gradient of from 1.5% to 2% is recommended.
   d. Exterior ramps: 1:12 is the maximum allowed, and 1:20 sidewalks are preferred. Current ADA requirements must be followed.
   e. Sidewalk grading is not to exceed 2% cross slope and not to exceed 5% running slope.
   f. Grading within drip lines of established trees is prohibited.

9. Prior to final soil placement:
   a. Remove all temporary construction sub-grades and construction debris.
   b. Existing grade is to be aerated prior to final soil placement and planting.
   c. No soil tillage under existing tree canopies.
   d. Soil and imported soils are to be free of noxious weeds: horse tail; oxalis; morning glory; thistle; etc.
   e. Soil testing is required prior to final soil placement to ensure prohibited items are not within the soil; zero tolerance. PM and FS Exterior Supervisor must be provided with either a test report and/or site visit to the pit prior to installation.
Section 32 90 00 – Planting continued

10. Vegetation on campus is to be planted and managed in a way that does the following:
   a. Avoids excessive damage to buildings.
   b. Contributes to a safe campus environment.
   c. Reduces susceptibility to pest infestation.
   d. Minimizes reliance upon the use of pesticides.
   e. Contributes to the aesthetic quality and enjoyment of the campus as a whole.
   f. Contributes to the function of campus as an outdoor classroom.

11. Tree Locations:
   a. See also requirements of the Campus Tree Plan.
   b. To avoid debris falling into air intakes tree species and locations require special consideration, avoiding deciduous trees.
   c. Tree placement should be considered as energy conservation measures on SW exposures from sun and wind.
   d. Trees with fleshy fruits shall not be planted adjacent to paved areas or entries.
   e. Shade trees shall be planted a minimum of 12ft from buildings. Exceptions require approval from FS Exterior Supervisor.
   f. Ornamental trees shall be planted a minimum of 6ft from buildings. Exceptions require approval from FS Exterior Supervisor.
   g. Trees shall be planted to avoid debris falling into air intakes and other building systems, discoloring exterior walls, and impacting locations requiring special consideration.
   h. Trees shall not be planted so that maintenance issues such as the following become an ongoing issue:
      - Clogged gutters.
      - Discolored exterior walls
      - Plugged air intakes.
      - Misshapen or leaning trees creating hazard conditions.
12. Coniferous tree planting detail to be followed:

**NOTES:**
- Trees planted too deeply will not be accepted.
- Remove tree ties and stakes one year after planting unless directed otherwise.
- Provide trees planted in lawn with minimum 5 foot diameter bark area.
  - Hold bark away from trunk.
- Remove burlap from top of root ball.

**CONIFEROUS TREE**

Planting and Staking
Section 32 90 00 – Planting continued

13. Deciduous & Broadleaf Evergreen tree planting detail to be followed:

**NOTES:**
- Trees planted too deeply will not be accepted.
- Remove tree ties and stakes one year after planting unless directed otherwise.
- Provide trees planted in lawn with minimum 5 foot diameter bark area. Hold bark away from trunk.
- Remove burlap from top of root ball.

**DECIDUOUS & BROADLEAF EVERGREEN TREE**
**Planting and Staking**
Section 32 90 00 – Planting continued

14. Shrubs and perennials shall be planted a minimum of 3ft from buildings. Exceptions require approval from FS Exterior Supervisor.

15. Shrub Planting Detail to be followed.

16. Landscape Materials **NOT** Approved for Planting on U of O Campus:
   
   a. All items listed as State Invasive Species.
   
   b. *Invasive Ornamental Species, on Native Plant Society of Oregon’s List.
   
   c. Prohibited Trees:
      
      - *Ailanthus altissima* - Tree of Heaven
      - *Cornus florida* – Flowering Dogwood
      - *Populus trichocarpa* – Black Cottonwood
      - *Gingko Biloba* – Female Gingko
      - *Norway Maple* – Straight Species
   
   d. Prohibited Street Trees:
      
      - *Liquidambar styraciflua* – Sweetgum
      - *Platanus x acerifolia* – London Plane Tree
      - *Platanus occidentalis* – American Sycamore
      - *Acer saccharinum* - Silver Maple
      - ALL Conifer species
Section 32 90 00 – Planting continued

c. Prohibited Shrubs:

- Buddleia davidii*-Butterfly Bush
- Cotoneaster spp.*-Cotoneasters
- Juniperus spp.(j. virginiana)*-Junipers
- Lonicera nitida-Box Honeysuckle, and Lonicera pileata-Privet Honeysuckle
- Juniperus spp. (j. virginiana* and selected varieties) – Juniper
- Large Cistus spp.
- Minimize use of shrub dogwoods.
- Prunus laurocerasus*(except dwarf varieties)- English Laurel
- Prunus lusitanica*- Portugal Laurel
- Ilex crenata*- Japanese Holly
- Hebe spp.- Hebe Species
- Minimize use of dogwoods.

d. Prohibited Perennials:

- Iris pseudocorus*-Yellowflag Iris
- Lythrum salicaria*-Purple Loosestrife
- Polygonum cuspidatum*-Japanese Knotweed
- ALL Bamboo species, unless contained.

e. Prohibited Groundcovers:

- Arctostaphylos uva-ursi -Kinnickkinnick, Bearberry
- Euonymus coloratus- Purple Wintercreeper
- Fragaria spp. Ornamental Strawberries
- Hedera helix*- English Ivy
- Hypericum perforatum*- St John’s Wort
- Vinca minor, Vinca major*- Periwinkle, Vinca

End of Section

END OF DIVISION 32
Section 33 00 00 – Utilities (Maintenance; Common Work Results; Schedules; Instrumentation & Control)

1. See also Division 02 for Site Improvement Standards.
2. See also Division 22 for Plumbing Standards.
3. See also Division 23 for HVAC (steam, chilled water, condensate, etc.) Standards.
4. See also Division 26 for Electrical.
5. See also Division 27 for Communications.
6. See also Division 31 for Earthwork Standards.
7. See also Division 32 for Exterior Improvements Standards.
8. See also appendices for various space type requirements.
9. FS Cartographer locates shall be initiated through ‘one-call’ to City of Eugene.
10. Exterior placement of any and all equipment requires CPRE and FS approval to ensure compliance with the UO Campus Plan. If approved, all University policies shall be followed.
11. Per the ‘Design Review Requirements’ at the beginning of this document, a drawing layer of ‘Maintenance Access’ is to be incorporated into ALL drawings and system designs. This layer MUST be maintained through all phases of design and construction.
12. ALL/ANY item that requires special tools and/or test equipment must be brought to the attention of the pertinent Owner’s FS personnel prior to specification and/or installation.
13. Inaccessible Equipment:
   a. If after meetings, reviews, comments, etc., there are documented and/or discussed changes not incorporated into the construction documents and installed equipment is not accessible for operation and maintenance, equipment shall be removed and reinstalled at no additional cost to the UO or the project. Discussions of payment will occur with the design team.
   b. ‘Accessible’ is defined as being capable of being reached without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and ductwork. Access must not exceed 14ft in height, a typical ladder working height.
14. FS maintains a survey database for storm sewer and sanitary sewer utilities on campus. These surveys shall be utilized in all design efforts. Coordination with FS for upgrades and/or replacements of nearby or impacted lines is also required.
15. Tunnel coordination with CPS is required for the following:
   a. Required tunnel ventilation locations and methods.
   b. Tunnel changes such as connection locations, connection methods, maintenance access locations, etc.
   c. Required tunnel access with each new building: locations and methods.
   d. New/replacement manhole locations for usability and maintenance; old manholes are then to be removed.
   e. Every straight tunnel length shall have at least one chase access.
   f. New building coordination with existing access locations.
   g. If tunnel ceiling damage occurs this must be adequately repaired at the contractor’s expense.
16. For any and all penetrations through utility tunnel walls, ceilings, etc. use ‘Link-Seal’ to seal the penetration.
17. Manhole requirements:
   a. Manhole covers must be labeled storm, sanitary, etc.
   b. Manholes must be labeled with UO manhole number/ID on the lid and inside the rim / collar. ID number is to be determined during design by coordination with FS Cartographer and noted on final drawings.
Section 33 00 00 – Utilities continued

c. New/replacement manhole locations must be coordinated with CPS for locations that makes sense for usability and maintenance.
d. Old/Abandoned manholes are to be removed.

18. Central utilities (power, steam, chilled water, etc.):

a. To be routed within tunnels and new tunnel connections shall be built where necessary.
b. All distribution lines are to be located underground (buried or encased in tunnels).
c. Direct burial of mainlines is not allowed unless CPS, FS, and FS Exterior approval is received via Construction Standards Substitution Request.
   • IF utility piping is approved by CPS & FS to leave the tunnel and continue underground all piping must be sleeved / cased with a direct-buried piping system and must continue into the building a minimum of 12 inches.
      i. Do not locate condensate pipes in conduit casings with steam pipes.
      ii. Provide a minimum of 1 inch air space between pipe insulation and casing.

19. Utility Vaults and Transformer Padmounts:

a. Vault lids must be galvanized steel non-slip construction.
b. American Concrete Institute (ACI) Publication: ACI 318 – Building Code Requirements for Reinforced Concrete.
c. Vaults with built in ladders must have extensions above the opening that are OSHA compliant.
d. Vault doors must open completely so that in the open position there is no ceiling to the vault during maintenance.
e. Preferred vault manufacturer: Utility Vault, division of Oldcastle Precast Inc.
f. Preferred vault base: Utility Vault Model # 644-B.
g. Preferred vault top: Utility Vault Model # 44-332P.
h. Preferred padmount: Utility Vault PGE.
i. Preferred riser extensions for base No. 644: Utility Vault shown below.
j. Preferred vault ladders: Utility Vault Model pull-up or wall mount shown below.
Section 33 00 00 – Utilities continued

20. Utility Monitoring & Verification Instrumentation
   b. Monitoring and verification follows IPMVP Option D for new buildings and Option B for ECM (Energy
      Conservation Measures) with Savings Method 2.
   c. Meter digital readouts are to be mounted and visible for manual read; not mounted within tunnels.
   d. All meters and related components are to be design, specified, and installed to manufacturer standards and
      recommendations.
   e. Metering and monitoring requirements must be clearly defined by 100% DD.
   f. Monitoring for all auxiliary buildings is required.
   g. Meter Communication Systems:
      • Connection to standby / emergency power.
      • Must be compatible with and connect to FS private Ethernet trunk.
      • Panels must be within 300ft of an Ethernet switch for remote monitoring.

End of Section

Section 33 10 00 – Water Utilities (Distribution Piping; Distribution Equipment)

1. In lieu of city water supply to a building a flow meter is required on water supplied reporting to the DDC
   system.
2. Gallon meter required for make-up water to heat exchangers with pulsed output ONLY to the DDC system.
3. Fire Hydrants:
   a. Reference the latest revision of the American Water Works Association (AWWA) standard C502.
   b. Manufacturers known to be acceptable; Mueller Centurion; Kennedy K-81D; M&H #129.
   c. Hydrants shall be painted safety yellow.
   d. Dry barrel compression type that opens against pressure is required. The valve shall be in the up position
      when closed.
   e. Provisions shall be provided for lubrication of the operating stem; either an oil reservoir or pressure
      lubrication fitting.
   f. The main valve’s drain valve shall be of non-corrosive metal with rubber drain valve facings.
   g. All packaging glands and seals shall be O-ring type.
   h. Hydrants shall be the dry bonnet type with the internal operating nut enclosure located above the plane of
      the nozzles.
   i. The main valve shall be 5-1/4 inch.
   j. The inlet flanges shall be 6” with MJ style connection on the shoe; EWEB requirement.
   k. The nozzle section shall be a 3-way design with two 2-1/2 inch NST hose nozzles and one 5-1/2 inch
      NST pumper nozzle. There shall NOT be any type of cap retainer chains or devices.
   l. The operating nut shall be a one piece design with a weather cap or seals. It shall have a 1-1/2 inch
      pentagon, opening left.
   m. The hydrant shall be a high profile design with 30 inch minimum dimension from the top of the hydrant
      to the bury line at approximately 3 inches below the break flange.

4. Building Chilled water metering; Required:
   a. All measurements are to be remote monitored via the DDC system.
   b. Mag type flow meters:
      • Pulse output ONLY via the DDC system.
      • Manufacturers known to be acceptable: Foxboro; Bailey; Cadillac.
   c. Usage / flow to be measured in tons, calculated at the remote readout, and then pulsed to the DDC system.
Section 33 10 00 – Water Utilities continued

d. Usage / flow, supply temperatures, and return temperatures to be monitored via the readout at the sensor.

e. Supply valve at the point of entry is to be remotely controlled via the DDC system.

f. Supply valve is to be modulating and not 2-position.

g. If chilled water is used for any application other than HVAC cooling, then a separate and additional mag


type meter is required at the point of usage with remote monitoring to the DDC.

h. Pete’s plugs are required within 1ft of the temperature sensors on supply and return.

5. Building Domestic water metering, cold; Required:

a. All measurements are to be remote monitored via the DDC system.

b. Usage/flow is to be measured in K-gallons, calculated at the remote readout, and then pulsed to the DDC


system.

c. Flow meters:

• Pulse output ONLY via the DDC system.

• Manufacturers known to be acceptable: Foxboro; Bailey; Cadillac.

End of Section

Section 33 40 00 – Storm Drainage Utilities (Piping; Drains; Pumps; Subdrainage; Structures)

1. NO site drainage into sump pumps is allowed without FS approval due to a lack of gravity.

2. No downspouts or site drainage piping internal to a building.

3. Grates:

a. 3/8” x 1” minimum grate openings.

b. 60 square-inch minimum grate area serving a maximum of 300 square-feet of paved watershed.

c. 144 square-inch grate to serve a maximum of 1000 square-feet of paved watershed.

d. 4 square-feet grate to serve all areas larger than 1000 square feet.

e. Decorative grates require prior FS Exterior Supervisor approval and will not be used in traffic areas.

f. Grates require non slip surfaces.

4. Drains:

a. Storm drains are to be labeled ‘Storm Drain – Do NOT Dump’ with a thermally applied decal.

b. Corner drains are preferred vs. flat drains, and are to be installed against planters and/or retaining walls

when possible.

c. Positive drainage to storm sewer at building perimeters and entries is required.

d. Positive drainage to building is prohibited.

5. Catch basins are not to be placed within parking spaces.

6. Rock drainage is required at all foundation walls and slabs.

End of Section

Section 33 50 00 – Fuel Distribution Utilities (Hydronic & Steam; Hydronic Energy; Steam Energy)

1. Building Steam metering; Required:

a. All measurements are to be remote monitored via the DDC system.

b. Vortex type flow meters:

• Pulse output ONLY via the DDC system.

• Manufacturers known to be acceptable: Foxboro; Bailey; Cadillac.

c. Usage / flow are to be measured in K-pounds, calculated at the remote readout, and then pulsed to the

DDC system.

d. Usage / flow, steam temperature, and steam pressure are to be monitored via the readout at the sensor.
Section 33 50 00 – Fuel Distribution Utilities continued

e. Supply valve at the point of entry is to be remotely controlled via the DDC system. Valve is to be modulating and not 2-position.
f. If there are multiple heat exchangers multiple / additional steam flow meters will be required to monitor each exchanger.

2. Building Condensate metering; Required:

a. All measurements are to be remote monitored via the DDC system.
b. Mag type meter on the final condensate line to the tunnel located after the final steam trap.
   - Pulse output ONLY via the DDC system.
   - Manufacturers known to be acceptable: Foxboro; Bailey; Cadillac.
c. Usage / flow are to be measured in K-pounds. Calculated at the remote readout, and then pulsed to the DDC system.
d. If there are multiple heat exchangers multiple / additional condensate flow meters will be required to monitor each exchanger.

End of Section

Section 33 70 00 – Electrical Utilities (Transmission & Distribution; Substations; Transformers; High-Voltage Switchgear & Protection Devices; Medium-Voltage Switchgear & Protection Devices; Site Grounding)

1. Primary power is to be encased in 2-inch cover minimum and in red-dyed cement.

2. Metering, reporting of meters, and commissioning of main meters must be complete and documented at the time the system is energized.

3. Campus Power Metering & Power Management; Required:

a. General Requirements:
   - There shall be provided a UL listing for all equipment.
   - Manufacturer will provide services including all materials and labor to maintain operation of equipment for two years.

b. Basic Power Meter:
   - Only manufacturer known to be acceptable: Square D
   - Features:
     i. Split Core CT’s
     ii. Remote Display
     iii. Minimum Functions:
        ◊ Phase Current
        ◊ Volts, L-L
        ◊ Volts, L-N
        ◊ Real Power (KW)
        ◊ Reactive Power (kVAR)
        ◊ Apparent Power (kVA)
        ◊ Power Factor
        ◊ Real Energy (kWh)
        ◊ Power Demand with configurable demand interval
        ◊ Min-Max readings (kW)
Section 33 70 00 – Electrical Utilities continued

iv. Modbus communication capability to Ethernet Gateway.
v. Capable of being configured to have specified data alarmed, displayed and logged using Square D SMS-3000 software via Ethernet Gateway or network interface card.

c. Advanced Power Meter:
   - Only manufacturer known to be acceptable: Square D, PM 870
   - Features:
     i. Integral display with option for remote display.
     ii. Minimum Functions:
        ◊ Current, per phase RMS +/- 0.075%
        ◊ Current, 3-phase average RMS +/- 0.075%
        ◊ Current, apparent RMS +/- 0.075%
        ◊ Voltage, phase-to-phase & phase-to-neutral +/- 0.075%
        ◊ Power factor, per phase +/- 0.15%
        ◊ Power factor, 3-phase total +/- 0.15%
        ◊ Real power, 3-phase total +/- 0.15%
        ◊ Reactive power, 3-phase total +/- 0.15%
        ◊ Apparent power, 3-phase total +/- 0.15%
        ◊ Frequency +/- 0.01%
        ◊ Average demand current, per phase
        ◊ Peak demand current, per phase, coincident with kW Peak, kVAR Peak, kVA Peak
        ◊ Average demand, real power
        ◊ Predicted demand, real power
        ◊ Peak demand, real power, coincident with kVA Peak, kVAR Peak
        ◊ Accumulated real energy In, accumulated real energy Out
        ◊ Accumulated reactive energy In, accumulated reactive energy Out
        ◊ Accumulated apparent energy
        ◊ Onboard Alarms (analog, digital, and Boolean)
           - Undervoltage
           - Overvoltage
           - Unbalanced Current
           - Unbalanced Voltage
           - Phase Loss Current
           - Phase Loss Voltage
           - Reverse Power
           - Phase Reversal
        ◊ Onboard logging of alarms, electrical data, trending, and forecasting, maintenance logs and waveform capture using non-volatile memory of at least 800kb with zero blind sampling capability at 128 samples per cycle.
        ◊ Modbus communication capability to Ethernet Gateway.
        ◊ Capable of being configured to have specified data alarmed, displayed, and logged using Square D SMS-3000 software via Ethernet Gateway or network interface card.
Section 33 70 00 – Electrical Utilities continued

d. Distribution Power Meter:

- Only manufacturer known to be acceptable: Square D, CM-4000T or CM3000
- Features
  i. Remote Display
  ii. Minimum Functions:
      ◊ Phase Current 0.04% of reading
      ◊ Volts, L-L 0.04% of reading
      ◊ Volts, L-N 0.04% of reading
      ◊ Real Power (KW) 0.075% of reading
      ◊ Reactive Power (kVAR) 0.075% of reading
      ◊ Apparent Power (kVA) 0.075% of reading
      ◊ Power Factor +/- 0.002 of reading
      ◊ Frequency +/- 0.01 of reading
      ◊ Real Energy (kWh) 0.075% of reading
      ◊ Reactive Energy (kVARh) 0.075% of reading
      ◊ Apparent Energy (kVAh) 0.075% of reading
      ◊ Energy Accumulation Modes
      ◊ KYZ Output
      ◊ Front Display
      ◊ THD, Voltage and Current with discrete harmonics to the 255th
      ◊ Current Demand
      ◊ Power Demand
      ◊ Date / Time Stamping
      ◊ Predicted Power Demand
      ◊ Advanced Demand Options
      ◊ Onboard Alarms (standard, high speed, disturbance, digital, Boolean)
          - Under voltage
          - Over voltage
          - Unbalance current
          - Unbalance voltage
          - Phase loss current
          - Phase loss voltage
          - Reverse power
          - Phase reversal
      ◊ Min / Max Readings
      ◊ Data and Event Logging
      ◊ Downloadable Firmware
      ◊ Adaptive Waveform Capture configurable up to 64 seconds and up to 512 samples per cycle
      ◊ Sag / Swell Detection
      ◊ Programmable
      ◊ Oscillatory and Impulsive Transient Detection using 5mHz sampling on three channels simultaneously
      ◊ Sequence of Event Recording
Section 33 70 00 – Electrical Utilities continued

iii. Modbus communication capability to Ethernet Gateway or integrally mounted Ethernet network interface card.

iv. Capable of being configured and having its data alarmed, displayed, and logged, including waveform capture and transient detection information using Square D SMS3000 software either directly or via an Ethernet Gateway.

e. Ethernet Gateway:

- Only manufacturer known to be acceptable: Square D EGX400
- Ethernet Gateway Requirements
  i. Provide an Advanced Ethernet Gateway meeting the requirements.
  ii. One 10/100 Mbps UTP port and one 100 Mbps fiber optic port.
  iii. 16 MB of internal memory.
  iv. Provide storage for standard and custom web pages to display real-time power equipment data and status, instruction manuals, and equipment drawings.
  v. Capable of accepting HTML files, PDF files, Active X, CRG, GIF, JPG graphics, MS Office files (doc, xls, ppt, etc.).
  vi. Configurable remotely using a standard internet browser.
  vii. The Ethernet Gateway shall feature one RS-485 serial port and a second port configurable for RS-232 or RS-485 (support for 2-wire or 4-wire).
  viii. A single Ethernet Gateway, assigned a single IP address, shall provide high speed Ethernet support for up to 192 devices.
  ix. Protocols supported: Ethernet – MODBUS / TCP HTTP, FTP. Serial – MODBUS, JBUS, and SY/MAX.
  x. Input voltage: 24 Vdc; maximum burden 8 Watts.
  xi. The Ethernet Gateway shall operate in ambient temperature of -30 to 80° C, an ambient storage temperature of -40 to 85° C and will operate in relative humidity of 5 to 95%.
  xii. The Gateway shall be fitted with a web server to allow users to configure its Ethernet and Serial communication parameters, troubleshoot both Ethernet and serial communication, and add stand-alone product that offers various mounting configuration and includes at least one of the following mounting options: DIN rail mounting; wall / panel mounting; flat surface or desk top.
  xiii. UL, CUL, CE, NOM and FCC class A compliant.
  xiv. Compatible with Ethernet TCP / IP networks and allow users to access power monitoring information from any location on a local area network (LAN) or a wide area network (WAN).
  xv. Utilize Modbus / TCP protocol as its high-speed backbone network protocol.
  xvi. Allow direct Ethernet connection to monitoring and protective RS-485 field devices. Power monitoring software running on a PC with a Modbus / TCP driver shall be able to access monitoring, metering, and protective data via the LAN. The PC shall be connected to the Ethernet LAN via Network Interface Card (NIC).
  xvii. The Gateway shall provide a twisted pair connection to connect to the Ethernet backbone. The Ethernet twisted pair port shall have the following:
  ◊ An RJ45 connector.
  ◊ Support for 10/100 BaseT connection (10 or 100 Mbit auto-negotiate)
  ◊ Support for both unshielded twisted pair (UTP) as well as shielded twisted pair (STP) wiring.
  ◊ LED’s to indicate Ethernet activity. At a minimum, there shall be the following LED’s; one for Physical Ethernet Link (LK), one for Transmit (TX), one for Receive (RX).
Section 33 70 00 – Electrical Utilities continued

xviii. Provide two serial RS-485 ports to connect serial field devices to the LAN. Each RS-485 serial port shall:

◊ Support up to 32 serial devices without a repeater.
◊ Support Modbus, Jbus, or mixed mode daisy chain devices.
◊ Support 2-wire or 4-wire daisy chain devices.
◊ Support baud rates of 1200 to 38400.
◊ Support parity values of even and none.
◊ Include screw type connectors with 5-positions.
◊ Include LED’s to indicate serial communication activity. At a minimum, there shall be the following LED’s; one for Transmit (Tx), and one for Receive (Rx) per port.

xix. A minimum of one port shall be configurable for either RS-485 or RS-232.

xx. Each serial port shall have configurable biasing and termination to support 2-wire and 4-wire communicating devices.

xxi. The Ethernet Gateway shall allow a Modbus master on one of its serial ports to request data from devices on the second serial port.

xxii. Compliant to industrial temperature. It shall withstand an operating temperature range of -30° to +80° C.

xxiii. Configurable by either local RS-232 connection and a Hyper Terminal ® interface or local or remote Ethernet connection and a standard web browser.

xxiv. Setup of the Ethernet communication card shall be accomplished via the on-board Ethernet port and a web browser. It shall also be possible via the Ethernet port to upgrade the firmware of the Ethernet Gateway in the field to accommodate new system features.

f. Remote I / O Monitoring Module:

- Only manufacturer known to be acceptable: Square D EGX400
- Components

i. Programmable Logic Controller:

◊ Provide a fully functional Programmable Logic Controller (PLC), suitable for simultaneously monitoring up to 16 single ended analog points and 16 digital points (1 digital input module and 1 analog input module).
◊ PLC shall have an RJ-45 Ethernet output suitable for connection to the University of Oregon fiber backbone.
◊ PLC shall be programmable to fully interface with the University of Oregon SMS-3000 power monitoring software via an Ethernet Gateway.
◊ PLC shall be capable of communicating over Ethernet using Modbus TCP.
◊ All components shall be housed in a steel enclosure.

ii. Uninterruptible Power Supply:

◊ Provide an Uninterruptible Power Supply (UPS), rack or wall mountable, suitable for operating the fully configured PLC for 30 minutes.
◊ The UPS shall be 120 volt AC input.

iii. Equipment Rack or Enclosure:

◊ Provide a standard equipment rack, designed for floor standing applications, suitable sized to support the PLC, the UPS, and any other accessories required in a fully configured system
◊ A wall-mounted NEMA 1 enclosure suitable to house all components is acceptable provided that this is the manufacturer’s standard configuration.
Section 33 70 00 – Electrical Utilities continued

iv. Digital Input Module: The digital input module shall accommodate up to 8 24-volt DC inputs.
v. Analog Input Module:
   ◊ The analog input module shall accommodate up to 16 single-ended analog inputs.
   ◊ Each of the analog inputs shall be user-configurable as either 4-20ma.
vi. Digital Output Module: The digital output module shall accommodate up to 8 24-volt DC contact outputs.

4. Medium Voltage Switching and Protection Cable: Includes: Medium Voltage Cable; Cable Terminations; Faulted Circuit Indicators
   a. Manufacturer known to be acceptable: The Okonite Company.
   b. Submittals:
      • Product Data: Provide for cable, terminations and accessories.
      • Test Reports; from the factory and prior to energizing: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.
      • Manufacturer’s Instructions:
         i. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
         ii. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
   c. Project Record Documents: Accurately record actual sizes and locations of cables.
   d. Operation and Maintenance Data: Include instructions for testing and cleaning cable and accessories.
   e. Qualifications:
      • Manufacturer: Company specializing in manufacturing products specified in this section with minimum thirty (30) years documented experience.
      • Installer: Company specializing in installing products specified in this section with minimum three (3) years documented experience.
   f. Delivery, Storage and Handling:
      • Accept cable and accessories on site in manufacturer’s packaging. Inspect for damage.
      • Store and protect in accordance with manufacturer’s instructions.
      • Protect from weather and provide adequate ventilation to prevent condensation.
   g. Project Conditions:
      • Verify that field measurements are as shown on drawings.
      • Verify routing and termination locations of cable prior to rough-in.
      • Cable routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
   h. Field Samples: After approval and prior to installation, furnish the Facilities CPS Electrician and Electrical Supervisor with a 2-foot length of each type and size of wire and cable along with the tag from the coils or reels from which the samples were taken. The sample shall contain the manufacturer’s markings.
   i. Industry Standards: Cable shall meet or exceed the latest editions of the following industry specifications.
      • ICEA S-68-516.
      • ASTM B-8, B-231.
Section 33 70 00 – Electrical Utilities continued

- AEIC CS-6.
- REA Bulletin 50-70 (U-1).

j. Cable shall be manufactured on a continuous vulcanization machine with three tandem extruders.
k. Multi-Conductor Medium Voltage Cable, 15KV:

- All cable shall conform to the current standards, where applicable:
  - Insulated Cable Engineers Association (ICEA)
  - Institute of Electrical and Electronic Engineers (IEEE)
  - National Electric Code (NEC)
  - Underwriters’ Laboratories (UL)
  - Association of Edison Illuminating Companies (AEIC)

- Each reel of cable furnished shall be newly manufactured (no more than 12-months old), and shall bear a tag containing name of manufacturer, NEC designation, year of manufacture.
- Technical Requirements: Conductor shall be compact stranded, Class B annealed copper, covered with an extruded semi-conducting EPR strand screen, 220 mil ethylene-propylene insulation (133%), extruded EPT semi-conducting insulation screen, with a peel strength between 8 and 16 pounds per ½” width strip. 5 mil bare copper shielding tape with 12.5% minimum overlap. 80 mil PVC jacket. UL listed and labeled type MV 105, MC/HL. Suitable for operation continuous at 150°C conductor temperature, 140°C emergency conditions and 250°C for short circuit conditions.
- Insulation System: The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene, nor shall it contain any polyethylene; both features to limit the degree of susceptibility to treeing experienced by highly crystalline materials. The insulation shall be compounded by the cable manufacturer in its own facility using a closed system to insure maximum cleanliness. All ingredients will be mixed, screened through a 300 mesh screen pack and then treated with an accelerator agent to assure complete blending. The extrusion process will be true triple (utilize three distinct extruders and heads) in order to control the thickness and concentricity of each layer while providing the means to strip the EPR insulation screen from the EPR insulation. All variations in the extrusion process shall be recorded in the plant log.
- Cable Assembly: Three shielded conductors shall be cabled along with an un-insulated copper grounding conductor, and fillers, to form a round cable core covered with a binder tape overall. A tight fitting, continuously welded, impervious, corrugated aluminum sheath is applied over the cable core. The sheath shall have the ability to safely carry fault currents as indicated in the National Electrical Code. A red, PVC low temperature minimum 40°C jacket shall be extruded over the C-L-X core.
- Experience: The cable manufacturer shall have a minimum of 30 years proven and successful experience with the manufacturer of EPR insulated cables.
- Tests: Furnish certified test reports of all applicable tests per AEIC to the purchaser at the time of delivery.
  i. Apparent Discharge Test: The completed cable must be tested for corona discharge and shall comply with AEIC requirements. A copy of the original X-Y plot showing discharge levels for the cable shipped shall be submitted at time of delivery. The maximum discharge shall not exceed 5pico-coulombs for all voltage levels. No d-c test shall be performed.
- Shipping Reels: All reels shall be marked as to installation location as required by the purchaser. Cut lengths shall have a tolerance of -0/+3% or as agreed to by the purchaser.
- Warranty: The cable shall have a 40-year design life.
- Field Advisor: The cable manufacturer shall provide a field advisor for a full day of installation support that includes cable pulling calculation support, termination training, installation training, d-c testing recommendation.
Section 33 70 00 – Electrical Utilities continued

1. Single Conductor Medium Voltage Cable, 15KV:
   - All cable shall conform to the current standards, where applicable:
     i. Insulated Cable Engineers Association (ICEA)
     ii. Institute of Electrical and Electronic Engineers (IEEE)
     iii. National Electric Code (NEC)
     iv. Underwriters’ Laboratories (UL)
     v. Association of Edison Illuminating Companies (AEIC)
   - Each reel of cable furnished shall be newly manufactured (no more than 12-months old), and shall bear a tag containing name of manufacturer, NEC designation, year of manufacture.
   - Technical Requirements: Conductor shall be compact stranded, Class B annealed copper, covered with an extruded semi-conducting EPR strand screen, 220 mil ethylene-propylene insulation (133%), extruded EPT semi-conducting insulation screen, with a peel strength between 8 and 16 pounds per ½” width strip. 5 mil bare copper shielding tape with 12.5% minimum overlap. 80 mil PVC jacket. UL listed and labeled type MV 105, MC/HL. Suitable for operation continuous at 150°C conductor temperature, 140°C emergency conditions and 250°C for short circuit conditions.
   - Insulation System: The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene, nor shall it contain any polyethylene; both features to limit the degree of susceptibility to treeing experienced by highly crystalline materials. The insulation shall be compounded by the cable manufacturer in its own facility using a closed system to insure maximum cleanliness. All ingredients will be mixed, screened through a 300 mesh screen pack and then treated with an accelerator agent to assure complete blending. The extrusion process will be true triple (utilize three distinct extruders and heads) in order to control the thickness and concentricity of each layer while providing the means to strip the EPR insulation screen from the EPR insulation. All variations in the extrusion process shall be recorded in the plant log.
   - The cable manufacturer shall have a minimum of 30-years proven and successful experience with the manufacturer of EPR insulated cables.
   - Tests: Furnish certified tests reports of all applicable tests per AEIC to the purchaser at the time of delivery:
     i. Apparent Discharge Test: The completed cable must be tested for corona discharge and shall comply with AEIC requirements. A copy of the original X-Y plot showing discharge levels for the cable shipped shall be submitted at time of delivery. The maximum discharge shall not exceed 5pico-coulombs for all voltage levels. No d-c test shall be performed.
   - Shipping Reels: All reels shall be marked as to installation location as required by the purchaser. Cut lengths shall have a tolerance of -0/+3% or as agreed to by the purchaser.
   - Field Advisor: The cable manufacturer shall provide a field advisor for a full day of installation support that includes cable pulling calculation support, termination training, installation training, d-c testing recommendation.
   - Warranty: The cable shall have a 40-year design life.

m. Load break Elbow Termination Manufacturers: Elastimold #166LR, with test point; Cooper.

n. Load break Junctions:
   - 4-way load break junction: Elastimold #163J4; Cooper.
   - 3-way load break junction: Elastimold #163J3; Cooper.
   - Provide (2) parking bushings for each junction.
   - Provide ground wire lug at each junction.
Section 33 70 00 – Electrical Utilities continued

- Provide an insulated cap with ground (Elastimold #160DRG) for each load break bushing insert that will not have a load break elbow connected to it.
- Load break elbow connectors must be compatible with those existing in the University’s electrical distribution system.

o. Faulted Circuit Indicators:
   - Description: Three phase, standard indicator, hinged small core with 25-feet of cable, relay output and pull over bail, 200 amp timed inrush restraint trip, 1 amp standard reset and two point mounting (for three phase remote units).

p. Preassembles Cable Termination Kits or Splices:
   - Acceptable Manufacturers: Elastimold Series K150; Cooper; Raychem; 3M.
   - Description: IEEE 48; Class 1, molded rubber cable termination in kit form with stress cone, ground clamp, non-tracking rubber skirts, load break connector, rubber cap, for universal bushing.

q. Preparation: Use swab to clean conduits before pulling cables.

r. Installation:
   - Install cable and accessories in accordance with manufacturer’s instructions.
   - At each point of termination, install plastic cable collars with printed feeder number. Write on this collar in indelible ink the location and distance in feet to the next termination point.
   - Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling-in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.
   - Avoid abrasion and other damage to cables during installation.
   - Do not exceed cable pulling tensions and bending radius as specified by the cable manufacturer.
   - In cable trays, secure manholes to avoid interference with duct entrances.
   - Provide a minimum of 3-feet extra armored cable per 100-feet of run when installed in cable trays to provide sufficient slack at terminal points and cable try expansion points so that movements of cable after installation will not cause damaging strain on cables or terminals.
   - In manholes, underground raceways, vaults and other outdoor locations:
     - Seal the cable ends prior to pulling them in to prevent the entry of moisture.
     - Allow sufficient slack in medium voltage cables, grounds and shield wires to allow elbow connectors to be moved to other existing and future load break junctions inside the vault.
     - Splice the cables and wires only in manholes and accessible junction boxes. Ground shields and neutral conductor.
     - In manholes, trenches and vaults install the cables on suitable porcelain insulators with steel cables racks. Ground cable racks.
     - Install faulted circuit indicators so they are easily viewed from outside the vault
     - Arrange cable in manholes to avoid interference with duct entrances.
   - Protect installed cables from entrance of moisture.
   - Where CLX Armor is exposed for splices and terminations provide heat shrink (Ray-Chem) material over exposed shield.

s. Field Quality Control:
   - Inspect exposed cable sections for physical damage.
   - Inspect cable for proper connections.
   - Inspect shield grounding, cable supports and terminations for proper installation.
Section 33 70 00 – Electrical Utilities continued

- Contractor shall contact cable manufacturer and arrange for one day of on-site cable installation advice prior to starting installation.
- Electrical Acceptance Tests:
  i. The Electrical Contractor shall engage the services of a recognized independent testing laboratory for the purpose of performing inspections and tests.
  ii. Tests are to assure that all electrical equipment is operational within industry and manufacturer’s tolerances.
  iii. Upon completion of the tests and inspections noted, a label shall be attached to all serviced devices. These labels will indicate date serviced and the service company responsible.
  iv. The tests and inspections shall determine suitability for continued reliable operation.

  t. Division of Responsibility:
     - The Electrical Contractor shall perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior and in addition to tests performed by the testing laboratory.
     - The Electrical Contractor shall supply a suitable and stable source of test power to the test laboratory at each test site. The testing laboratory shall specify requirements.
     - The Electrical Contractor shall notify the testing laboratory when equipment becomes available for acceptance tests.
     - The Electrical Contractor shall supply a complete set of electrical plans, specifications and pertinent change orders to the testing laboratory prior to commencement of testing.
     - The testing laboratory shall notify the Engineer prior to commencement of any testing.
     - Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the Engineer and Facilities PM.
     - The testing laboratory shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report. The test report (6 copies) will be distributed to the Engineer, PM, and to the Electrical Contractor who shall include it into the project Operation and Maintenance Manuals.
     - The test report shall include the following:
       i. Summary of project.
       ii. Description of equipment tested.
       iii. Description of test.
       iv. Test results.
       v. Conclusions and recommendations.
       vi. Appendix, including appropriate test forms.

  u. The independent testing laboratory shall perform appropriate tests for the new primary cable installation. Responsibilities shall include the following:
     - Medium Voltage Cable, Visual and Mechanical Inspections:
       i. Inspect exposed sections from new metering cabinet to transformer vault for physical damage.
       ii. Verify cable is supplied and connected in accordance with one line diagram.
       iii. Inspect for shield grounding, cable support and termination.
       iv. Visible cable bends shall be checked against ICEA or manufacturer’s minimum allowable bending radius.
Section 33 70 00 – Electrical Utilities continued

- Electrical Tests:
  
  i. Perform a shield continuity test by ohm meter method. Record ohmic values.
  
  ii. Each conductor shall be individually tested with all other conductors grounded. All shields shall be grounded.

   ◊ Terminations shall be properly corona suppressed by guard ring, field reduction sphere or other suitable methods.
   
   ◊ A DC hypotential shall be applied in at least eight (8) equal increments until maximum test voltage is reached. D.C. leakage current shall be recorded at each step after a constant stabilization time consistent with system charging current decay.
   
   ◊ A graphic plot shall be made of leakage current (X axis) versus voltage (Y axis) at each increment.
   
   ◊ The test conductor shall be raised to a maximum test voltage and held for a total of ten (10) minutes. Readings of leakage current (Y axis) versus time (X axis) shall be recorded and plotted on thirty (30) second intervals for the first two (2) minutes and every minute thereafter.
   
   ◊ The applied conductor test potential shall be reduced to zero (0) and grounds applied for a period adequate to drain all insulation stored potential.

- Safety Precautions: Exercise suitable and adequate safety measures prior to, during and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltage.

v. Feeder Identification:

  - In each manhole and pull-box, install permanent tags on each circuit’s cables and wires to clearly designate their circuit identification and voltage.
  
  - In manholes, the tags shall be the embossed brass type and shall also show the cable type and voltage rating.
  
  - Position the tags so they will be easy to read.

w. Quality Assurance: Cable shall be manufactured under a quality assurance program as defined by ISO 9000 and 10 CFR 50 of the Federal Register.

End of Section

END OF DIVISION 33
The following information is specific to a ‘Classroom’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

General Guidelines

1. For classrooms, seminar rooms, distance learning spaces, and videoconference spaces, CMET (Center for Media & Educational Technology), UO Information Services (which includes Network, Telecom, and Academic Services) must be engaged in the programming and design phases. These entities must review and approve design and installation. Collaborative work with these entities provides for proper integration with existing systems, adherence to standards, and frequently reduces fees. If outside consultation or installers are required to meet project timelines for design and/or installation, CMET, IS Academic Services and Network / Telecom shall help to determine scope of work, assist in the selection process, review submittals, and review and approve final work. These entities are to work directly with the design team, specialized consultants, engineers, contractors, and installers for the purposes of proper project coordination.

2. AV equipment and any network and telecom systems shall be Owner Furnished.

3. Review and approval of the following in design is required:
   a. Data/Network signal paths including conduit diameters. Signal paths between rooms and floors such as hallway cable trays or conduits between floors such as through network closets.
   b. Lighting requirements and configurations.
   c. Control rooms and/or projection room requirements.
   d. Project Drawings: floor plans; room elevations; reflected ceiling diagrams; AV floor or ceiling plans; AV one line riser diagrams; electrical; mechanical; etc.
   e. Casework drawings and/or furniture specifications if the project does not use the UO standard podium and lectern.

4. Audio Visual – AV Guidelines:
   a. AV technology design considerations for classroom, conference room, distance learning, seminar, etc. shall include the following: (The portions following expand upon these technologies and requirements associated with each.)
      • Presentation systems including Data/video projectors, flat screen high definition televisions, AV and Multimedia switching systems, video and audio distribution systems.
      • Signal transcoding and routing over other types of cable such as Cat5 or fiber optic.
      • Audio systems including amplification, speakers, microphones, etc.
      • Video production systems including control spaces and lighting, installed camera placement, and control.
      • User accessible controls, portable equipment connections and alter-abled AV access technologies.
   b. Design guidelines for AV provisions within public atrium spaces that could be used for gatherings include the following:
      • Portable video production equipment needs power and signal connection to any installed audio and video systems: camera and microphone inputs; network connections; power requirements.
      • Depending on the size of the space, atrium spaces may require floor and/or wall boxes to supply multiple locations for recording systems and microphones. Wall boxes are preferred over floor boxes. If floor boxes are to be used, they should be recessed in to or flush with the floor.
      • Atrium spaces should be designed with signal/power paths to control rooms and/or associated distribution systems.
Space Planning

1. Guidelines for selection of classroom locations:
   a. Locate general classrooms, large-capacity classrooms, and lecture halls as close as possible to main entrances of buildings to limit travel through the buildings.
   b. Classrooms on upper floors of buildings shall be located as close to building stairways and elevators to limit travel through the buildings.
   c. Locate classrooms away from indoor noise-generating equipment and activities; such as restrooms, building systems, etc. If a classroom must adjoin a noise-generating area, provide adequate sound barriers to minimize class disruption.
   d. For distance education classrooms, particular attention is needed in regard to day lighting and noise controls. If the classroom is to be used exclusively for distance education, consider placing in a position without exterior windows.

2. Classroom Configuration Requirements:
   a. The preferred configuration of seminar, small, and large classrooms shall be determined by the needs of the faculty and instructors, the department program and curriculum, and the currently adopted pedagogy in mind. Future pedagogy, instructional technology, and forecasted student and instructor needs should be reviewed with related infrastructure for such should be planned. Rooms are typically rectangular with a length-to-width ratio of no greater than 1 to 1.5 with the headwall on the long side. Use of all walls for instructional purposes should be considered. Instructional pedagogy and User function is paramount for room configuration. Involvement of the UO Committee for Academic Infrastructure (CAI) is required for detailed needs.
   b. The preferred configuration of a lecture hall is fan-shaped with seating, screen, and instructional needs dictating the exact shape. Involvement of the CAI is required for detailed needs.
   c. Ceiling height and ceiling access consideration is important for the placement of projection and screens.
   d. Clear sightlines from all student seating is required.
   e. Projection path from projectors to screens is essential. Avoid lighting and ceiling fan placement which interrupts or compromises projection paths.
   f. Power provisions for laptops; floor boxes are preferred.
   g. Movable furniture, with power plugs, if feasible.

3. Corridors and Seating outside of classrooms:
   a. Corridors, common areas, and areas outside classrooms should be considered valuable teaching and learning spaces. Design should utilize every opportunity to create multiple types of learning spaces.
   b. Bench type seating should be provided outside of classrooms. Provide backs on benches or protective wall mounted panel to lean against. Provide easy access to multiple electrical outlets to support student technology devices.
   c. Waiting / meeting alcoves along circulation paths encourages informal meeting and discussion while waiting for class changes.

4. Seminar, conferencing, and distance learning design guidelines:
   a. Specify lighting, window treatments, and interior room finishes and surfaces suitable for video.
   b. Provide permanent camera mounts with power and signal.
   c. Accommodate display of near and far participants at front and back of room.
   d. Provide network connection for conferencing codec at teaching station and at rear of room with necessary conduit pathways to teaching station.
   e. Provide a control station, or room, with pathways for display, audio and control to all displays.
   f. Provide adequate power for laptops; floor boxes are preferred.
   g. Moveable furniture, with power plugs, if feasible.
Classroom Types & Characteristics
1. Small Classroom: 21 – 35 students; moveable tablet arm chairs or moveable chairs and lightweight tables.
2. Medium Classroom: 36 – 60 students; moveable tablet arm chairs or moveable chairs and lightweight tables.
3. Large Classroom: 61 – 100 students; fixed seating with tablet arm or fixed tables with moveable chairs.
4. Lecture Hall: 100+ students; fixed auditorium seating with tablet arms or fixed tables.
5. Seminar rooms are general-purpose classroom designed for up to 20 students, comfortable moveable seating, and fixed or moveable tables.
6. Distance education classrooms are general classrooms specifically equipped with support facilities that include a control room, specialized lighting systems, camera positions, and additional audio/visual equipment.
7. Utilization of all four walls as potential instructional area is ideal for all learning spaces.
8. Flexible and Interactive Computer Classrooms include specialized instructional technology, hands-on wireless computers, and moveable furniture.
9. In addition to providing proper power and data for instructor use, provide adequate power and data for student laptops and student mobile technology devices.

Classroom Surfaces & Finishes
1. ALL finishes MUST be durable, easily cleaned, and easily repaired and maintained.
2. Latex paint is to be used; NO flat latex.
3. Access for Disabilities:
   a. Small rooms; capacity 49 or less and different from above: minimum of one table with vertical adjustment and 2 wheelchair capacity.
   b. Accessible tables must provide vertical height adjustment capability by individual users unassisted.
   c. Large rooms; capacity over 49.
      • Floor slopes should be avoided. If they are necessary, floor slopes shall be 5% or less.
      • Access to front, rear, and middle seating.
      • Vertical adjustable writing surfaces.
      • Room controls at 18 – 48inch reach ranges.
4. Floors:
   a. Classrooms include flat, sloping, or stepped floor types.
   b. Seminar and small classrooms shall have flat floors.
   c. Wood floor riser construction is NOT allowed.
   d. Flooring finishes:
      • Shall be commercial / institutional grade.
      • Medium to light colors with pattern to conceal dirt and/or stains.
      • NO wood floors.
      • Carpeting is very hard to maintain in classrooms. However, if approved and used, carpet tile vs. rolls is preferred to allow easier spot replacement. Resilient flocked flooring product is appropriate if acoustics are an issue (Example: Forbo Flotex carpet tile).
      • Provide adequate power for laptops; floor boxes are preferred.
5. Chair Rail:
   a. Classrooms with moveable furniture shall receive a simple profile chair rail to protect walls.
   b. Rail finish shall not require painting.
   c. Rail shall be installed 25 – 33 inches above finish floor AND verified with specified furniture height.
Classroom Surfaces & Finishes continued

6. Doorways:
   a. Doors shall be solid construction for durability and sound control.
   b. Door sweeps are recommended for sound control.
   c. Classroom doors shall have narrow relight windows.
   d. The main entry to classrooms shall be located at the rear.

7. Windows:
   a. Classrooms that have a projector shall be provided with blackout shades.
   b. Windows are strongly encouraged for all instructional areas.
   c. Windows shall not be placed along instruction walls.
   d. Windows shall not swing into the space where a hazard will be created.
   e. Windows and window treatments must address sound, light, and thermal controls.
   f. Window Treatments:
      • All exterior windows shall receive solar roller shades. (Metal blinds may rattle in the window frame
due to sound waves or air currents in window).
      • Only when appropriate for teaching needs shall blackout shades be provided.
      • Motorized shades are acceptable if:
         i. Budget allows.
         ii. Window size or location makes manual cord control shades difficult to operate.
         iii. Hard-wired; no remote controlled shades.

8. Ceilings:
   a. Ceilings shall be a light color with a minimum reflectance value of 80.
   b. Minimum ceiling height shall be 10'-0” above finish floor for all classrooms.
   c. In classrooms with sloping or stepped floor systems, the ceiling height shall be a minimum of 8’-0” from
      finish floor at the highest floor elevation.
   d. Acoustic panel and grid systems shall be a minimum of 24” x 24”.
   e. Ceilings must have access to projector and speaker locations for future wire pulls or maintenance.

9. Acoustics:
   a. Careful acoustic consideration must be given to the configuration of each wall surface, ceiling plan, and
      floor finish.
   b. Walls and ceilings shall be designed to evenly distribute sound throughout the space.
   c. Acoustic control shall be designed so that sounds and voices are heard easily and accurately from all
      seating locations while keeping unwanted background or outside noises from intruding into the space.
   d. In small classrooms, modest wall and ceiling acoustic treatment is required.
   e. In larger classrooms and lecture halls, a thorough acoustic evaluation by an acoustic consultant will be
      required. A Design Acoustician must work with CMET, Information Services, and CAI for an
      understanding of room acoustics in regard to amplified speaker systems and oral sound origination.
      Acoustic evaluation must include consideration of reinforced, distributed speaker system.
   f. Classrooms for distance education have more specific requirements to prevent background noise that
      must be explored and implemented.

Classroom Casework, Fixtures, Furnishing, & Accessories

1. Chalkboards & Marker-boards:
   a. All general purpose classrooms shall be equipped with either chalk- or marker-boards. Chalkboards are
      acceptable if required by the needs of the faculty and instructors, the department program and curriculum
      and the currently adopted pedagogy.
Classroom Casework, Fixtures, Furnishing, & Accessories continued

b. UO approval is needed for any rolling style boards.

c. Chalkboards shall be black with a 50-year warranty against polishing.

d. Marker-boards shall be: either white or off-white; concealed spine connections; porcelain enamel or glass material; 25-year warranty.

e. All boards shall include chalk / pen trays, 2” cork strips at the top, and map hooks / rails.

f. Boards shall extend the full length of the instruction wall with placement so that an 8ft board section can be used when projection screen is in use.

g. Marker-boards are preferred in distance education spaces for better contrast.

h. Classroom size and board requirements:

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>Minimum Board Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 35</td>
<td>12 feet long x 4 feet high</td>
</tr>
<tr>
<td>36 – 60</td>
<td>20 feet long x 4 feet high</td>
</tr>
<tr>
<td>61 – 100</td>
<td>30 feet long x 4 feet high</td>
</tr>
<tr>
<td>Lecture Halls</td>
<td>3 sections; 12 feet long x 4ft high</td>
</tr>
</tbody>
</table>

2. Projection Screens:

a. Each classroom shall be equipped with one, or more, projection screen.

b. Da-Lite projection screens with a white matte finish are preferred with out blackout blocking at the top of the fabric.

c. Screen size is to be determined by individual project / user needs, or based on room depth and seating capacity. Viewable areas less than 84” wide or 72” high must be reviewed by CMET and CAI.

d. The bottom of the viewable area shall be no lower than 48” from finish floor and should be above 36” unless viewing height will be compromised.

e. Projection width-to-height ratio shall be 16:9; however, screen height should not be compromised in pursuit of a framed image with that ratio.

f. Screen height should follow the guideline of 1/5 the maximum viewing distance.

g. All screens are to be mounted to allow sufficient clearance from the board trays.

h. All screens are to be positioned so that a minimum of 8ft linear of board remains usable while screen(s) is in use.

i. All screens wider than 6ft shall be motorized with a wall-mounted toggle control switch. Classrooms with control consoles (i.e. Crestron) shall provide screen control from the console. If screen control is incorporated in AV control system, also include wall mounted screen control switches.

j. All screens shall be seamless.

k. Screen gain shall be between .9 and 1.5. Preferred is 1.0, matte finish.

l. For ceiling recessed screens, the screen and screen housing shall be able to be independently of one another and removable.

3. In seminar and conference rooms plasma, LCD displays, or smart boards may be installed. Sufficient reinforcement structure for weight of displays shall be incorporated in walls at designated locations. Consultation with CMET and CAI is needed for review and approval.

4. Seating:

a. Seating style shall be determined by individual projects and/or user needs.

b. ALL seating MUST be durable, easily cleaned, easily repaired, and easily maintained.

c. Seating types include:
   - Moveable tablet-arm chairs.
   - Fixed seats with folding or fixed tablet arms.
Classroom Casework, Fixtures, Furnishing, & Accessories continued

- Moveable tables and chairs.
- Fixed tables and moveable chairs.
- Fixed auditorium seats with folding tablet arms.
  i. Tables shall be sturdy, minimum of 24 inches deep, and minimum of 30 linear inches per student.
  ii. Tablet arms shall be as large as possible; 280 square-inches preferred; 212 square-inches minimum.
  iii. Tables must not tip easily.

5. Instructor Consoles & Podiums
   a. Use approved UO designed and developed standard podium & lectern whenever possible. Podium shop drawings are available for integration in to drawings sets and bid documents. Contact Capital Construction Project Planner or Capital Construction Project Manager.
   b. Media credenza, whether custom fabricated or purchased, must be approved in collaboration with CMET, Information Services, UO Capital Construction, and CAI.
   c. Instructor furniture shall serve as both the instructor’s desk, instructor podium, and a locking cabinet for technology components.
   d. If UO standard podium is not used, podium and/or lectern design, whether custom fabricated or purchased, must be developed and approved in collaboration with CMET, Information Services, UO Capital Construction, and CAI.
   e. AV equipment shall be controlled at the podium.

6. Signage:
   a. Clear signage must direct students to classroom spaces. This may be a building directory at each entry, or if necessary, highlighted way finding signage place at strategic locations.

7. Digital Signage:
   a. Digital signage, if requested and approved for a project, should follow campus hardware and software standards. Contact Information Services for complete and comprehensive system requirements and standards.

8. Other Fixtures:
   a. A large clock shall be mounted in the classroom so that it’s easily read by the instructor/presenter.
   b. A minimum of one manual pencil sharpener is to be installed.

Classroom Mechanical Systems

1. Classroom renovations shall include a mechanical system that generates a background noise of no more than NC25 to NC30.

2. New classroom construction shall include a mechanical system that generates a background noise of no more than NC20 to NC25.

3. Low velocity transfer grills and low velocity air shall be included.

4. Supply outlets and return air intakes shall be located away from lecterns, podiums, projection screens, and fixed microphones.

5. Supply Air:
   a. Supply air shall not be located at or directed onto projection screens. The preferred arrangement of supply air outlets is toward the front, with return air intakes at the rear of the classroom.
   b. Supply grille colors should be considered in spaces with cameras.
   c. Supply grille openings should be orientated not to face mounted cameras as the openings distort captured image.

6. Thermostats are to be housed in locking covers.
Classroom Mechanical Systems continued

7. Distance education classrooms require:
   a. Constant temperature between 65 – 80°F and 65 – 75°F for distance learning control rooms, both with relative humidity between 30 – 75%.
   b. Noise and vibration must be minimized.
   c. No higher than NC-20 noise levels at each grill.
   d. Return air grills shall be located near equipment to help draw heat from the room.

8. Control Room / Projection Booth Mechanical Requirements:
   a. Different HVAC zone than classroom or surrounding corridors.
   b. Return air near equipment location for extraction of heat from equipment.

9. For distance education and video conferencing control rooms and/or projection booths HVAC noise is more of an issue and supply air shall be located at perimeters with sound levels no more than NC 20 at each grill.

Classroom Lighting Systems

1. All classrooms shall be designed with lighting zones so that the lighting for instructor/presenter, whiteboard / projection screen, and audience can be adjusted in such a way that they do not interfere with each other.

2. Room lights shall not shine directly on projection surfaces.

3. Ambient room light shall be minimized for the projection screen.

4. Lighting for instructor / presenter and whiteboard / chalkboard should be separate and adjustable so that the instructor / presenter are well lit for recording without busy-patterned or over-bright background.

5. For video, lighting for instructor / presenter/panel should be as even and 3-dimensional as possible and not directly above the presenter. Lighting instruments for front of room should be adjustable for brightness and throw pattern with barn doors, louvers or baffles.

6. Lighting must be installed to be independently controlled by the instructor, but must be capable of interface and control by a UO CMET installed AV control system.

7. Lighting of classrooms shall include the following zones as applicable:
   a. Main classroom lighting; student seating area.
   b. Instruction area lighting; front of class and lectern.
   c. Non-projection board lighting; board that is not obscured by a lowered projection screen.
   d. Projection board lighting; board that is obscured by a lowered projection screen.
   e. Instructor lectern / workstation lighting.
   f. Spot lighting with correct lighting angles for recording / taping of the instructor and the projection screen / white-board.
   g. All classrooms must have lighting that while projection area is darkened, the general lighting is sufficient enough for student work surfaces and note taking.

8. Seminar rooms, small classrooms, and conference rooms must have lighting systems designed to accommodate projection, wall mounted flat panel displays, and/or video conferencing.

9. All fixtures must be coordinated to avoid conflict with projectors and screens so that they do not cause shadows on projection screens.

10. Bulb replacement must be considered; scaffolding for bulb replacement is not acceptable.

11. If multiple occupancy sensors are used in one classroom, they shall be installed in a parallel fashion, when an individual enters the classroom late the rear sensor sees them but do not turn on the lighting to a normal level; the selected scene for presentation must be maintained.
Classroom Lighting Systems continued

12. Classrooms must have a dimming range of 1% to 90% with variable switching options available.

13. Required Lighting Controls:
   a. Light switches at entrance(s) to classroom shall turn on and off lighting to preset levels.
   b. Wall mounted switch controls for lighting and projector(s) shall be adjacent to the teaching station / podium. (AV equipment shall be controlled at the podium).
   c. Scene controls with clearly labeled pre-sets at teaching station podium.
   d. If there is a control room and/or projection booth, full lighting and scene controls must be installed within these spaces as well.
   e. Each room with dimming capabilities shall have a dedicated control panel. Multiple rooms shall not be on the same dimming panel.
   f. Lighting scenes shall be preset and clearly labeled. Instructors, presenters, etc. shall not have access (locked-out) to scene control settings in order to avoid inadvertent reprogramming. UO Facilities and/or CMET shall have access to these control settings.

Classroom Power & Communication Systems

1. All communication (voice & data) design requires collaboration and consultation with UO Information Services.

2. Provide a minimum of 2 duplex power outlets on each wall; maximum spacing is to be 16ft.

3. Spaces without control rooms but with cameras require a 1” conduit pathway from the camera location to the podium / lectern.

4. Provide 2 duplex receptacles on a dedicated circuit on the exterior of the AV / lectern casework.

5. Provide 4 duplex receptacles inside the lectern casework in the rear of the cabinet; coordinate location with CMET.

6. Provide a minimum of one duplex outlet in the ceiling for projection per projector location.

7. Additional outlets may be required at fixed student seating for laptops, etc. as requested by the University and/or classroom users.

8. Interactive and flexible classrooms may require wall boxes or floor boxes, as requested by the University and/or classroom users.

9. Classrooms and control rooms shall be equipped with cable TV in buildings that have such service. These spaces in buildings without an existing cable TV service shall have cable pulled for future service.

10. A minimum of 6 cat5e cables must be installed into AV casework and/or lecterns. A minimum of 2 cat5e cables must be installed into a faceplate on the exterior of AV casework and/or lecterns.

11. Each projection booth and/or control room needs to be equipped with a minimum of 6 cat5e cables.

12. All classrooms shall have wireless network coverage and classrooms seating 75 or more students require multiple wireless transmitter point locations cabled with 2 cat5e cables each.

13. All spaces require at least 1.5” minimum conduit pathway provisions for 2 current and/or future camera locations; one in the front of the space and one in the rear of the space.

14. A minimum of one phone line per classroom is required.
Classroom Power & Communication Systems continued

15. Possible cable needs for cameras include one of each:
   a. Camera cable needs vary according to what type of camera will be installed. Conduit should be sufficient for control cable and signal path according to specifications of cameras being considered for the project.
   b. Cat5, RG59 video coax, 9 conductor VISCA / RS232 / RS422 control cable; minimum of 1.5” conduit.
   c. Depending on the type of camera, power through cable or nearby on the wall. Minimum 1.5” conduit pathway.

16. Flat Panel Displays:
   a. Adequate mounting reinforcement shall be part of the wall makeup wherever flat panels will be installed.
   b. Standard 15 amp power shall be supplied on a double gang plate, preferably inset and hidden from view.
   c. If the flat panel requires local user access an accessible connection plate will be provided, typically below the mounted screen.
   d. For flat panels that will receive signals or supply signals to/from other equipment or remote switching/control equipment in a nearby room, signal routes shall be of sufficient number and volume to accommodate these wires. 2” diameter conduit is strongly recommended; 1.5” may be adequate in some installations.

Projection Booths and Control Rooms

1. Booths and control rooms are typically required for large lecture halls and distance education classrooms. Pathways to shared control spaces and routing for communication cable paths outside the building shall be included in the design of booths and control rooms.

2. Booths/Rooms are to be 12ft wide by 7ft deep at a minimum per classroom space the booth/room serves.

3. Doors shall be oriented so that no direct exterior light is allowed into the space or classroom.

4. A single projection window shall be provided with good visibility and flexible projector locations.

5. Full lighting and scene controls must be installed within these spaces as well.

6. The floor, window, counter height, etc. shall be accessible for ADA users and equipment carts.

7. Film projection locations shall have space to the right of the projector for access to projector controls.

8. Cable pass-through required for temporary cabling from the booth to the space.

9. No plumbing equipment and/or piping shall be routed through these space types.

10. A minimum of one equipment rack location is to be provided within each space. Additional rack requirements are to be determined with CMET consultation during design.
   a. Racks are from the ERK series; Height 7ft, width 22in, depth 22in.

11. Projection Windows:
   a. Dimensions shall be as high and wide as possible.
   b. Shall be set high enough so that projected images pass completely over the heads of students/audience.
   c. Shall contain glass of optical quality or water white seamless glass without visual imperfections.
   d. Provide glass with gasket seals for sound control.
   e. Shall be installed in a tilted orientation to prevent reverberations within the classroom.
   f. Any projection window shall be placed so that the projector(s) (slide or data/video) may be placed at a perpendicular angle to that projector's portion of the projection screen, both horizontally and vertically.

12. Projection-booth & control-room countertops:
   a. Minimum countertop depth should be 29inches.
   b. For each conferencing/camera control station, counter length should be 30”.
**Projection Booths and Control Rooms continued**

c. If a projection window is specified, counter length should be full length of the window wall, with no cabinet doors or kick plates under the counter to allow for operator knee room or portable cabinet placement.

13. **Electrical:**
   a. Each projection location shall be provided with a duplex outlet at countertop height.
   b. Each equipment rack shall be provided with a 4-plex, 20amp outlet on a dedicated circuit.

14. **Lighting:**
   a. Provide 1 lighting system of general fluorescents for high illumination during maintenance and setup.
   b. Provide a second lighting system of dimmable task lighting to illuminate workspaces during lectures and/or programs.

15. **Telephone, Data, and Cable TV:**
   a. Cable TV shall be installed in all control rooms and/or projection booths. These spaces in buildings without an existing cable TV service shall have cable pulled for future service.
   b. A minimum of 16 cat5e cables, multi-mode, and single-mode fiber optic cables shall be installed for voice and data.

16. **Distance Education and Video Conferencing:**
   a. Lighting: 100 FC for general lighting.
   b. Electrical: Duplex outlet at each camera location; 1 inch conduit from camera location to control room.

**Wireless laptop classrooms:**

1. Closets and/or carts are required for computer storage, recharge, and disk maintenance.
2. Additional network for disk maintenance.
3. Multiple projectors and projection surfaces.
4. Moveable furniture.
5. Maximum wireless coverage (multiple access points) to address high and simultaneous demand.
6. Power provisions for laptops during use; floor boxes, moveable furniture with power & plugs, etc.
7. Additional power for battery recharge.
   a. Generally, we should provide 110 Watts worth of power for every laptop. Provide one 20A circuit for every 15 laptops.
   b. Calculation it is to take the current rating of the notebook brick and multiply by number of notebooks. For example a Mac book uses a 65watt brick, while the 15in latitudes tend to use 90 watt bricks. Then add in a factor for AC/DC conversion losses (20% is more than enough). If you are sure the notebooks will never be operating when charging, you can get by with less.

**End of Section**
The following information is specific to a ‘Communication Room’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

**General**

1. There are three major areas that must be accommodated in the design of a facility: Space; Pathways; Cabling.
2. NO sharing of program is allowed. These spaces may not double as a custodial closet, storage, etc.
3. These spaces may be shared with electrical, however, if these spaces are shared with electrical, sufficient cooling shall be provided to cool the heat load of electrical devices.
4. Coordination with UO Network and Telecom Services (N&TS) is required during design.
5. Communication reach-in spaces shall have one 36-inch door that swings out of the space with flush thresholds.
6. The TSER and TER may be combined to optimize space planning; this method is preferred.
7. **Telecommunications Service Entrance Room (TSER):** This space is where the communications cabling enters the building from the campus tunnel or conduit system. Each building is required to have this space located near the electrical service entrance. This location is where primary and secondary protection is installed on all metallic cabling entering the building to protect building occupants and equipment from stray voltages, currents, and lightning strikes. This room must provide adequate space for the protection as well as cross connects to the building backbone cabling system. If the TSER is not combined with the TER described below, no special environmental conditioning is required beyond the general building HVAC.
8. **Telecommunications Equipment Room (TER):** This is a centralized and conditioned space that houses telecommunications equipment common to the building as a whole. Such equipment includes: telephone system modules; local area networking equipment; specialized network services; other building-level telecommunications equipment. Only one TER space per building. The TER shall be 0.75 square feet per 100 square feet of floor space served by the TER; the minimum space size being 10’x7’. The TER shall be 10ft wide and as long as required to reach the square footage requirements outlined previously.
9. **Telecommunications Rooms (TR):** This is a centralized and conditioned space that houses equipment similar to TER spaces but provide a much more limited function; typically per building level. The equipment in a TR provides service to a floor or part of a floor within a building. The TR shall be centrally located to minimize cabling lengths. TR space sizes shall be the following: 10’x7’ for up to 5000 sq. ft., 10’x9’ for 5000 to 8000 sq. ft, and 10’x11’ for 8000 to 10,000 sq. ft.
   a. TR wall construction shall include plywood backboards of 3/4" AC fire rated plywood, 8' tall, width is to be determined by project.
   b. Coordinate the installation of ladder rack with all other construction within telecommunications room.
10. The TER and TR require air conditioning on a 24-hour-a-day, 7-day-a-week basis with standby power. The environmental limits of these rooms are 65°F to 75°F (70°F set point) and 30% to 55% relative humidity. Rooms must have a minimum illumination of 50 foot candles with fixtures coordinated with telecommunications equipment to ensure good lighting throughout the rooms. If these rooms are located below grade, they must be equipped with a sump pump system on a standby power source. These rooms shall not be located under locations that would introduce water (kitchens, restrooms, etc.). Also, water, sewer, and/or steam lines are not allowed to pass through either the spaces. The doorways shall be a double door with 36” leafs that outward swing, that are lockable, that has removable mullions, and the threshold shall be flush with the finished floor.
Pathways
1. TSER shall be equipped with at least two 4” conduits stubbed to the campus utility tunnel for provision of campus telecommunications services to the building.
2. Building pathways shall consist of cable trays in hallways or other common and direct paths through the building. Conduits from station locations shall stub into the cable tray. The pathway shall stub into the serving TER or TR. There shall be at least two 4” conduits running from each TR to the TER.
3. Conduits 2” or larger shall have no more than 180 degrees of bend or 100 feet between pull points. Conduits smaller than 2” shall have no more than 270 degrees of bend or 100 feet between pull points. Pull points shall be appropriate sized junction boxes. Conduit bodies (LB’s) are not allowed.
4. Individual station outlets will be served by at least a 3/4" conduit from the cable tray.
5. Individual station outlets will be equipped with a 4” deep square box with a single gang mud ring.
6. Additional pathway requirements will be outlined during the detailed design process.

Cabling
1. Four extra headroom category 5e cables to each station outlet.
2. Cable TV is supported via quad shield RG6.
3. Backbone cabling includes multi and single mode fiber optic cable, multiple category 5e cables, multi-pair telephone cable, and rigid cable TV cable.

End of Section
The following information is specific to a ‘Construction Overstock Storage’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

1. Construction Overstock Room is required in all new construction to house all building specific and required extra items; paint, carpet, lighting, filters, etc.

2. Room size should use the general rule of 0.75 ft² per 100 ft² of building space with a minimum room size of 10ft x 12ft.

3. Flooring shall be sealed concrete.

4. General fluorescent lighting is required with wire guards on fixtures.

5. Ventilation:
   a. Basement locations: ventilation only, no heating or cooling necessary.
   b. Attic and/or Penthouse locations: careful consideration should be given to the amount of ventilation and/or heating and/or cooling is required to provide an appropriate environment. (Housing)

6. Shelving is required for efficient storage. Shelving type required will be determined by the design team in consultation with the Facilities PM and Maintenance during design.

7. Minimum of 2 power duplex that remains accessible; not on shelving wall(s).

8. NO sharing of program is allowed. Construction Overstock Rooms may not double as a custodial closet, etc.

End of Section
The following information is specific to a ‘Custodial Closet’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

**General**
1. Custodial closets are to be included in all new buildings in accordance with Oregon State System of Higher Education (OSSHE) space standards at a minimum.
2. Remodeling activities are not to result in the reduction of available custodial space below space standards, and to the extent possible, remodeling projects shall be viewed as opportunities to improve substandard facilities.
3. NO sharing of program is allowed. This storage room may not double as a storage closet, server room, etc.

**Closet Location**
1. One custodial closet located within 50ft of each rest room area.
2. Minimum of one custodial closet on each floor.
3. Minimum of one oversized custodial closet in each building.
4. Closets shall not be near, nor exit into, carpeted hallways.

**Closet Dimensions**
1. Minimum closet is 6ft x 6ft.
2. Doors shall be a minimum of 36in wide, swing out, and no automatic closures.
3. Tall ceilings are needed for ladders and extension poles.
4. Oversized closets shall be 6ft x 12ft and have ventilation to the outside as this closet will then be used to charge batteries of larger equipment.

**Closet Shelving, Hangers, & Accessories**
1. Three 6ft long shelves per closet.
2. Bottom shelf shall be 4ft-6in off finish floor.
3. Each shelf is to be 12in deep and allow 12in clear height to next shelf.
4. Two mop hangers at 6ft off finish floor located over the floor / mop sink.
5. Four additional mop hangers at 6ft off finish floor within the room.
6. 3/4 inch brass coupling and stainless steel hose bracket; Fiat 889-CC or Fiat 832-AA.

**Closet Plumbing**
1. Floor drain is required in each closet; to be installed at the lowest point.
2. 1/2 inch isolation ball valves required on hot and cold water.
3. One mop sink in each closet.
4. Cold water hose bib 72 inches from finish floor.
5. **Faucet:**
   a. 40 inches from finish floor & centered over mop sink.
   b. Wall mounted service type.
   c. 6 inch spout with integral vacuum breaker.
   d. 3/4 inch threaded hose outlet.
Closet Plumbing continued

e. Adjustable centers.
f. Integral check arms.
g. Chrome plated.

6. The following sketch is a diagram of plumbing noted above and to be included. Wall layout must comply.

Closet Electrical

1. Each closet shall be provided with a GFI outlet.

2. Lighting shall be controlled by occupancy sensor.

3. Lighting is to be placed in an area where it will not be hit with mop handles when using the sink and is to have a plastic / wire cover to protect bulbs from accidental contact with mop handles.

Closet Finishes

1. Floor:
   a. Resilient safety flooring.
   b. Light colored 8in x 8in non-glazed quarry tile. Grout lines, tile, flooring, etc. must be sealed.

2. Wainscot: light colored 4.25in x 4.25in glazed ceramic tile and/or FRP 4ft from finish floor.


4. Wall assemblies are to use appropriate materials such as wonder board, hardy board, etc. for wet conditions.

End of Section
The following information is specific to a ‘Faculty Office’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

Generally office furniture is Owner Furnished Owner Installed (OFOI) from the following Standards. However the scope, budget, schedule, etc. of individual project will determine the process in which furniture will be selected and purchased.

Furniture & Accessories:

The following specifications are representative of furnishings typical for a faculty office. Budgetary constraints, integration of existing furniture, and User preference often dictate what is specified. UO cannot sole-source product.

1. Office Desk Chairs:
   a. Herman Miller; Mirra Work Chair; MR133AAFAJG1C7ZLBK3Q118M01.
   b. Herman Miller; Caper Multi-Purpose; WC121PBKG1C7BK6V01.

2. Side Chair: Herman Miller; Caper Guest; WC410NBKG1U5.

3. File Cabinet:
   a. File cabinets should be evaluated for height and weight to determine if they should be secured to the wall using common earthquake restraint practices.
   b. Herman Miller, Meridian Filing and Storage; MT – Medium Tone metal finish.
   c. Upholstered cushion top fabrics for mobile file cabinet; also used as additional seating with upholstered cushion top fabrics; Herman Miller colors:
      • Moiré, 3A05 Fern.
      • Moiré, 3A04 Chambray.
      • Moiré, 3A11 Spice.
      • Moiré, 3A03 Rattan.

4. Free Standing Desks:
   a. Herman Miller, Avive Table Series.
   b. MT – Medium Tone metal finish.

5. Desktop Work Surfaces:
   a. Fiber Laminate Colors:
      • Pionite (from Herman Miller); 1x Vanilla.
      • Pionite; 3x Celery Fiber.
      • Pionite; 4x Coriander.
   b. Formcoat Colors:
      • CL, Cool Gray
      • Y9, Pond Green
      • LU, Soft White

6. Fabric Panels – Walls, Partitions, Acoustic, Tack Boards, etc.:
   a. Herman Miller; Kira, 5D01 Flaxen.
   b. Other fabrics and colors available.

7. White Board:
   a. All boards shall include chalk / pen trays, 2” cork strips at the top, and map hooks / rails.
   b. Either white or off-white; concealed spine connections; porcelain enamel or glass material; 25-year warranty.
Furniture & Accessories continued:

8. Adjustable Wall Shelving:
   a. Bungee or strapping systems should be incorporated to restraint shelving contents.
   b. Vertical Standard: Knap & Vogt 85 double slot, heavy duty; 4ft length typical.
   c. Bracket: Knapp & Vogt 185 double bracket, heavy duty; 12in depth typical.


10. Freestanding cabinets and bookcases should be evaluated for height and weight to determine if they should be secured to the wall using common earthquake restraint practices.

11. Ceilings should be included to conceal piping in office spaces as often as able.

Color Palettes:
The following 3 color palettes are representative of finishes typical for a faculty office. Budgetary constraints, integration of existing finishes, and User preference often dictate what is specified. These can be a starting point for discussion of finishes with the User(s), but do not have to be adhered to.

1. Wall & ceiling paint: Miller 07E2103 eggshell; Benjamin Moore 2151-70 ‘Powder Sand’.
2. Trim paint: Miller 07E2208 semi-gloss; Benjamin Moore HC-27 ‘Monterey White’.
3. Rubber wall base: Roppe P150 ‘Dark Grey’, TSRT150SBR.
4. Palette A – Pacific Coast
   b. Accent Wall Paint Color; choice of 1 of the following:
      - Miller 07E2102, eggshell; Benjamin Moore HC-115 ‘Georgian Green’.
      - Miller 07E2105, eggshell; Benjamin Moore HC-146 ‘Wedgewood Gray’.
      - Miller 07E2104, eggshell; Benjamin Moore HC-5 ‘Weston Flax’.

2. Palette B – High Desert
   a. Carpet Tile: Interface FLOR modular carpet; color 7769 ‘Foundation’; pattern 17Z ‘To Scale’.
   b. Accent Wall Paint Color; choice of 1 of the following:
      - Miller 07E2102, eggshell; Benjamin Moore HC-115 ‘Georgian Green’.
      - Miller 07E2106, eggshell; Benjamin Moore HC-50 ‘Georgian Brick’.
      - Miller 07E2104, eggshell; Benjamin Moore HC-5 ‘Weston Flax’.

3. Palette C – Willamette Valley
   a. Carpet Tile: Interface FLOR modular carpet; color 7776 ‘Details’; pattern 17Z ‘To Scale’.
   b. Accent Wall Paint Color; choice of 1 of the following:
      - Miller 07E2102, eggshell; Benjamin Moore HC-115 ‘Georgian Green’.
      - Miller 07E2105, eggshell; Benjamin Moore HC-146 ‘Wedgewood Gray’.
      - Miller 07E2104, eggshell; Benjamin Moore HC-5 ‘Weston Flax’.
Color Palettes continued:

4. Palette D – Cascade Peaks
   a. Carpet Tile: Interface FLOR modular carpet; color 7777 ‘Linear’; pattern 17Z ‘To Scale’.
   b. Accent Wall Paint Color; choice of 1 of the following:
      - Miller 07E2102, eggshell; Benjamin Moore HC-115 ‘Georgian Green’.
      - Miller 07E2105, eggshell; Benjamin Moore HC-50 ‘Wedgewood Gray’.
      - Miller 07E2104, eggshell; Benjamin Moore HC-5 ‘Weston Flax’.

5. Alternate rubber flooring option; for offices adjacent to ‘wet’ spaces (i.e. laboratories).
   a. noraplan®, environcare 2945; sheet or 24”x24” tile.
   b. noraplan®, environcare 2944; sheet or 24”x24” tile.
   c. noraplan®, environcare 2949; sheet or 24”x24” tile.

Lighting:

1. Fixture: Lithonia AVSM 2 32; MDR diffuser; MVOLT OSPSX ballast; 4ft, T-8 lamp.
2. Switching: Watt Stopper DW-100-W.

End of Section
The following information is specific to a ‘Laboratory’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

Laboratory Definitions

1. OSHA 1910.1450(b) Laboratory: A facility where the laboratory use of hazardous chemicals occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

2. OSHA 1910.1450(b) Laboratory Scale: Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. ‘Laboratory scale’ excludes those workplaces whose function is to produce commercial quantities of materials.

3. Laboratory Ventilation:
   a. 29 CFR 1910.106(d)(4)(iv) Ventilation: “Every inside storage room shall be provided with either a gravity or a mechanical exhaust ventilation system. Such system shall be designed to provide for a complete change of air within the room at least 6 times per hour.”
   b. 29 CFR 1910, Appendix A; NRC recommendations for chemical hygiene in labs (C)(4)(f): Performance: Rate: of 4-12 room air changes / hours is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control (194).”

4. Oregon 2007 Fire Code, Hazardous Materials:
   a. 2704.3 Ventilation: “Indoor storage areas and storage buildings shall be provided with mechanical exhaust ventilation or natural ventilation where natural ventilation can be shown to be acceptable for the materials as stored.”
   b. 2704.3.1(2): “Mechanical ventilation shall be at a rate of not less than 1 cubic foot per minute per square foot [0.00508 m3/(s•m2)] of floor area over the storage area.”
   c. 2705.1.9 Ventilation: Indoor dispensing and use areas shall be provided with exhaust ventilation in accordance with Section 2704.3.”

5. Oregon 2007 Mechanical Code, Table 403.3: “Required outdoor ventilation air, Educational Laboratories, 20 cfm per person, 30 person maximum occupant load per 1000sf.”

Laboratory ADA Guidelines

Accessibility and ADA Compliance in Research Laboratories at the University of Oregon
F.Tepfer 22 March 2011

‘The UO strives to create accessible, welcoming working and learning environments, a key part of which is accessible research labs. The UO has long been a leader in this area as with other aspects of accessibility.

The challenge in making accessible work environments is to build facilities that work well for everyone’s abilities and yet adapt still further to the widest range of disabilities that we encounter, some of which are covered under the ADA. Conventional catalogue choices for accessibility, the ones with the little blue wheelchair symbol, are often ineffective or even dangerous for those without disabilities. The Hamilton HOPEC fume hood is one such example. We take a different approach that is more effective for all users and results in an environment that looks and feels more universally welcoming.

The basic premise of UO’s accessible lab design is to ensure that the permanent elements either are already accessible to Federal standards or can be adapted to be accessible on reasonably short notice. Our position is that a week’s notice is reasonable for making minor changes to a research lab environment. In some cases, this requires modest compromises in the design compares to inaccessible solutions, but in most cases, we have developed methods that can easily be adapted for the whole population on short notice.
Laboratory ADA Guidelines continued

These principles were developed over many years of providing access to researchers, including individuals confined to wheelchairs, others who use other mobility aids, some who were blind, and others with moderate to severe deafness. Our track record has kept us ahead of federal and state requirements for accessibility.

1. As required by the ADA Standards and by state code, the built structure of walls and doors is fully compliant with the latest ADA Standards as strengthened to comply with UO Universal Access policies. This generally results in a level of accessibility beyond Oregon code. The UO-modified ADA Standards can be found at http://uplan.uoregon.edu/plandoc/OregonizedADA.html.

2. The deafness provisions of the ADA Standards and Oregon code are to be provided in full, and provisions for blindness are provided into all circulation areas within the lab.

3. The most challenging research lab elements to modify, generally involving research equipment such as fume hoods and lab benches, are built to be accessible or adaptable on reasonable notice for a reasonable number of stations, generally one per lab suite or 10% (whichever is more). In particular:
   - Lab benches generally have countertops no higher than 34 inches or are vertically adjustable from 29 inches to 36 inches.
   - Safety showers, eyewashes, fire extinguishers, and other safety-related devices are accessible or could be modified to be accessible on short notice.
   - We consider lab benches to be furniture in a workplace, but we still take measures in advance to assure that a reasonable number or work stations in our generic research labs can be made accessible. If no stations in the lab suite have vertical adjustability with mobile base units, knees space is provided or could be created by removing cabinet boxes, after which a reasonable number of stations will be accessible.
   - A reasonable number of fume hood base cabinets can be removed to provide knee space, after which basic hood functionality is accessible.
   - A reasonable amount of storage is within reach range or could be made accessible on short notice.

4. Some elements are not made accessible initially or in some cases ever.
   - As mentioned above, lab benches may or may not be accessible at the outset but a reasonable number can be modified to accommodate a wide range of individuals.
   - The same applies to fume hoods.
   - Sink depth is usually non-compliant, as a safe sink for ambulatory users is generally deeper than a compliant sink. Sinks will be changed as needed in the future to ADA-compliant sinks.
   - Specific pieces of research equipment such as centrifuges, electron microscopes, mass spectrometers, and so forth are unlikely to be accessible or to be adaptable, but other methods such as a lab assistant would be used to ensure access to the services.

We recognize that acceptance of this approach for code compliance requires some degree of trust of the UO to be responsive when necessary. Federal requirements to accommodate individuals with disabilities put our Federal research grant support at stake should we not comply when needed, providing us with an incentive and providing the City of Eugene with some confidence that our assurances about adaptability are not empty promises.’

U of O Laboratory Types

1. Individual labs may vary from these models in level of risk, materials and systems, and other respects. Labs are expected to be generic within large categories to allow flexibility of future assignment:
   a. Bioscience: moderate chemical use; moderate radioactivity use; significant use of carcinogens, toxics, mutagens.
   b. Synthesis chemistry: high chemical use; high flammable solvent use; high corrosive use; high gas use.
   c. Analytical chemistry: low or moderate chemical use.
   d. Optics: low or moderate chemical use.
   e. Physics: low or moderate chemical use; high cryogen use.
U of O Laboratory Types continued

f. Human Physiology: low or moderate chemical use.
g. Animal Research: low or moderate chemical use; significant use of carcinogens, toxics, mutagens.
h. Geological sciences: low or moderate chemical use; moderate corrosive use; moderate flammable gas use.
i. Anthropology: low or moderate chemical use.
j. Fine arts studios, painting, printmaking, photo labs, etc.: moderate to high chemical use (low diversity and high volumes)
k. 4 ACH (Air Changes per Hour) when unoccupied and greater than 8 ACH when occupied appear to be common standards for laboratory ventilation. UO laboratory standards do store hazardous material in quantities above Maximum Allowable Quantities (MAQ) per control area and as such could be interpreted as regulated to storage room standards of a minimum 6 Ach or 1 cfm/ ft² storage area, whichever is greater.

Space planning & General Items

1. B occupancies only.
2. For research spaces allocate 100 ft² per occupant.
3. For equipment spaces allocate x ft² per occupant.
4. For teaching spaces allocate 50 ft² per occupant
5. Locations of chemically intensive spaces are to be determined with discussion between Facilities EH&S, Planning, Facilities Maintenance, Facilities PM, and Science department requesting the space. Locations shall be designed to comply with Chapter 27 storage requirements.
6. Fire sprinkler piping:
   a. To be included at all times. If not installed at time of construction, plan for dry pipe and heads for future connections.
   b. No sprinkler heads in hoods or ducts.
7. Fire rated separations shall be provided to allow for chemical control areas.
8. Structural module of 20ft to 22ft.
9. Planning module of 10ft to 11ft.
10. Double faced aisles: 4ft-6in minimum width, 5ft desirable.
11. Single-faced aisles: 3ft-6in minimum width, 4ft desirable.
12. Counter depth: 30in, flat across entire depth.
13. Peninsula depth: 4ft-6in minimum, 5ft desirable.
14. Gas cylinders:
   a. Provide at least one wall-mounted restraint system for cylinder placement and/or storage.
   b. Placement is to be near or at fume hoods.
   c. Provide space for future gas cylinder(s).
   d. Cylinder racks shall have chain restraints at the top and bottom of cylinders.
15. Lab entrance:
   a. Door width shall be 36in to 42in to accommodate large equipment.
   b. Special cases may require door pairs. If leaves of various sizes are needed with 1 active and 1 inactive, the inactive leaf must be painted wall color in order for flush bolts to be used / allowed.
   c. Relight to corridor is desirable when possible.
Space planning & General Items continued

d. Corridor doors to have automatic closure hardware and adjusted to a slow close for safety in chemical transportation.

e. Freestanding furniture and equipment near lab entrances should be evaluated for height and weight to determine if they should be secured to the wall using common earthquake restraint practices.

16. Student desks within chemical-intensive labs, such as high chemical volume or high toxic, are to be avoided in order to discourage eating and drinking within the lab space.

17. When student desks are permitted within lab spaces, exit routes from the desks shall not pass through hazardous areas such as in front of fume hoods. The exit path shall be from greater hazard to lesser hazard.

18. Preferably student offices / desks shall be located in separate adjacent spaces.

19. Kitchenettes, human food storage, etc. should be designed / located in separate adjacent spaces, and such that path of travel from kitchenette to the office does not move through lab space.

20. Under-counter refrigerator units are not ideal and are not preferred by maintenance staff. Front vented units are required if this type of application is pursued.

21. Provide storage space for miscellaneous equipment such as carts, and other mobile equipment.

22. Areas requiring building services / utilities shall be concentrated and located near a corridor wall, not over lab bench spaces.

23. No operable windows.

24. Labs must be designed to provide environments and work areas accessible or adaptable for use by the disabled on short notice and at low cost.

25. Agreed Standard & standard process/policy for Oxygen sensors and alarming needed; not via the fire alarm.

26. Agreed Standard & standard process/policy for adding fire alarm horn or horn/strobe devices in remodels.

Chemical Evaluation and Storage

1. Evaluation of chemical types, usage, and storage must occur with UO EH&S and at the various design stages as follows:

   b. Design Development: Detailed inventory of planned hazardous materials; EHS review, and consultant code path analysis & determination. Review of operational requirements specified by chosen code path.
   c. Construction Documents: Details of operational components required by code path & life/safety requirements.

2. Appropriate and allowed storage shall be provided in each lab building and lab for acids, solvents, and hazardous waste volumes as determined by Environmental Health and Safety working with lab users and the applicable Codes.

3. As much as possible, chemical intensive and other high hazard spaces are to be located on ground floors.

4. No custom fabricated chemical or acid storage units; manufactured units only. Consideration must be given to chemical storage size and weight of containers.

5. Chemical Storage should be evaluated for the inclusion of lip or other restraint systems to prevent toppling during an earthquake.

6. Flammable & Acid Cabinets:

   a. Flammable cabinets may be ventilated with exhaust if consult with UO EHS indicates there is a health/safety benefit. NO supply or make-up air to cabinets.
Chemical Storage continued

b. Must be built to flammable cabinet standards. No custom fabricated cabinets; purchased only.

c. Corrosives & Toxics storage cabinets in casework under hoods shall be vented.

d. When provided, exhaust shall be 1 cfm per square foot of cabinet footprint, piped in stainless ductwork to fume hood exhaust from the lower bung.

e. Upon consult with EH&S, ventilated cabinets may not be required in remodels or where existing infrastructures will not support adequate exhaust.

Oxygen Deficiency Monitoring & Notification

1. Evaluation of spray types, usage, and necessity of oxygen deficiency monitoring and notification must occur with UO EH&S no later than Design Development.

2. Low oxygen alarms to be provided when potential exists for hazardous materials release causing an oxygen deficiency hazard.

3. Alarm sensors shall be placed low, or high, according to the vapor density of the material displacing breathable air. Low sensors shall be 18 inches above lowest grade; high sensors, 60 inches above grade.

4. A visual and audible alarm shall be provided within affected space, and at its entry.

5. Local entry warning alarms shall be set for oxygen concentrations <19.5%; consultation with EH&S is necessary to determine if additional alarm stages are required.

6. Local notification shall incorporate an audible alert, and visual notification of a blue strobe.

7. Standard signage as follows shall be placed below strobe and where readily visible.

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Casework & Furniture

1. Purchased and engineered furniture systems are allowed with UO (various groups listed above) review and approval and will not incorporate all components listed here.

2. All furniture and/or casework must meet expected load requirements.
Casework & Furniture continued

3. Shelf standards and brackets:
   a. Heavy duty double slotted steel.
   b. 440 pound load rating for 16 inch deep shelf.
   c. 520 pound load rating for 12 inch deep shelf.

4. Drawer and door pulls:
   a. Steel wire, 1-3/8 x 4 inch pull.
   b. US10D finish.

5. Drawer slides: Full extension type, 100 pound capacity.

6. Pull-out shelf slides; ‘bread boards’:
   a. Shall be considered for inclusion in each work bench.
   b. Full extension type, 100 pound capacity.


9. Door and drawer bumpers: Rubber, brown color.

10. Grommets:
    a. Plastic, 2in to 3in diameter opening, matching caps with slot for wire passage.
    b. Black in color.

11. Wire shelf guards:
    a. Stainless steel, brushed finish.
    b. 1/4 inch diameter.
    c. Bend to profile indicated.
    d. Lengths not to exceed 24in.

12. Typical 24in deep casework depth.

13. Utility Access:
    a. Building services / utilities shall be concentrated together and located in a corridor wall or at a lab entry.
    b. Valves, controls, and shut-offs may NOT be buried within casework without easy access.
    c. No junction boxes in or under casework.
    d. Utility service shut-off at entry into the lab space and at each lab bench / peninsula.
    e. Access must be by quarter-turn hardware per Section 08 30 00; access is NOT to include removal of screws.

14. Counter tops:
    a. High chemical exposure: cast epoxy, stone, or stainless steel. No phenolic-resin.
    b. Moderate or low chemical exposure: Acid-resistant plastic laminate.
    c. No chemical exposure: plastic laminate.

15. Reagent shelves:
    a. Peninsula supports: welded tube steel; 4in x 4in; welded top cap of the steel support required.
    b. Adjustable shelves.
    c. Wire shelf guards or seismic rods required, see above.
**Finishes**

1. **Floors:**
   b. All other labs MUST be a seamless and continuous sheet rubber with welded seams. Continuous flooring must continue under casework, fume hoods, etc. as much as practical within project scope.
   c. Coved flooring as wall-base with silicone sealant at the top of the cove shall be considered for all project scopes. Especially those projects with existing casework and fume hoods that will not allow continuous flooring under such items.
   d. All manufacturer recommendations and directions must be followed and performed for the initial cleaning of all flooring systems.
   e. Manufacturer known to be acceptable: noraplan.

2. **Ceilings:**
   a. NO ceilings in lab spaces.
   b. Ceiling required in chemical storage rooms.
   c. Paint overhead elements such as structure, ducts, pipe, etc.
   d. Do NOT paint dampers, pumps, motors, belts, or labels.

3. **Walls:**
   a. Gypsum board or veneer plaster.
   b. FRP to be used in wet and/or animal spaces.
   c. Paint color: Benjamin Moore; ‘China White’; 1412-0110 White Tint; 1402 Dolux or 1412 Ultra-Hide; 4 3YY 81/051.

**Lab Equipment**

1. **Safety showers:**
   a. Combination shower/eyewash stations known to be acceptable: WaterSaver unit EW102BP and SSBF2150.
   b. Shower only stations known to be acceptable: Haws 8122HWC.
   c. Every lab suite must have a safety shower, located as close as possible to an exit, within an exit route, and over a floor drain. Should not be located near electrical panels.
   d. Drench shower can be supported from either the wall or ceiling.
   e. Showers do not require tempered water in remodels. For new construction flushing tempered water is desired per NCZ358.1-2004.
   f. Isolation or shut-off valve for each emergency shower is required.

2. **Eyewash:**
   a. Eyewash units known to be acceptable: WaterSaver unit EW1022BP with ASSE 1024 dual check; WaterSaver unit EW1028VB.
   b. Sink mounted eyewashes should not be located under drying racks and/or storage.
   c. Eyewash waste to be hard-piped or a directional pipe leading to floor drain.
   d. Eyewashes do not require tempered water in remodels. For new construction flushing tempered water is desired per NCZ358.1-2004.

3. **Vacuum pumps:**
   a. Require spot exhaust and damper. If exhaust is routed to a fume hood then the design must not compromise fume hood containment.
   b. Acoustical enclosures are to be considered.
HVAC

1. General room ventilation shall be provided to prevent the buildup of laboratory emissions. A general room ventilation system shall maximize the clearance of contaminants from the room while minimizing overall energy use. In labs where heat load exceeds required ventilation rates stand alone cooling systems shall be considered.

2. No heating and cooling simultaneously.

3. Constant volume, VAV, and heat recovery systems are acceptable. However, the system selection shall be supported by a life cycle cost analysis and the designer shall submit an economic analysis during schematic design. Consultation with EH&S and Facilities Maintenance is also required to determine appropriate design parameters.

4. The lab designer shall provide a ‘basis of design’ statement for all labs that clearly defines all systems, systems criteria, and assumptions made. Documentation shall include items such as lab air change rates, description of air flow control system, equipment loading, assumed occupancy, etc.

5. Localized cooling via fan coils. Multiple or many local cooling areas shall utilize a system such as a ‘chilled beam’ (example only) vs. many fan coil units at each location.

6. Lab ventilation rates:
   a. 100% outside air with ventilating at a minimum of 1 cfm/ft² of floor area (6 air changes per hour) minimum in occupied lab spaces. (2007 Oregon Fire Code, 2704.3.1(2))
   b. Set-backs and/or less air changes per hour in unoccupied lab spaces may be considered in consultation with Facilities EH&S and Maintenance. Purge modes shall return the room occupancy.
   c. Higher and/or lower ventilation rates may be required and/or acceptable when the lab process is well defined. If pursued, the proposed ventilation rate must control room air contaminant concentrations below the threshold limit value.
   d. The lab designer shall include provisions for room purge mode in rooms where the use and/or storage of high hazard chemicals are anticipated. The lab designer shall work with the Facilities EH&S to determine need of purge mode and purge flow rates.

7. Single mode infrared sensors, with a minimum of 2 sensors per lab area, shall be used to establish occupied/unoccupied intervals. Schemes that utilize time-of-day light switches and/or manual switches to establish lab occupancy shall be avoided. Purge modes shall return the room occupancy.

8. Provisions shall be made for local exhaust of instruments, gas cabinets, vented storage cabinets or special operations not requiring the use of a fume hood. Dampers and taps required for future take-offs.

9. Supply air shall be properly balanced with hood exhaust in each room and slightly less than exhaust air to allow for lab rooms to be under negative air pressure at all times to areas of lower hazard.

10. Special care shall be made during renovations to seal windows and corridor wall penetrations.

11. Lab static pressures of -0.02 in to -0.05 in w.g. negative relative to the corridors shall be established; unless specific requirement such as bio-optics exist. Pressurization shall be established by initial balance and maintained by linked supply and exhaust flow. Through-the-wall pressurization controllers are not allowed.

12. Ganged hood ducts with dual exhaust fans are preferred to allow redundancy and half capacity.

13. Supply air filtration of 95% is required in all new lab buildings; MERV rating of 14 – 16 or HEPA.

14. Siemens DDC control systems are to be used.
Fume Hoods

1. Fume Hood manufacturers known to be acceptable: Fisher Hamilton; Labconco; Advanced Lab Concepts.
   a. Basis-of-design fume hood manufacturer shall be Fisher Hamilton; SafeAir or Concept model.

2. Hood Sashes:
   a. Vertical sashes ONLY.
   b. Automatic Sash Positioner:
      • Automatic sash positioner systems are required for new fume purchases / installations; especially in VAV air systems.
      • Factory installation is preferred versus a 3rd party installation on site.
      • Manufacturers known to be acceptable: NewTech; Advanced Lab Concepts

3. Bulletin boards shall not be mounted at fume hood ends blocking maintenance access.

4. Ductless fume hoods require EH&S and FS Maintenance review and approval.

5. Constant volume fume hoods shall have bypass grills of adequate size to maintain an acceptable face velocity over the entire range of sash movement.

6. Auxiliary air fume hoods shall not be used.

7. No chemical fume hood installations are allowed in rooms with return air to other spaces. All chemical use rooms shall have 100% exhaust.

8. In new construction hoods which are high hazard as well as radio iodination hoods must be separately exhausted.

9. All new fume hood installations shall be designed to provide face velocity of 100 FPM at 18in sash height and full open face velocity of 60 to 80 FPM. At the normal working sash height (8in to 18 in) the face velocity shall not exceed 150 FPM.
   a. All center points of a uniform nine point grid at the full open face of a hood shall have velocity readings within +/- 20 FPM of each other; ANSI Z9.5.

10. The lab designer shall specify on the drawings both full open and operating design face velocities and areas. For each hood installed with variable flow controls minimum flows and response times shall also be specified.

11. When the lab area is in the unoccupied mode it is encouraged to provide control systems that will close sashes and reduce the fume hood face velocity within parameters of health and safety.

12. Variable Air Volume (VAV) hoods present large energy use savings, and are preferred.
   a. Drawings shall specify minimum flows, and response times. Minimum exhaust volume shall be the larger of 50 cfm/ft² of hood width, or 25 cfm/ft² of hood work surface areas; ANSI Z9.5.3.3.1.
   b. When the lab area is in the unoccupied mode, control systems should reduce the fume hood face velocity of vertical rising sash styles to 65 FPM if the sash position is a maximum of 18in open – control systems shall be tied to room occupancy sensor (not hood occupancy).
   c. VAV hoods should be provided with an emergency switch that allows the exhaust volume to go to maximum flow velocity with a closed sash or for a set time; ANSI Z9.5.5.3.2.4.

13. Hood placement:
   a. The location of fume hoods, supply air terminals, lab furniture, and pedestrian traffic shall encourage horizontal, laminar flow of supply air into the hood, perpendicular to the hood opening.
   b. Hoods shall be placed at least 10ft from any doors; except emergency doors.
   c. Hoods shall be separated from each other as far as practical.
Fume Hoods continued

d. Corner locations shall be avoided unless two paths of egress are available.
e. Hoods shall be placed to avoid pedestrian traffic immediately in front of the hood.
f. Large pieces of equipment shall not be positioned in front of a hood.
g. In new construction hoods shall not be placed where they would face each other across a narrow aisle (6ft minimum spacing) as this will cause turbulence at the face of the hood.
h. Fume hoods should be secured to the wall using common earthquake restraint practices.

14. Fume Hood Testing & Commissioning:

a. Proper operation of fume hood must be demonstrated by the contractor installing the fume hood prior to project closeout. EH&S may provide this service in a remodel.
b. All new and renovated fume hood installations shall be properly commissioned with a balance performed of the total exhaust flow using a duct traverse followed by face velocity measurements. If the hood equipped with VAV or two position controls, these shall be exercised in all modes of the intended operation.
c. Hood testing shall be in accordance with current methods outlines in ASHRAE standard 110.
d. Where possible the recommended containment performance test is ANSI / ASHRAE 110. UO Standard Operating Procedure EHS-LS-01 may be used for remodel work.
e. All center points of a uniform nine point grid at the full open face of a hood shall have velocity readings within +/- 15 FPM of each other.

15. Controls and Alarms:

a. All new hoods must be equipped with minimum and alarm points:
   - Visible and audible alarms for high and low face velocity.
   - Local alarm reset and calibration.
   - Dry contact for alarm status.
   - Low-flow alarm required.
b. VAV hoods shall be equipped with indicators of airflow (CFM) and/or energy use.
c. VAV hoods control systems shall have a minimum acceptable response time of 10 seconds.
d. Within design discussions, determination of need for optional user over-ride on VAV shall be accommodated for full exhaust with a DDC system reset to VAV after 2 hours with a digital display of remaining time until VAV reset.
e. The minimum acceptable speed of response time for VAV hood control system to maintain face velocity set-point upon repositioning the sash in 10 seconds.

16. Supply Air Criteria:

a. Supply air delivery must be designed to ensure hood performance and safety.
b. Perforated ceiling / plenum supply air or perforated duct diffusers may be used. Discharge velocities may not exceed 200 FPM at the diffuser outlets or anywhere else within the lab room.
c. Air velocity caused by supply outlets, window drafts, traffic, etc. shall not exceed 30 – 50 FPM at the hood face when the exhaust fan flow if forced off.
d. The minimum distance from a diffuser to the face of the hood shall be 4 feet.

17. Ducting Details:

a. Exhaust ducts shall be sized for 1400 – 2000 FPM velocity at full flow.
b. Duct materials shall be compatible with vapors to be exhausted. Stainless steel (type 304, 18 gauge) shall be used with most solvents and potentially flammable vapors. PVC ducting (type 1, grade 1, and schedule 10) shall be used for corrosive vapors and perchloric acid.
c. All duct seams and joints shall be sealed. Stainless steel ductwork shall be welded. Solvent welding is acceptable for PVC and FRP ductwork.
**Fume Hoods continued**

d. Fume hood exhaust ducts shall not contain fire dampers.

e. Effluent discharge shall be a minimum of 8 feet above the roof surface with velocity of 3000 FPM at full flow.

f. Fans shall be as close to the discharge point as possible. If located in a mechanical penthouse, the penthouse shall be ventilated at a minimum rate of 1 air change per hour.

g. Duct chases shall be reasonably oversized for future additional ducts. Systems that require maintenance or inspection shall be accessible. Labs backed on utility corridors are encouraged.

h. Access for cleaning at top of fume hood is required.

18. **Fume Exhaust Fans:**

a. All fans used for fume exhaust shall be AMCA Type B spark-resistant construction.

b. Fans shall be Class 1 belted utility sets with a steel scroll sized to operate below 2000 RPM. All components exposed to the air stream shall be coated with primer, baked enamel and baked Heresite. Inline centrifugal fans of the same material and coatings are acceptable where space precludes the use of a utility fan. Fans constructed of PVC or FRP shall be used where high concentrations of corrosives are anticipated.

c. Design team explanation / demonstrate how HVAC will mitigate a vapor from x-amount of open containers of chemical-y (scenario to be chosen by U of O EH&S).

d. The design must carefully consider acoustics and result in a lab noise level of NC 50 or lower. Proper acoustic design shall be accomplished by providing appropriate fan size and type. Sound attenuators are acceptable, though not preferred. When used, sound attenuators must be constructed of 304 stainless steel and pack less.

19. **Fume Hood Interior:**

a. Work surfaces are to be cast epoxy or stainless steel.

b. Radioisotope hoods are to have stainless steel or impervious work surfaces and liners.

c. Work surface is to be dished.

d. Hood liners are to be poly-resin, epoxy, or stainless steel.

20. Existing hoods that are functional may be relined with Facilities EH&S and Maintenance approval.

21. Service valves, switches, etc. are to be front-mounted for serviceability.

22. Interior light must be accessible from outside of the hood for replacement and service.

23. Duplex 120v grounded GFI outlet on both left and right face of hood.

24. At least one fume hood per lab complex is to be adaptable for ADA use.

25. NO gas allowed within bio-safety hoods.

26. Explosion-proof and any special-use hood interiors shall be reviewed and approved by Facilities EH&S and Maintenance.

**Plumbing**

1. **Backflow prevention:**

a. To be provided either building-wide, by floor, by zone, or by lab.

b. Approach to be determined by Facilities EH&S and Maintenance with each project.

2. If lab use calls for a plaster trap, ‘Gleco Trap’ is a code compliant system.

3. **Piping material standards:**

   a. Cold water: copper type L, insulated.

   b. Hot water: copper type L, insulated.
**Plumbing continued**

c. Compressed air: copper type L braised joint, or black iron schedule 40.
d. Natural gas: black iron. Do not use threaded connectors; couplings must be used.
e. Nitrogen: copper type L, braised joint, purge pipe per proper nitrogen installation procedure.
f. Purified water: threaded PVC schedule 80.
g. Lab pipe shall be IPEX Labline (formerly called ‘Enfield’) with mechanical joints.
   - Fusion welded joints are not allowed. Exception may be granted for buried below-grade piping.
   - Tie to main with cement solvent through lab bench or sink, threaded is preferred.

4. **Sinks:**
   a. Epoxy resin or stainless steel.
   b. Specify standard sizes only.
   c. Molecular Biology, deck-mounted stainless steel only.
   d. Cup sinks with non-removable strainers preferred. If removable-type strainers are specified, they must be mechanically attached and removable by UO Maintenance.

5. **Valves, controls, and shut-off valves:**
   a. To be provided for ALL utilities and services at each lab, each peninsula, and each emergency shower.
   b. May NOT be buried within casework without easy access.
   c. If they are located within chases or casework, then access must be at open knee-wells or peninsula ends.
   d. All valves shall be clearly labeled at appropriate intervals.

6. **Service fittings:**
   a. To be wall mounted with exposed piping and valves.
   b. At peninsulas, fittings are to be mounted to tube steel supports with exposed piping and valves.

7. **Non-potable water:**
   a. Supply to laboratories, makeup water, equipment cooling or similar applications shall be isolated from the domestic water system by use of a reduced pressure backflow preventer.
   b. All outlets served by non-potable water shall have prominently displayed signs stating ‘Non-Potable Water – Do Not Drink’.
   c. Purified or polished water shall be piped from centralized RO system to a location where lab user can connect a water polisher that they provide.

**Electrical**

1. Spare conduits and circuits with homeruns to the panel are required; minimum of two 3/4” conduit runs.

2. **Lighting:**
   a. Occupancy sensors controlling under-counter fixtures are to be switched / controlled with overhead lighting as well vs. separate switching / occupancy.
   b. Up and down light is to be provided within 1 fixture.
   c. Higher lighting levels are to be achieved with task lighting.

3. **Power:**
   a. Panel locations are to be at lab entries. Either exterior in the corridor prior to entry, or interior and immediately adjacent to entry.
   b. Safety shower and egress shall not interfere with electrical.
   c. Disconnect switch for each lab is required at panel / entry.
Electrical continued

4. Wiremold:
   a. Single channel equal to wiremold 3000 or 4000 series, depending on the application.
   b. Double channel required in all computer lab applications.

5. Emergency and standby power requirements and locations are to be determined by Facilities EH&S and Maintenance for each project with research requirements in mind.

6. Telecom and Data:
   a. Distribution capability to all areas is required, for current and future potential needs.
   b. Distribution from building IDF, except in high-intensity areas such as computer labs.
   c. Provide at least one phone location per lab.
   d. Minimum 18” to 24” clearance above work surface / desk areas and any upper shelves.

End of Section
The following information is specific to a ‘Lactation Room’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

Lactation rooms on the University of Oregon campus shall comply by AIA Best Practices Lactation Room Design Guidelines (February 2008).

For review, approval, and potential funding for furnishings contact:

Karen Logvin, Director of Work /Life Resources, UO Human Resources
Phone: (541) 346-2962
Email: klogvin@uoregon.edu

Minimum physical room requirements:

1. A minimum 7' x 7' footprint, allowing for a 5' radius circle with 24" deep counters on two walls. Other configurations, such as a 10 x 5', would work as well.
2. Rooms shall be located in a safe, private, and accessible area to all.
3. The room must have a lockable door with pin-code access.
4. Provide adequate HVAC, well-placed electrical outlets, telephone service, and network connection.
5. Sound privacy is important. Specify carpeting, fabric acoustic panels, upholstered furniture, or other sound dampening materials to minimize sound transmission.
6. The room must be plumbed with a sink and faucet combination deep enough to wash bottles and pump parts. Gooseneck or kitchen-type faucets are recommended.
7. A counter area must be provided; 20" deep by 30" wide; provide a 30" wide clear knee space beneath the counter; provide above counter electrical outlets.
8. Provide storage for paper towels and cleaning supplies.
9. Provide a place to hang clothing (hooks, hangers) and a mirror.
10. Provide a cabinet or shelving for personal items.

OFOI Furniture & Accessories:

1. One comfortable chair; upholstered preferred; must have arms. If a task type chair is provided, it must have arms, lumbar, tension, height adjustments, and casters.
2. One under counter size refrigerator for milk storage.
3. One small side table for pump.
4. One small microwave.
5. One radio.
6. One table lamp.

End of Section
The following information is specific to a ‘Loading Dock & Service Area’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

1. For each campus building or building complex, a designated building service area is to be established. Each service area shall provide facilities / locations for loading, package delivery, garbage / trash collection, and parking for maintenance and service vehicles.

2. Building service areas shall be located on the least public façade.

3. Dumpster facilities / locations shall be incorporated into a loading dock. In the absence of loading dock, these sites shall be near a building entrance (but NOT the main entrance) and screened from view by an appropriately designed fence and/or vegetation.

4. Building service areas shall not be near building air intakes.

5. Walkways and drives that serve loading areas shall be designed and constructed to withstand heavy vehicle traffic.

6. Mail delivery may be located within designated building service areas. If so, space for convenient vehicle parking shall be included.

7. These spaces must be well lit for personal safety as well as use in the evening hours FS Custodial.

8. Protection required at the rear wall of loading dock to prevent damage to the facility by vehicles.

End of Section
The following information is specific to a ‘Mechanical & Electrical Room’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

1. Weather-Tight Construction required at all construction surrounding mechanical, equipment, or electrical.

2. NO sharing of program is allowed. These spaces may not double as custodial closets, storage, etc.

3. Electrical rooms must be sized for the equipment to be housed by using the largest dimensions from potential vendors to ensure that all components fit within the room with proper clearances.

4. In mechanical and electrical rooms any components requiring routine service/maintenance must be installed / mounted below 7ft in height. Prior to installation of any component above 7ft requires onsite review and explanation with FS Maintenance and/or FS Electrical Supervisor.

5. All previously noted accessibility requirements per OSHA and/or NEC must be followed in these spaces.

6. A hose-bib must be provided in each mechanical room.

7. Elevator access is required to penthouse locations; NO mechanical room access is allowed by use of a ladder in new construction.

8. Mechanical and electrical rooms must be provided a campus phone.

9. Mechanical and electrical rooms require installation of one spare / un-used data jack at a minimum to monitor control system(s) from a portable computer.

10. Mechanical room doors must be 36in at a minimum, 40in to 42in is preferred. Double doors are preferred and must have a removable mullion.

11. If system within is hydronic and has drainage, then epoxy or water proofed floor is required in the penthouse. Epoxy or waterproofing is to extend up walls 6inches at a minimum.

12. Space shall be provided for storage of 1 full change of filters at a minimum.
   a. Storage may be located on top of a unit if space is dry and protected.
   b. Filter storage may require wall shelving if space above unit is not adequate or not protected.
   c. Filter storage on the ground is NOT acceptable.

13. All mechanical rooms shall have watertight floors with all penetrations fully sealed. Mechanical room floors shall contain floor drains. Slope floors to drains

14. All mechanical rooms shall have adequate primed floor drains located in close proximity to those pieces of equipment most likely to leak or require draining for servicing or replacement. (Housing)

15. All below grade mechanical and electrical (transformer) rooms shall have an access path and adjacent areaway of sufficient size to allow for the removal of the largest piece of equipment without significant disassembly of the equipment. Large equipment shall be removed via the areaway rather than elevator. (Housing)

16. In the main facility mechanical room, provide dedicated space for the following: (Housing)
   a. Storage of O&M and as-built information
   b. Layout space for large drawings
   c. Wall area for valve charts, fire sprinkler zoning, etc

17. Lighting:
   a. 5 foot-candles of emergency lighting is to be provided and programmed to remain on at all times for safety.
   b. Occupancy sensor controls to a level of 50 foot-candles at 30in elevation when lights are on.
   c. These occupancy sensors/controls are to have a long (30 minutes minimum) delay for safety.

End of Section
The following information is specific to ‘Public & Circulation’ space types and is in addition to all previously stated standards listed in Divisions 01 – 33.

1. Public & circulation spaces include such spaces as hallways, corridors, reception areas, lobbies, atriums, etc.
2. Latex eggshell paint is to be used as public areas walls accumulate many smudges and are washed often.
3. Hallway ceilings are to be accessible in all locations to allow for future modifications.
4. Public and Circulation Spaces should be free of free-standing furniture. If tall or heavy furniture must be in these spaces, they should be evaluated for height and weight to determine if they should be secured to the wall using common earthquake restraint practices.
5. Lighting of circulation spaces is to be at low-levels with occupancy sensors that provide increased light levels when needed based upon occupancy.
6. Flooring:
   a. Carpeting shall not be used at entry levels, at floors with a great deal of classrooms, or other high traffic areas. IF carpeting is used it shall NOT be the type that requires dry cleaning methods.
   b. On floors with a great deal of classrooms carpeting shall not be used.
   c. On floors that are high traffic areas carpeting shall not be used.
   d. No rubber surfaces with textured ‘dots are’ to be installed at entries.
   e. Hard surface floors such as concrete, VCT, or linoleum products are easier to maintain in hallways.
   f. NO wood floors.
7. Design guidelines for AV provisions within public atrium spaces that could be used for gatherings include the following:
   a. Portable video production equipment needs power and signal connection to any installed audio and video systems. (Camera and microphone inputs; power)
   b. Depending on the size of the space, atrium spaces may require floor and/or wall boxes to supply multiple locations for recording systems and microphones.
   c. Control room systems.
   d. Atrium spaces should be designed with signal/power paths to control rooms and associated distribution systems.

End of Section
Complete room number assignment are required by 100% DD of design. The design Architect will provide floor plan(s) with initial room numbers, adhering to the following guidelines, to be confirmed and revised as needed by Facilities Design Services Program Specialist.

GUIDELINES FOR NUMBERING ROOMS, UNIVERSITY OF OREGON
Design Services, May 2010

The following room numbering guidelines convey the general principles used by the UO for numbering spaces in new or renovated buildings. The intention in providing them is to achieve a more consistent numbering system in campus buildings and to provide designers with adequate guidance as they produce design and construction documents. Because each building has its own character and configuration, exceptions will sometimes be the rule. Therefore, the principles should be applied using judgment and common sense and with consideration of reasonable way finding for building users.

For state-mandated inventory purposes, each space within a building (including circulation) must have a unique number. Prefixes (such as H, S, E, etc.) and suffixes (such as A, AA, B) are considered part of the space designation, so it is acceptable to have, for example, 101, 101A, 101B, H101, E101, S101.

Room numbering may not change after 100% DD, only added to. Additional room numbers require Facilities review and approval as well.

**Rooms**
Assign room numbers in sequence by floor as follows:
- B001-B099 (Basement);
- 100-199 (First Floor);
- 200-299 (Second Floor); etc.

When numbering rooms stack the floors, if possible; for example, room 201 would be above 101; for stairs and elevators show E201 above E101, S201 above S101, etc. In most cases room configurations by floor will not be identical, so best judgment should be used.

To begin numbering, the main entrance is generally the starting point. Number rooms in a clockwise direction. [SEE ATTACHED EXAMPLE #1] Number exterior doors in the same manner; for example, the main entrance door would be labeled 100; if it is a double door the number would be 100AB.

Numbering offices along a hallway, place even numbers on one side of the hallway and odd number on the other. If an office or conference room is large, skip one or more numbers to allow for future divisions within the space.

**New Building:** Some buildings may have more than one main entrance; in such a case, user and design team discussions are encouraged, as programmatic or other considerations may favor one entry over another.

**Suites**
When numbering a suite of rooms, number the main room (door to main hall) consistent with its placement along the hall. To number the proximate rooms within the suite, use the central room number followed by A, B, C, D, etc. This same process of appending a letter to the room number also is used for closets and for single rooms attached to other rooms; a closet in room 101 would be labeled 101A, as would an office accessed only through another office that is accessed from the main hallway.

If room 101 contains a closet and also a contiguous office accessible only through 101, label the latter 101AA and the closet within 101 as 101A.
Sansures continued

New Building: In some cases a suite may be programmatically separate from the rest of the building, will have its own entrance from the outside, and may have a tenuous physical connection to the rest of the building's spaces. An example is the Lewis Center for Neuro-imaging in Straub Hall. If discussions merit, it may not be inappropriate to consider a separate numbering system. However, each room number within the entire building still must be unique.

Wings

[SEE ATTACHED EXAMPLE #2] Most buildings will not be segmented into wings; wings should be designated only in certain situations:

- If the number of rooms exceeds available numbers.
- If an addition to an existing building cannot be numbered sequentially to the existing spaces.
- If the user group or building administrator has significant programmatic reasons to segment a building into wings and to number two or more wings in a similar manner; i.e., A101, B101, and C101.

When labeling a building wing, insert an alphabetic character as a prefix either alphabetical or directional (e.g., begin with ‘A’, ‘B’, etc. or ‘E’ East, ‘W’ West, etc.).

Circulation

All hallways or corridors will be numbered in the same order (direction) that rooms are numbered in the building. Such spaces will be numbered consecutively, that is H001, H002, H003, for halls located in the basement; H101, H102, H103, etc., for halls located on the first floor, and continuing up for each floor level until all building hallways or corridors have been numbered. Elevators, lobbies, ramps, stairways, and vestibules will be numbered in the same manner as halls, using the prefixes ‘E’, ‘L’, ‘R’, ‘S’, or ‘V’, respectively.

Multiple Buildings (Complex)

[SEE ATTACHED EXAMPLE #3] In a complex comprised of two or more buildings, it is useful to try to provide unique numbers within the complex to facilitate way finding. For example, the Lillis Business Complex is composed of four buildings. Peterson Hall is numbered so that the second digit on the first, second, and third floors is ‘0’ (101, 201, 301); for the Chiles Center the second digit is ‘2’ (127, 227, 327); for Gilbert Hall the second digit is ‘9’ (194, 294, 394); and Lillis Hall uses everything else.
EXAMPLE 2: Volcanology, First Floor plan
EXAMPLE 2: Student Health & Counseling, First Floor plan
EXAMPLE 3: Lillis Business Complex, First Floor Complex Plan

End of Section
The following information is specific to a ‘Stair’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

1. Walls are to be a latex eggshell paint finish. Flat latex does not clean well.
2. Flat and smooth rubber tile or sheet flooring is preferred; no raised ‘dots’.
3. Stair treads are to contain a color and/or material contrast from the tread to the nosing and from the landings, or floor levels, to the steps.
4. Metal stair nosings only are to be used.
5. Consideration is required when choosing metal pan stairs as they are a noise concern and become a trip hazard once the concrete wears down.

End of Section
The following information is specific to a ‘Toilet Room’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

General
1. Comply with ADA and UO Accessibility standards.
2. Each restroom must have either a counter around the sink OR an adjacent stainless shelf large enough to place notebooks etc.
   a. Royce Rolls HDS12 shelf model is preferred.
3. Counters are to be installed so that trash receptacles can be placed underneath, without conflicting with wheelchair knee space.
4. GFI power receptacles only.
5. Counter grommets are provided shall be 8in diameter over waste receptacle.
6. Provide a hose bib in each restroom located at lavatories.
7. Floor drain is required in each closet; to be installed at the lowest point.
8. Provide coat hooks in various locations; including individual stalls and/or wall hooks. Bobrick B-7671 model is preferred.
9. Paint: Benjamin Moore, Eco line, no VOC’s.
   a. Avoid using deep colors.

Tile
1. Flooring:
   a. 6in x 6in or 8in x 8in, glazed ceramic tile.
   b. Crossville Eco-cycle 12in x 12in, Plymouth Rock.
   c. Mottled gray color acceptable, not just a straight color.
2. Wainscot:
   a. 4in x 4in and 6in x 6in, glazed ceramic tile.
   b. Wainscot to 4ft from finish floor.
3. Mortar grout is to be used.
4. All grout lines and tile must be sealed.
5. Supply 10% of all tile types for construction overstock.

Toilet Accessories
1. Install solid backing at all locations to receive toilet accessories.
2. Facilities Custodial Owner Furnished and Contractor Installed (OFCI) dispensers and receptacles.
3. Do not mount dispensers on mirrors
4. Paper towel dispenser must be installed near sinks, with top of actuator no more than 48in above floor. May not extend more than 4in into accessible route, and must be ADA compliant.
5. Soap dispenser must be installed in such a way that the top can be easily opened for re-fill of soap.
6. Waste receptacle location shall be planned and provided for.
Toilet Accessories continued

7. Toilet paper dispenser in restrooms with grab bars shall be mounted so the bottom of the dispenser is 6in above the grab bar.

8. Sanitary napkin receptacles are to be installed with the top of the device no more than 48in above floor, and within easy reach of the toilet.

9. Seat cover dispensers are to be installed with the dispensing slot no more than 48in above floor. The dispenser must be installed in such a way that product can be loaded; at least 6in above grab bars.

10. Fasteners shall be stainless steel tamper-proof style.

11. The following table lists all Facilities Custodial OFCI dispensers and accessories:

<table>
<thead>
<tr>
<th>Dispenser</th>
<th>Manufacturer</th>
<th>Part No.</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet Paper</td>
<td>Vista Jr.</td>
<td>58250</td>
<td>AmSam</td>
</tr>
<tr>
<td>Paper Towel – Roll</td>
<td>Perrin craft no touch</td>
<td>PC-0500</td>
<td>Coastwide</td>
</tr>
<tr>
<td>Toilet Seat Covers</td>
<td></td>
<td>57748</td>
<td>AmSam</td>
</tr>
<tr>
<td>Soap Dispenser</td>
<td>Deluxe Triad</td>
<td>9352</td>
<td>AmSam</td>
</tr>
<tr>
<td>Sanitary Napkin Receptacle</td>
<td></td>
<td>1103</td>
<td>AmSam</td>
</tr>
<tr>
<td>Sanitary Dispenser (Kotex – 2 Product)</td>
<td>Rochester Midland SSS</td>
<td>J6N</td>
<td>AmSam</td>
</tr>
<tr>
<td>Sanitary Dispenser (Kotex – 3 Product)</td>
<td>Rochester Midland SSS</td>
<td>J10</td>
<td>AmSam</td>
</tr>
<tr>
<td>Stainless Shelf</td>
<td>Royce Rolls</td>
<td>HDS 12</td>
<td>Catalog</td>
</tr>
<tr>
<td>Waste Receptacle</td>
<td>Bobrick</td>
<td>B-277</td>
<td></td>
</tr>
</tbody>
</table>

10. Grab bars: (CFCI; Contractor Furnished & Contractor Installed.)

   a. Stainless steel
   b. Peened grip
   c. Concealed fasteners
   d. 1.5in diameter
   e. Provide backing in wall
   f. Installed at 33in to the top of the bar
   g. Bobrick B-6106 model is preferred.

11. Mirrors: (CFCI)

   a. Stainless steel frames or no frames.
   b. Provide full length mirror in accessible rooms.
   c. NO mounting on doors.
   d. Corners are to be welded and ground smooth.
   e. Bobrick B-290 model is preferred.
   f. Hangers are to be rigid, tamper and theft-resistant installation.

12. Toilet Partitions: (CFCI)

   a. Solid plastic panels that contain color all the way through the panel allowing for sanding repair of scratches or other damage.
Toilet Accessories continued

b. NO particle board within panel construction.
c. Partitions must have good stainless hardware vs. chrome plated.
d. Preferred Model: Bobrick style 1092 Sierra
e. Brace panels floor to ceiling or floor mounted with overhead braces when possible.

Lighting

1. Sconces shall be used if mirror lighting is required.
2. All lighting shall be in the 20-30 foot candle range.
3. Sensor switches are to be evaluated and placed for maximum coverage.

End of Section